Biosalinity News

Newsletter of the Biosaline Agriculture Center

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مركز الزراعة الملحية

Biosaline Agriculture Center Centre d'Agriculture Biosaline

Dear reader,

Announcing the Biosaline Agriculture Center

It is with great pleasure that I welcome you to this first issue of the Biosaline Agriculture Center's newsletter, *Biosalinity News*.

BAC is a new applied research center located in Dubai, UAE. Our mission is to develop and promote the use of sustainable agricultural systems that use saline water to grow crops. We are initially focusing on forage production systems and greening plants in countries of the Gulf Cooperation Council and other parts of the Islamic world. The technologies we develop will, however, be of value globally, wherever farmers face problems of saline soils or irrigation with salty water.

BAC arose from a series of technical meetings in the late 1980s and early 1990s that identified the need for a research and development institute focusing on the problems of salinity and using saline water for irrigated agriculture. The Islamic Development Bank took the lead in establishing BAC to meet this need, providing funding for the Center and attracting the support of the Government of the UAE, through its Ministry of Agriculture and Fisheries, and other donors, including the Arab Fund for Economic and Social Development, the OPEC Fund, and the Municipality of Dubai.

It is our goal to make BAC a focus for applied research and technology development in saline irrigated agriculture, not only in generating new knowledge but also gathering, synthesizing and disseminating knowledge in this field, wherever it has been generated. Our objective is to bring this knowledge to bear on improving the lives of farmers who rely on saline water to grow their crops, reducing pressures on scarce water resources while increasing food production.

This is the task I and the staff of BAC are dedicating ourselves to.

I wish to express my gratitude to all those who have contributed to the creation and development of BAC. I again thank our donors who have so generously supported all the planning and development activities that led up to the establishment of BAC. I want to especially acknowledge the vision and wisdom of Dr. Ahmed Mohamed Ali, President of IDB, who has steadfastly championed the establishment of BAC and has rallied support to our cause. I thank the members of BAC's Technical Advisory Committee, who have guided us in developing the programs of our new Center.

Biosaline agriculture is a promising new frontier for many regions of the world. Much has already been done in this field, but much more is still to be done before its promise is fulfilled. BAC has a huge task facing it, but together we will prevail.

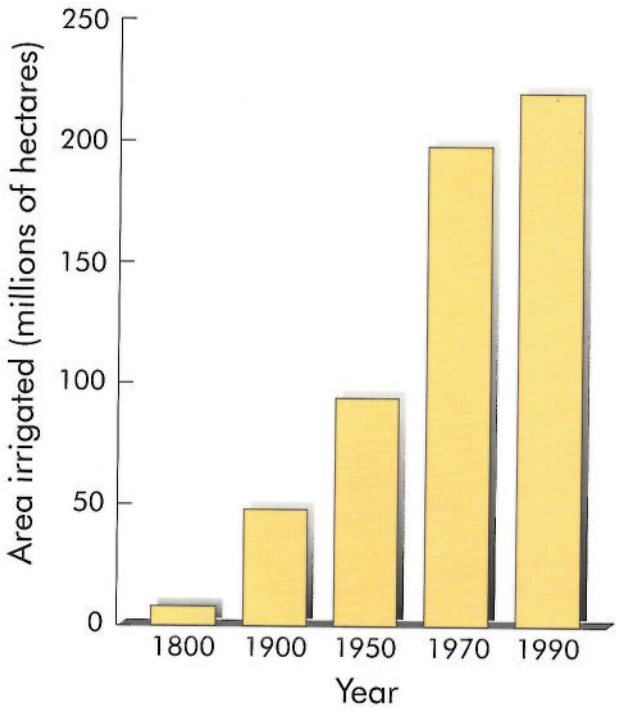
Dr. Mohammad H. Al-Attar
Director General

ANCIENT PROBLEMS, NEW APPROACHES

The world's population is growing by a billion people—the population of India—every 10 years. Feeding all these extra mouths is one of the most urgent problems facing humanity at the close of the millennium.

Over the next 30 years we must increase food production by a fifth in developed countries and by nearly two thirds in the developing world, just to maintain current levels of nutrition. But most land suited to agriculture is already cultivated; most of the increase will have to come from increasing the productivity of land that is already cropped and growing novel crops on land currently considered unfit for cropping.

A major weapon in the farmer's armoury of productivity-enhancing tools is irrigation. This is reflected in the dramatic increase over the past 200 years in the area of land that is irrigated, from about 8 million hectares in 1800 to about 220 million hectares in 1990 (FAO statistics). Now, however, we are running out of the "sweet" water normally used for irrigation.



Salicornia, a promising oilseed and forage crop that can be grown under irrigation with seawater.

More than half the world's groundwater supplies are already saline and the proportion is increasing as demand for water outstrips supply. Salinity already limits crop production on about half the world's irrigated land and there may be as much as twice as much saline land as there is land currently under irrigation. Ten million hectares of cropland are lost to agriculture each year because of waterlogging and salinization—becoming too salty for normal crops to grow. Yet many studies show that these problems are largely caused by inefficient application and use of irrigation water—they can be solved through appropriate technology.

Opportunities—learning from the past, learning from others

Problems with soil and water salinity are not new. The Babylonian story of Atrahasis, written nearly 4000 years ago, referred to the "turning white of the fields". Faced with rising soil salinity, the Babylonians turned to crops that could grow under these saltier conditions, such as barley. Elsewhere, traditional societies gathered the seeds of plants growing at the ocean's edge, garnering much of their food from land that modern farmers consider a salty wasteland.

For example, Yuman Indians on the west coast of North America gathered the seeds of *Distichlis palmeri* (Palmer's saltgrass), a "wheat-like" cereal grass, and used them to make a kind of porridge as well as bread. Once thought extinct, this grass has been rediscovered growing in the wild. Palmer's saltgrass has one serious drawback as a cereal crop—its seed heads are fragile and

Plants being irrigated with high-salinity water (>15,000 ppm salt) at the Sheikh Zayed International Center for Agricultural and Environmental Research, UAE.

shatter easily, which makes for problems in harvesting the grain mechanically. (It shares this characteristic with many "undomesticated" grasses, including wild relatives of barley and wheat.) However, a company in the USA has developed a commercial cultivar of Palmer's saltgrass with a non-shattering seed head, showing the potential for changing "wild" salt-tolerant plants to meet the needs of modern farmers.

Other salt-tolerant plants are widely used as animal feed. Saltbushes (*Atriplex* species), for example, are found around the world, commonly in arid areas and on salt-affected soil. Not only do many *Atriplex* species tolerate saline soil, many can be irrigated with saline water. In one trial, *Atriplex* irrigated with seawater produced 20 tonnes of dry matter per hectare, with crude protein content of 12-18%. Trials in the USA have shown that a pasture containing a mixture of *Atriplex canescens* and native vegetation can support up to three sheep per hectare with rainfall of only 250 mm a year. One saltbush, *Atriplex hortensis*, is grown in India for its spinach-like leaves. Another saltbush species, *Atriplex triangularis*, also has leaves that are similar to spinach in both appearance and nutritional quality and has been grown using seawater for irrigation.

Salicornia, a highly salt-tolerant plant, has shown considerable potential as an oil-seed and fodder crop in Mexico and the Middle East. In the United Arab Emirates, *Salicornia* irrigated with seawater was able to support up to 20 goats or sheep per hectare, as well as producing seed with high oil content.

Some "traditional" crops, such as barley and pearl millet (*Pennisetum typhoides*) show some tolerance of salinity. In trials in India, pearl millet yielded up to 1.6 tonnes of grain per hectare when irrigated with seawater. Barley has yielded up to four tonnes of grain per hectare when irrigated with water of half the salinity of seawater.

Improving current systems, developing new ones

The opportunities are there to create new, viable, and sustainable agricultural systems based on the use of saline water. Many of the compo-

A small selection of seed from BAC's genebank.

nents of such systems are already known or available. A key task for the Biosaline Agriculture Center, and indeed one of the core reasons why it was established, is to assemble what is already known into workable solutions to farmers' problems.

BAC is the only center of its kind focusing on the use of salt-tolerant plants in practical production systems. It is also one of only a few centers that have an irrigation system that allows scientists to mix water of different salinities and apply irrigation water at precise rates to evaluate the impact of salinity and water application on plant production.

The Center's initial program is based on a comprehensive review of plant biosaline and irrigation research at the major centers around the world. Key areas that the program will cover include:

- Assembling and maintaining a collection of plants adapted to saline conditions and potentially useful for productive agriculture and horticulture as well as landscaping and greening programs.
- Selecting within existing forage and horticultural crops for greater salt tolerance. Early research will focus on forage crops such as Rhodes grass and alfalfa and the more important greening plants.
- Assessing the salinity tolerance of potential new forage crops. The Center will identify material that is productive when irrigated with brackish and highly saline water.
- Developing irrigation methodology that will allow the productive use of saline and highly saline irrigation water while minimizing its adverse impacts on soils and the environment.

Over the past ten years or so, many institutes around the world have been taking an interest in using saline water for food production, both for land-based agriculture and for aquaculture. The current knowledge base on the topic is now extensive. The next step is to bring this knowledge to bear on solving farmers' problems.

Biosaline agriculture—promising new frontier

There are millions of hectares of salt-affected land and vast resources of saline water, much of them in the developing world. Bringing these into productive use will be a major step forward in efforts to boost food production as we enter the new milennium.

A PROFILE OF BAC'S DIRECTOR GENERAL

Dr. Mohammad Al-Attar took up the post of Director General of the Biosaline Agriculture Center (BAC) in September 1999. As Director General, Dr. Al-Attar is also chairman of the BAC Board of Directors.

From 1994 until he joined BAC, Dr. Al-Attar was Deputy Director General for Research, Life and Environmental Sciences at the Kuwait Institute for Scientific Research (KISR). In this position he was responsible for programs comprising some 60% of KISR's research program, with a budget of about US$ 18 million a year. From 1983 to 1994 he was Director of KISR's Food Resources Division.

Dr. Al-Attar's connections with the new institute date back to 1996, when he joined the Technical Advisory Committee advising the Islamic Development Bank on the establishment of BAC as its chairman.

A marine biologist, with a Ph.D. in Marine Science from the University College of North Wales, Bangor, UK, Dr. Al-Attar has a long history of achievement in research management, institutional development, and fund raising, and an extensive list of research publications. His extensive network of international contacts will be invaluable to BAC as it strives to develop collaborative research networks with partners in the Gulf region and beyond.

BAC is fortunate to have a scientist and administrator of such standing as its Director General to guide the Center's formative steps.

A BRIEF HISTORY OF THE BIOSALINE AGRICULTURE CENTER

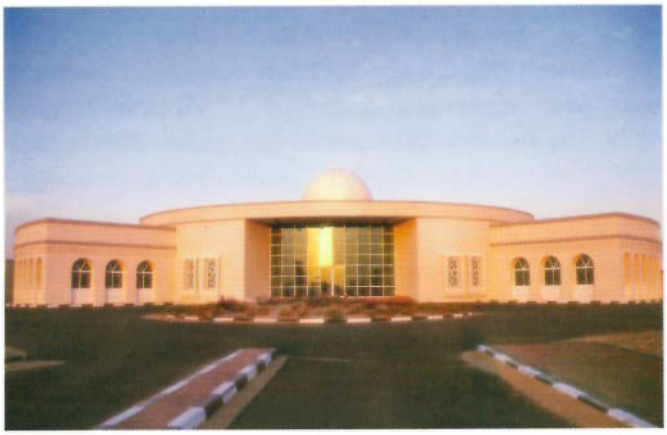
The origins of the Biosaline Agriculture Center (BAC) date back to the late 1980s and the early 1990s, when scientists around the world started taking a greater interest in saline water and the possibilities of using it more productively. International conferences in 1990 at the Islamic Development Bank's headquarters in Jeddah, Saudi Arabia, and at the UAE University at Al Ain, United Arab Emirates (UAE), first put forward the idea of establishing a research and development center to promote biosaline agriculture in the Gulf region.

The IDB initiated a series of expert consultations in 1992, which outlined the objectives and activities

of the new institute. In November 1992, the IDB's Board of Executive Directors approved financing for the establishment and initial operation of what was to become BAC. The Bank commissioned SAGRIC International, an Australian consulting company with extensive experience in the Middle East, in saline agriculture, and in developing and managing major research facilities, to undertake a detailed feasibility study for the Center and to develop detailed plans for the Center, its operations and the development of its facilities.

The consultants identified the major irrigation and salinity problems being experienced by countries of the Arabian Peninsular. They determined that productive agriculture and effective greening projects could be conducted with high-salinity irrigation water, particularly at salinities between 6000 and 15,000 parts per million.

BAC's headquarters facilities at Al Ruwayyah, near Dubai, UAE.



The review found that little was known about salt-tolerant plants for use in arid environments and that infrastructure available was inadequate for evaluating the salt tolerance of plants and for developing management strategies for productive use of saline irrigation water.

A Technical Advisory Committee advised the IDB during the feasibility study and development phases of the project. This committee had members from Australia, Kuwait, Libya, Morocco, Pakistan, Saudi Arabia, the UAE, the United Kingdom, and the United States of America. TAC ensured that BAC's programs would make a major contribution to the Center's target countries, as well as to biosalinity technology globally. It also helped develop the early phases of the Center's networking program.

Consultations between the Bank and the General Secretariat of the Gulf Cooperation Council led to the selection of the UAE to host the fledgling Center. In 1996 an agreement was signed between IDB and the Government of UAE, represented by the Ministry of Agriculture and Fisheries, establishing BAC as a formal entity. IDB also attracted additional financial support for the Center from the Arab Fund for Social and Economic Development and the OPEC Fund.

In 1997, the Municipality of Dubai gave the Center 100 hectares of land at Al Ruwayyah, 23 km

south of Dubai. The site was developed by the Municipality of Dubai in 1997 and 1998, with 35 hectares being leveled and prepared for irrigation. The remainder of the station has been kept as native rangeland.

Interviews for the initial professional staff positions were held in November 1998, and appointments were made beginning in August 1999. The Center's first Director General, Dr. Mohammad H. Al-Attar (see "A Profile of BAC's Director General"), took up his post at the beginning of September 1999.

The initial work of this core group of staff has been to further develop the Center's initial strategy and program of work. In this the Center has been assisted by Dr. Donald Plowman, Director of Research at the South Australia Research and Development Institute (SARDI), who joined the Center as a consultant at the beginning of September 1999.

The first draft of the strategy and program plans will be extensively reviewed, both internally and by experts in the field of saline agriculture around the world, before being presented to the Center's Board of Trustees in early 2000.

BAC's INITIAL PROGRAM

One of the early and crucial tasks facing the staff of the new Center is the development of Center's strategic plan for the first five years and details of its initial program of work. The Center has been greatly helped in this by Dr. Donald Plowman, Director of Research at the South Australia Research and Development Institute (SARDI). Dr. Plowman was on a consultancy with BAC to manage the development of these crucial areas.

The Center's early program priorities were determined by the Technical Advisory Committee as being to improve forage production, develop coastal greening, and establish the Center's communications and technical network. Building on these priorities, and based on the current staff appointments, the BAC team has identified four program areas and several projects that it will address initially. These will be reviewed as part of the development of the strategic plan prior to establishing the year 2000 program.

Improving existing forage production systems

This program is primarily aimed at increasing forage production through improvements to existing systems. The projects being developed to meet this objective are:

- Selection of salt-tolerant alfalfa varieties
- Evaluation of Rhodes grass cultivars for salt tolerance
- Selection of salt-tolerant annual forage crops
- Management of soil salinity when irrigating with medium- to high-salinity water
- Collection of germplasm of alfalfa, Rhodes grass and pasture legumes

Developing new forage production systems

This program will develop new forage production systems. Projects being developed to meet this objective are:

- Collection and evaluation of alternative perennial forage species
- Evaluation of annual forage crops

Assessing opportunities for coastal greening

This program will address the priority for coastal greening.

At this stage a project looking at the collection and evaluation of mangrove germplasm is under development for implementation in 2000. A part of this project would involve an ecological assessment of the distribution of mangrove and collection of information on the traditional use of the plant.

Information management and technology demonstration

This area covers program support, including information management and technology demonstration. Specific projects are:

- Networking and information management
- Demonstration of irrigation and salinity technology
- Farm management

BAC's Board of Directors

The governance and policies of the Biosaline Agriculture Center are in the hands of the Center's Board of Directors, an eight-member panel appointed by the Islamic Development Bank and the Center's host country, UAE. This Board is responsible to a Board of Trustees, chaired by the IDB President.

Appointed by IDB

Dr. Mohammed Al-Suwaiyel
Vice President, King Abdelaziz City for Science and Technology, Riyadh, Saudia Arabia

Dr. Mohammad H. Al-Attar* (Chairman)
Director General, BAC

Dr. Mujtava Naqvi
International Atomic Energy Agency, Vienna, Austria

Mr. Ahmed S. Hariri*
Deputy Director General, BAC

Appointed by Government of UAE

Eng. Rashid Khalfan Al-Sheraigy
Deputy Minister, Ministry of Agriculture and Fisheries, UAE

Eng. Mohammed S. Al-Assam
Director, Water and Soil Department, Ministry of Agriculture and Fisheries, UAE

Dr. Mahmoud A. Al-Afifi
Dean, Faculty of Agricultural Sciences, UAE University, Al Ain, UAE

Eng. Essa Maidoor
Director, Irrigation and Drainage Department, Dubai Municipality, UAE

* Dr. Al-Attar and Mr. Hariri were appointed to the Board prior to becoming BAC staff. New IDB nominees will be appointed in early 2000.

Technical Committee Shapes Initial Program

During the planning and establishment of BAC, the Center was fortunate to have a broadly based panel of experts guiding the development of its facilities and programs. The eleven members of the Technical Advisory Committee were drawn from Australia, Kuwait, Libya, Morocco, Pakistan, Saudi Arabia, the UAE, the UK, and the USA:

Eng. Rashid Khalfan Al-Sheraigy
Deputy Minister, Ministry of Agriculture and Fisheries, UAE

Dr. Farid H. Abdel-Nabi
UAE University, Al Ain, UAE

Eng. Mohammed S. Al-Assam
Head, Water and Soil Department, Ministry of Agriculture and Fisheries, UAE

Dr. Mohammad H. Al-Attar
Deputy Director General for Research, Life and Environmental Science, Kuwait Institute for Scientific Research, Kuwait (now Director General of BAC)

Dr. Ahmed Abu Zakhar
Agriculture Research Center, Tripoli, Libya

Dr. Rafiq Ahmed
Head, Biosaline Research Program, Karachi University, Pakistan

Dr. Ali Al-Jaloud
Institute of Natural Resources and Environment, King Abdelaziz City for Science and Technology, Riyadh, Saudi Arabia

Dr. Redwan Chukrallah
Head, Salinity and Plant Nutrition Laboratory, IAV Hassan II, Agadir, Morocco

Mr. Clive Malcolm
Land Rehabilitation Consultant, Australia

Mr. Peter Mather
Chartered Architect/Development Consultant, UK

Dr. M.S. Shannon
Director, US Salinity Laboratory, Riverside, California, USA

The work of the Technical Committee concluded with the establishment of BAC.

STAFF NEWS

Ahmed S. Hariri, Deputy Director General

Ahmed S. Hariri is BAC's Deputy Director General. Mr. Hariri's involvement with the Center dates back to 1992, when the Islamic Development Bank appointed him as Project Manager to guide the development and establishment of BAC.

An Agricultural Economist with degrees from California State Polytechnic University, USA, Mr. Hariri worked for IDB from 1988 until being seconded to BAC at the beginning of August 1999 to ensure the smooth handover of the new institute to the Director General.

John E. Noisette, Finance & Administration Officer

John E. Noisette joined BAC at the beginning of August 1999 from the International Center for Agricultural Research in the Dry Areas (ICARDA), Aleppo, Syria, where he was Director of Finance and Administration. He holds a BS in Public Accounting from the State University of New York at Albany, New York, USA, an MS in Business Administration from Purdue University, Indiana, USA, and an Executive Master in Business Administration from ESC Rouen, France.

Mr. Noisette has extensive experience in financial and administrative management of operations in the Middle East, having spent eight years on health-care projects in Saudi Arabia before moving to ICARDA in 1990.

Abdallah A. Jaradat, Plant Genetic Resources Scientist

Abdallah Jaradat came to BAC from the USA, where he spent the last three years as a visiting scientist at the National Germplasm Laboratory, Beltsville, Maryland, working as a consultant and developing a regional project for plant genetic resources in the Fertile Crescent. Prior to that he worked for the International Plant Genetic Resources Institute, based at its West Asia and North Africa Office at Aleppo, Syria. Dr. Jaradat went to schools in Damascus, Syria, Amman, Jordan, and Pullman, Washington, USA. He holds a Ph.D. in Plant Breeding and Genetics.

Bassam A. Hasbini, Irrigation Management Scientist

Bassam Hasbini has long experience in irrigation management in the UAE, having taught irrigation and drainage at the UAE University, Al Ain, UAE, and having worked in water resources consulting with multinational firms in Los Angeles, California, USA, and Abu Dhabi, UAE.

Dr. Hasbini holds a Ph.D. in Agricultural Engineering from Colorado State University, Fort Collins, Colorado, USA.

Paul J.H. Neate, Communication Specialist

Paul Neate joined BAC in August 1999. Prior to joining BAC he was in charge of publishing at the International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia. Mr. Neate holds a degree in agriculture from The University of Edinburgh, UK, and postgraduate qualifications in publishing from the Robert Gordon University, Aberdeen, UK.

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