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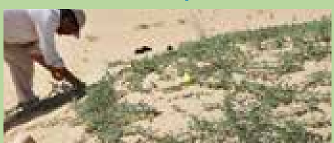

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@ICBA

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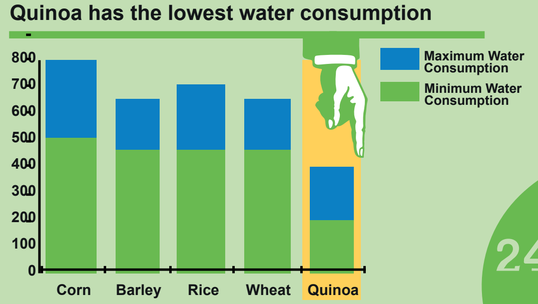
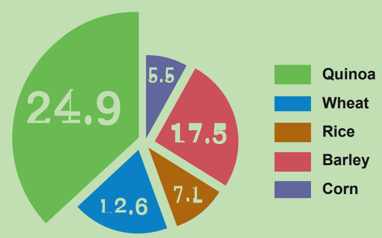
Quinoa

a super crop for marginal environments

Food Security...

Quinoa has the lowest water consumption



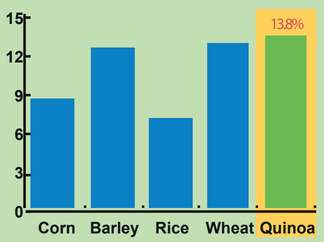


Salinity tolerance/Productivity in marginal environments

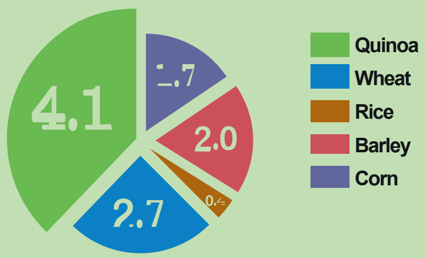
Salinity at which 50% reduction in yield occurs (C_{50})

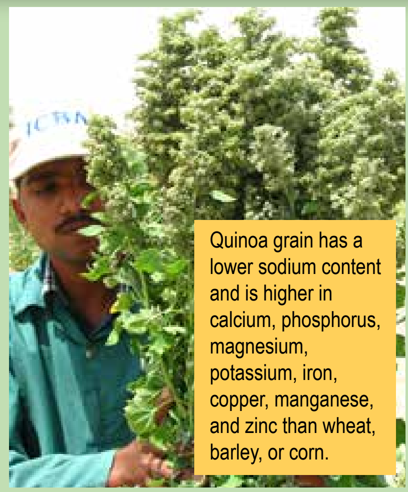
Nutritional Security...

Quinoa: Highest Crude Protein as % of dry weight



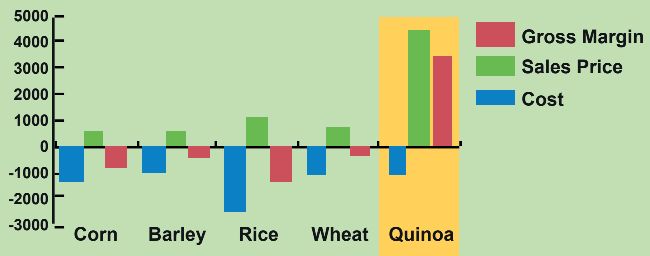
Quinoa: Highest Fiber % in dry weight





Income Security...

Average cost of production, sales revenue, and gross margin per hectare (US$ per hectare)



Know more about Quinoa and its importance for agriculture in magrinal environments; visit ICBA wesbite www.biosaline.org

Word from ICBA Director General

The global challenges of population growth, depletion of natural resources, and climate change impact require innovative thinking about sustainable management of all environments (arable and marginal).

While the green revolution era focused on 16 commodities of food crops that were mainly targeted for high potential environments, the benefit to marginal environments was very minimal. Where, most of the 1.4 billion people currently living in marginal environments depend on agriculture for their sustenance and survival. Creative strategies are needed to improve their livelihood, since many are barely able to sustain their existence under current conditions and technologies. The International Center for Biosaline Agriculture (ICBA) and its partners are actively trying to find solutions that address the needs of these farmers in our pursuit to improve the food and nutritional security of those living off marginal environments.

Innovations focusing on poor and marginal lands have sought to evaluate options for marginal quality land and water resources, and in particular recognize explicitly the importance of designing interventions with increased tolerance to harsh growing conditions.

Technological breakthroughs in the coming years offer the promise of making it faster and less costly to achieve these goals. "There is evidence that every dollar spent on agricultural research generates US$9 in additional food for developing countries..." said the President of the International Fund for Agricultural Development (IFAD), Dr. Kanayo Nwanze, during his talk at ICBA on 'the cost of neglect in agriculture, rural transformation and development'.

Speaking of which, Dr. Nwanze's address was the second in a newly launched series "AgTalk" that ICBA is organizing as means to foster discussions and awareness on matters related to agriculture in marginal environments. The first "AgTalk" session hosted Dr. Shenggen Fan, Director General of the International Food Policy Research Institute (IFPRI), who gave a presentation on 'Sustainable intensification is key to food security and nutrition in drylands'.

I wish you a pleasant reading.

Sincerely yours,
Ismahane Elouafi

in this issue...

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Horticultural production – water and energy use efficiency under greenhouse conditions in marginal environments

Assessment study on business, food security and environment benefits

Horticulture experiment at ICBA research station in Dubai, 2015

The Gulf Cooperation Council (GCC) countries are amongst the most water scarce countries in the world, yet agriculture in these countries consumes over 85% of the available fresh water. Nonetheless, the region imports the majority of its food needs. Hence, it is important to find solutions to optimize the use and productivity of fresh water in the agricultural sector.

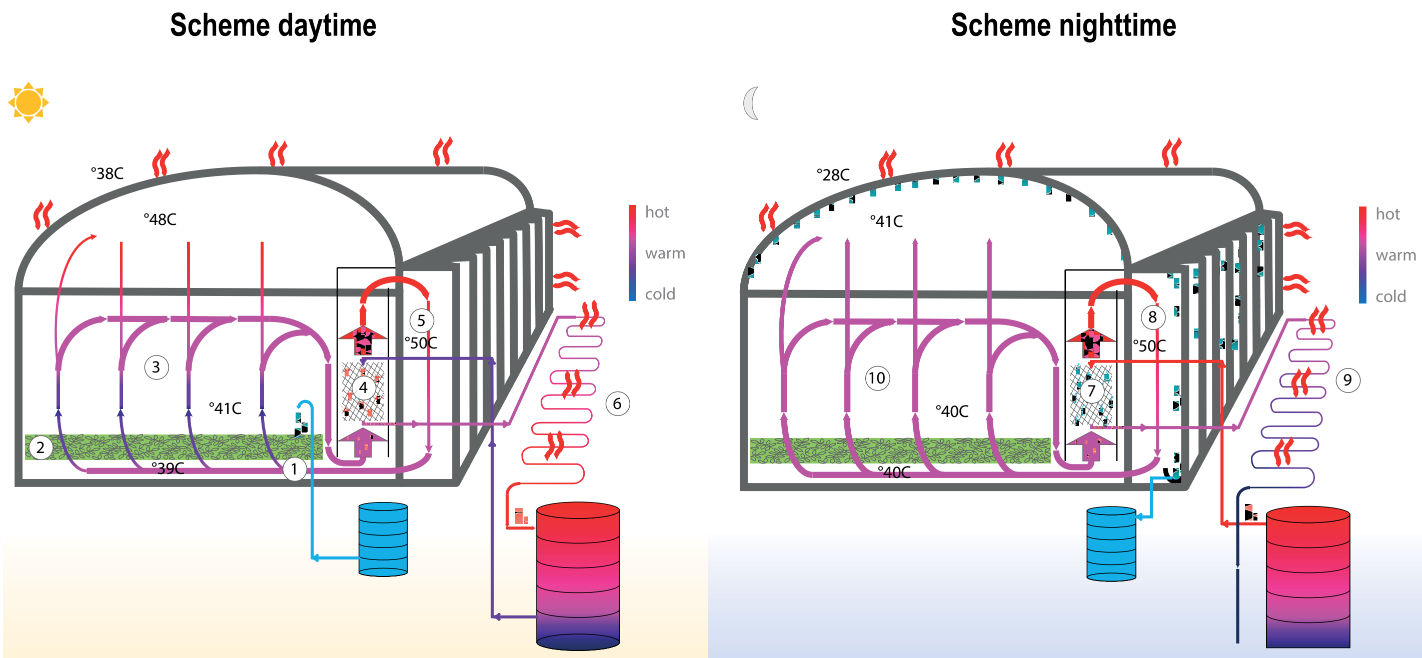
Therefore, improving water management and water productivity in agricultural systems is a major strategic issue for most GCC countries. Protected horticulture can play a key significant role in improving the water management and productivity of agricultural systems thus providing a feasible option in the regions pursuit to improve is food supplies with the limited available water. Cultivation on substrates under protected conditions can be considered as one of the spearheads in this process.

To-date, greenhouse production is considered the most water saving solution in the agricultural sector and greenhouse crop production is steadily growing with an estimated 3 million ha of greenhouses spread all over the continents. The degree of sophistication and technology in these greenhouses, depends on local climatic conditions and the socio-economic environment.

The development of greenhouse production in northern Europe stimulated the expansion of protected agriculture in other areas, including the Mediterranean region, North America, Oceania, Asia and Africa, with various rates of implantation and various degrees of success. It has been shown that a mere transposition of north European solutions to other parts of the world is not a valid process, as each environment requires further research, development, extension, training and new norms of application to meet local requirements.

The GCC countries have approximately 14,000 ha under protected agriculture. Due to the hot climate water consumption is high, plus the greenhouses need to be cooled down which requires a lot of energy. In fact, greenhouse energy consumption in the GCC constitutes the largest component of the system's environmental impact, especially during the hot season (May to September). For example, the energy consumption for greenhouse cooling is about 1700 kWh/ha/day. Reductions in fossil fuel energy consumption and possible replacement with renewable and sustainable energy sources, are of great importance to greenhouse growers. In the Arabian Peninsula, with its abundant sunshine, solar energy can prove to be a viable source of renewable-energy.

The United Arab Emirates (UAE) depends heavily on foreign market imports for its needs of fruits and vegetables, as it imports 62% and 47% of its vegetables and fruits needs respectively. Therefore, there is a great potential for horticultural production to meet part of this demand, and farmers have picked up on this with greenhouse production steadily increasing in the country. During the period from 2005-2011 the number of greenhouses increased by 48% with a total covered area of about 493 ha, with most of this expansion in greenhouse production in Abu Dhabi emirate. However, since 2011, there has been a notable decline in the total production levels in



New generation greenhouse, scheme prototype at Al Dhaid, United Arab Emirates

1. *Supply of dry air to the greenhouse*
2. *Evaporative cooling by vegetation*
3. *Zoning of hot air under roof, heat release through greenhouse cover*
4. *Humid greenhouse air is dried and further heated by absorption into liquid desiccant within WATERGY Absorber Box*
5. *Heat release through extended northern wall and return of air with reduced temperature and humidity to the greenhouse*
6. *Transport of greenhouse thermal energy and greenhouse water by liquid desiccant, additionally heated in a solar-thermal collector to storage container*
7. *Evaporation of water from liquid desiccant to greenhouse air within the absorber box (regeneration of desiccant for next day) under use of heat from storage*
8. *Cooling of air and condensation/collection of water on extended northern wall*
9. *Return of desiccant concentrate to storage, while passing the solar collector for further radiative cooling*
10. *Further condensation/collection of water on greenhouse cover surface*

greenhouses. This decline is mainly due to salinity and water scarcity problems. This has prompted ICBA to come up with solutions for better use of saline water and water efficiency technologies suitable in the UAE and the Arabian Peninsula.

In 2014, ICBA introduced hydroponic greenhouse facilities using technologically sophisticated and commercially proven horticultural techniques combined with unique energy saving innovations to test and adapt these technologies and develop best management practices under local conditions. These facilities consists of three greenhouses, two with a conventional pad and fan evaporative cooling system, and one with net walls and a fogging system for cooling. All are provided with desalinated water that is automatically dosed with nutrients under the control of a commercial computerized system designed for this purpose. The cooled greenhouse consists of two adjoining but separately controlled bays; while, the non-cooled greenhouse is controlled as a single unit.

The water provided to the hydroponic system is dosed and the drainage is collected, analyzed, disinfected and re-dosed before being recycled back to the crop. Various measurement systems are also used to monitor water consumption, the interior environment and the weather outside. An automatic screen is also installed to reduce solar radiation. Fertigation is monitored using the Hortimax system where the fertilizers injection is carried out automatically based on EC and pH values determined as input according to crops salinity tolerance and crops stages.

The facility will enable ICBA scientists to carry critical research related to optimizing crop productivity alongside energy and water balance ratios to maximize the economics of production in hot and humid arid climates such as the UAE and the Arabian Peninsula.

Written by: Dr. Redouane Choukr-Allah and Dr. Abdelaziz Hirich

Colocynth: A potential oilseed crop for bio-fuel production

Coal, petroleum and natural gas are the main sources of energy in the world today. All three sources are fossil-derived, non renewable and cause global warming by emitting greenhouse gases. Various crops like maize, rapeseed/canola, soybean, sugarcane, palm oil, jatropha and sunflower are being cultivated to produce bio-fuel. But crop bio-fuel has high cost of production; needs large amounts of fresh water for irrigation, which eventually will lead to global food shortage. There is need to find non-agricultural crops that grow in the wild, for bio-fuel production. Colocynth is one of the best candidates for this purpose as it has the potential to yield high oil seed production, while growing on marginal lands. The plant grows well in sandy soils, hot climate with little moisture and does not need much care. Since the colocynth seed has high oil contents of 22-53 %, it may produce more than 3,000 kg/ha of oil, which is comparable to major oilseed crops. Consequently, this hardy vine can be used to generate large scale vegetable oil for a viable bio-fuel industry.

Keeping in view the importance of colocynth as a potential oilseed crop for the marginal lands, ICBA carried out various botanical explorations between 2013 and 2014 to collect its fruits from different parts of the United Arab Emirates for a comprehensive study of the plant and its seeds for conservation, distribution and further research (Shahid and Rao, 2014). During the expeditions, fruits of about 25 accessions of the species were collected from all around the country (Figure 1). The majority of the *Citrullus colocynthis* accessions were found in the desert. Different characters of fruits and seeds of the collected colocynth germplasm were studied to ascertain its yield potential as oilseed crop.

In the UAE colocynth flowers from November to April

Table 1: Different traits of Citrullus colocynthis *germplasm of the UAE*

S.N.	Traits	Mean	Minimum	Maximum
1	Fruit length (mm)	57.9	48.7	70.1
2	Fruit diameter (mm)	59.7	52.3	74.6
3	No. of seeds per fruit	315	169	561
4	Seed weight per fruit (g)	7.7	3.2	20.0
5	Seed length (mm)	6.1	5.4	7.7
6	Seed width (mm)	3.6	3.2	4.3
7	Seed thickness (mm)	1.7	1.8	4.2
8	100 seeds weight (g)	2.4	1.8	4.2

ICBA's study shows that colocynth plants grow well in sandy soils with little available water, as little as 70 mm of water. The colocynth fruit, which is smooth and round is about 48-70 mm long and has diameter of 52-75 mm. One fruit contains roughly 170-560 seeds and total seed weight per fruit is 3.2-20 g. Seeds are egg shaped brown to dark brown, 5.4-7.7 mm long, 3.2-4.3 mm wide and 1.8-4.2 mm thick, while 100 seed weight is 1.8-4.2 g (Table 1). Results showed a large variation among the collected colocynth germplasm regarding its fruit and seed traits. The accessions with the best characteristics, as identified in (Table 1), could be exploited for the production of bio-fuel in the arid lands.

In 2014, the collected colocynth germplasm along with accessions from other countries were planted, at ICBA field experiment facilities, to study and explore its potential as an oilseed crop in the region.

Figure 1: Collection locations of Citrullus colocynthis *germplasm in the UAE*

One colocynth seed has 22-53% oil content

Colocynth (*Citrullus colocynthis* L.) is a perennial, herbaceous vine that grows naturally in North Africa, southern Europe, the Middle East and South Asia. Mostly it is found in deserts with high temperatures and low rainfall. In the United Arab Emirates, where it is called handhal (الحنظل), it is common and widespread in its eastern, northern and central regions.

It belongs to the gourd (Cucurbitaceae) family that also includes, squash, pumpkin, cucumber, zucchini, melon, watermelon etc.; however, its puplp is very bitter and not edible. The flowers are yellow and solitary, which are monoecious having male and female reproductive parts in different flowers on the same plant.

Colocynth has many medicinal benefits against different ailments including diabetes, toothache, rheumatism and cancer. It is also an antioxidant and can be used as laxative.

Although the plant can be propagated by seed and vegetative propagation, the later is more common and successful as seed germination yields poor results due to its dormancy which is hard to break. This prompted ICBA and Birla Institute of Technology and Science (BITS), Dubai Campus, to work together on colocynth seed dormancy problem. The mutual research resulted into finding an efficient way of breaking the seed dormancy with different treatments (Menon et al., 2014).

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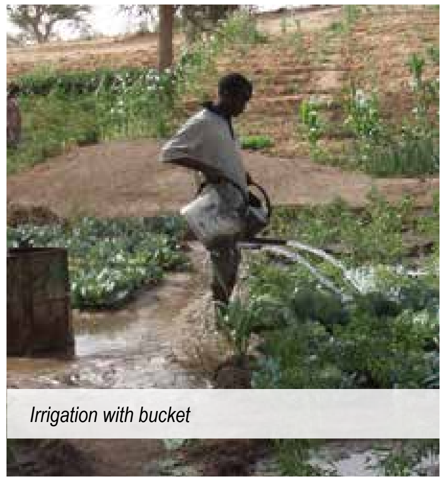
Written by Mohammad Shahid and N.K. Rao

Californian irrigation system: A low cost and water efficient irrigation system for smallholders in Burkina Faso

Californian system using the motor pump to lift water and the pipe to bring water in the field

For smallholder farmers in Sub-Saharan Africa (SSA), transportation of irrigation water from the main source (stream or canal) to their field is the major barrier in increasing agricultural productivity. In the existing supply networks, huge amount of water is lost as deep percolation due to the coarser texture of soils. Therefore, introduction of low cost and water efficient small scale irrigation technologies is the need of the hour to boost agricultural production and improve the livelihood of rural farmers.

In an on-going project, ICBA is carrying in SSA the efficacy of the 'Californian system' was tested in Burkina Faso. The Californian system is a network of PVC pipelines buried in the soil with several terminals for irrigation to route water from the source to farmer fields having an irregular topography. The system lifts water with a pump and uses



Irrigation with bucket

PVC pipes to distribute water in the field. This system reduces infiltration losses during the water delivery. With this system, crops are planted on ridges; which makes it most suitable for growing vegetable crops. Farmers start their irrigation by using the bucket during the four weeks after the transplantatio, during which the seedlings are irrigated three times a week. After that, farmers switch to the Californian system and the irrigation frequency decreases to two times a week.

The system includes a pump at the edge of the inlet channel, 50 cm deep buried pipes, water intakes, and accessories for the distribution and flow control. The delivery pipes are placed at 10 m distance. The system is designed in such a way so that each portion of 500 m^2 plot can be irrigated by a nearby water outlet. Depending on the configuration of the plot and the distance between source of water and field, the total cost of this system varies between US$ 670 to 750 per ha. Out of the total cost, about 40% is associated with the pump cost.

Californian irrigation system has several advantages over traditional irrigation system as field tests demonstrated that the technology is simple to use by local unskilled labors, the amount of labor needed for irrigation is lower, and the cost is affordable to smallholder farmers.

Furthermore, the Californian system is well adapted for plots with varied topography. It minimizes water loss during irrigation, improve infiltration and water is adequately distributed between several terminals. In addition, it reduces irrigation time and gives the possibility to use several terminals at the same time.

The Californian system saves lots of land because pipes take up less space compared to surface channels. It provides easy installation, use and maintenance because all materials are available locally. Expanding the irrigated area is a simple task. Two persons are able to conduct irrigation on the 0.5 ha plot, compared to four to five men under traditional pump irrigation system. The ease of setting up and maintaining this system empowers women; who can now independently operate their irrigation system.

Moreover, in water shortage periods when water level drops in channels and irrigation with two-cylender pumps is not possible, the Californian system works efficiently. Consequently, farmers are able to achieve higher yields due to timely plantation of seeds and timely irrigation of crops.

Californian system is particularly good in saving water through improved irrigation efficiency. For onion crop, Californian system used 9,800 m^3/ha of water, compared to 11,750 m^3/ha for traditional gravity system and 12,200 m^3/ha for the sprinkler system in Burkina Faso.

Written by Asad Sarwar Qureshi

New insight on climate change in MENA region

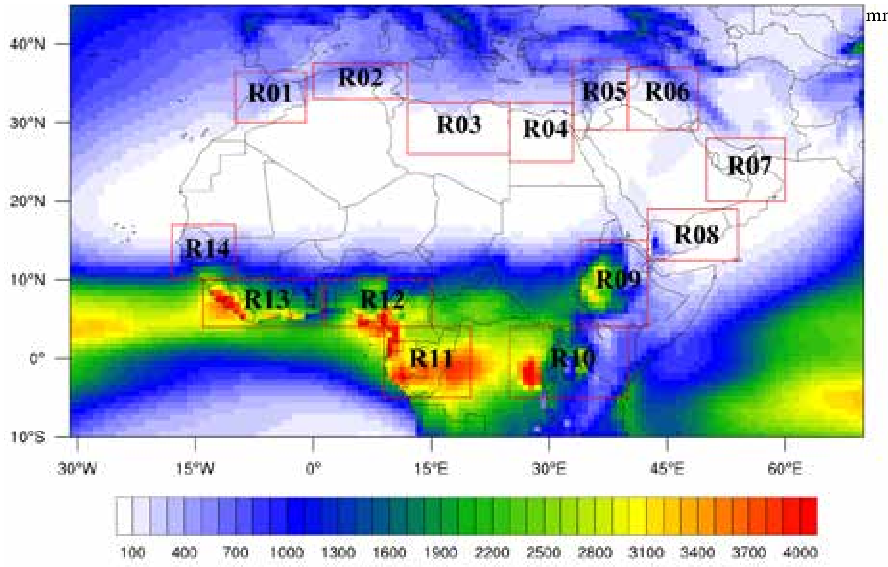


Figure 1: ERAI mean total precipitation 1979-2013

Any decreases in water availability, in the marginal areas in the Middle East and North Africa (MENA) region, will greatly impact not only food production systems but bring distress to the very people living there. For many of the countries in this region, the predicted likely impacts of a changing climate can bring serious threats to rural livelihoods and food security, jeopardizing the social and security well being of the local communities. Identifying the most vulnerable areas requires more localized data on likely changes in the climate than provided from any of the major General Circulation Model (GCMS)[1] outputs - the resolution of the information in the GCMS is around 200 km x 200 km for each grid square. To generate finer scale data it is possible to use downscaling model operations where local information such as topography is also included. It is also important to analyze the varying output data from the different models to determine which ones best represents the climatology for the area of interest.

ICBA has been working for the last three years on analyzing and downscaling climate change data for the MENA region under the USAID funded[2] 'Modeling and Monitoring Agriculture and Water Resources Development' (MAWRED) program. Initially work focused on building up data sets of the climatology over the region for the last 30 years. From analyzing and synthesizing these data sets, we developed a baseline of the climatology for each region and country against which future conditions could be compared to highlight the nature of any changes. This baseline data was also used to compare against the data from each of the different models for the same period. This is crucial for assessing just how representative of local climates each model is.

Comparing the outputs from many different models involves analyzing many terabytes of data. So to help us with this work, we used NASA Jet Propulsion Laboratories' Regional Climate Model Evaluation System (https://rcmes.jpl.nasa.gov/). This powerful open-source analytical tool facilitates the comparison of the various models outputs to observation data. At three different levels in the atmosphere, data on precipitation, geopotential height, temperature and humidity from six of the major GCMS from international research centers (CCSM4; CESM1-BGC; GFDL-ESM; BCC-CSM1-M; CNRM-CM5; MIROC5) were compared with the data at 14 different locations on the land (see Figure 1). In addition, sea surface temperatures, a major driver of climate, for 10 different locations around the region were compared between the observations and model outputs. Many different climatic comparisons were used to capture both seasonal and annual cycles. Figure 2 highlights the correlation of the annual cycle between model and observation data with the red highlighting a stronger match.

The figure highlights that not all models represent the different parts of the MENA region equally as well with the Gulf States and Yemen in particular proving particularly difficult.Using the many outputs from this analysis, it was decided to focus downscaling operations initially on the MIROC-5 model from Japan, with each set of activities taking over a month to complete even on ICBA's high performance computing cluster. The results of these ongoing activities are already beginning to highlight some of the likely impacts of climate change and these, when combined with other experiments shared through the Coordinated Regional Downscaling Experiment (CORDEX) (http://wcrp-cordex.ipsl.jussieu.fr/) website for the MENA domain, are showing that decreasing temperatures and increasing evapotranspiration are likely to result in the next 30 years in many areas of the region.

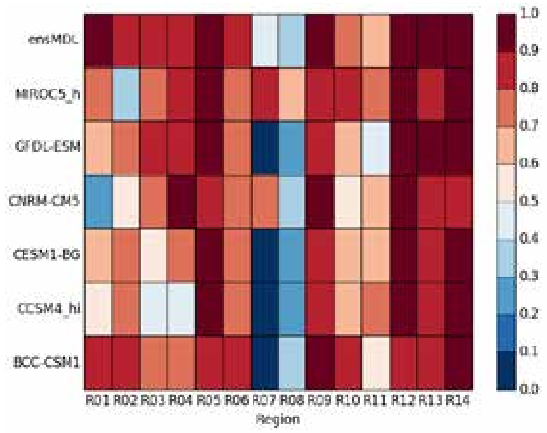


Figure 2: Annual cycle CORR COEF

The need for adapting agricultural practices and crop species for future climate change is even more important than for today. The trends identified in the climate change analysis show a drier hotter world in which water management and crop production will be ever more challenging.

Written by Rashyd Zaaboul, Karim Bergaoui, and Rachael McDonnell

1. A general circulation model (GCM), a type of climate model, is a mathematical model of the general circulation of a planetary atmosphere or ocean and based on the Navier–Stokes equations on a rotating sphere with thermodynamic terms for various energy sources (radiation, latent heat). These equations are the basis for complex computer programs commonly used for simulating the atmosphere or ocean of the Earth.

2. Work funded by USAID under grant Award Grant No. 263-G-00-09-00014-00.

FAO and ICBA new agreement to support enhanced agricultural development

Dr. Ismahane Elouafi, Director General of ICBA, and Dr. José Graziano da Silva, Director General of FAO, signing the Memorandum of Understanding in Abu Dhabi, UAE, 14 March 2015.

ICBA and the United Nations Food and Agriculture Organization (FAO) have had a fruitful co-operation that has existed for the last few years, including cooperation between ICBA and the FAO Regional Office for the Near East and North Africa ("FAO-RNE"), the FAO Representation in the United Arab Emirates in Abu Dhabi, the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture in Vienna, and the initiatives taken for strengthening cooperation in Central Asia and for supporting the Global Soil Partnership.

Both institutions desired to develop and strengthen the technical co-operation further between them, especially in the sector of agricultural land and water management. Specifically in identifying and streamlining policies and best practices in agricultural water management in FAO member countries as this can contribute to boosting agricultural productivity, improving food security and sustaining water resources.

On 14 March 2015, Dr. José Graziano da Silva, Director General of the United Nation's Food and Agriculture Organization (FAO), and Dr. Ismahane Elouafi, Director General of ICBA, signed a Memorandum of Understanding (MoU) that strengthens the cooperation between both parties in areas of common interest.Under this MoU, both parties agreed to cooperate to raise agricultural productivity, increase water security and alleviate poverty while ensuring sustainable use and management of natural resources and protection of ecosystems.

ICBA is an international, non-profit organization that aims to strengthen agricultural productivity in marginal and saline environments through identifying, testing and facilitating access to sustainable solutions for food, nutrition and income security. This creates a natural synergy with FAO's strategic objectives. FAO aims to help eliminate hunger, food insecurity and malnutrition; and to make agriculture, forestry and fisheries more productive and sustainable; reduce rural poverty; enable inclusive and efficient agricultural and food systems; and increase the resilience of livelihoods to disasters.

IAEA and ICBA sign practical arrangement in support of their soil, water, crop and nutrition activities

As a specialized agency of the United Nations, the International Atomic Energy Agency (IAEA) provides authoritative information and guidance related to the secure and peaceful use of nuclear science. When Agency activities intersect with other disciplines, however, the need to build partnerships and cooperate with other technical institutions becomes evident. For these reasons, the IAEA works in close partnership with other UN agencies, research organizations and civil society, with the aim of achieving strategic goals and expanding the peaceful application of nuclear technologies.

on 4 March 2015, IAEA Director General, Yukiya Amano, and Dr. Ismahane Elouafi, Director General of the ICBA, signed a Practical Arrangement, formalizing the already fruitful relationship between the two organizations. In addition to administrative and logistical affairs, the Arrangement clearly identifies the thematic scope of the cooperation, which includes mutual support in the areas of desertification and land degradation, soil and water management, water-use efficiency, and agricultural research. Moreover, the PA calls for an "exchange of data of mutual interest and relevance," thereby facilitating the work conducted by the respective institutions. This agreement demonstrates both agencies' commitment to developing productive relationships with other other partner organizations.

Based in Academic City, Dubai, ICBA is a not-for-profit organization devoted to research and development in marginal, often arid and semi-arid environments. These environments have sources of water, such as underground aquifers, but they are frequently brackish or saline. Traditionally, irrigation with salt water would lead to soil salinization, rendering the topsoil unfit for most kinds of crop cultivation. In studying the biochemical and physiological mechanisms of salt tolerance in plants, however, ICBA is developing methods to selectively breed plants for halotolerance, control the ripening process, and increase desirable traits (such as sugar concentration in fruit).

IAEA and ICBA sign a Practical Agreement on the 4 March 2015.

Trust builds confidence – the story of Abu Rafee from Jordan

Recent changes in climate pattern, such as prolonged droughts, and extreme temperatures, as well as increased rainfall irregularity, intensity and distribution, have further negatively impacted the natural and agro-ecosystems in the region and increased the vulnerability of the people dependent on these resources for their livelihood. As the populations and economies of the region grow, the demand for food will increase and the water scarcity will worsen, resulting in further competition between the industrial, agricultural and domestic sectors.

The past decades saw an increasing number of farmers abandon their lands or face very low productivity, and this is having dire social and economic consequences necessitating the development of alternative, more productive, and sustainable farming systems appropriate for the socio-economic and changing environmental conditions of the region.

In response to these challenges, ICBA along with local partners launched the Adaptation to Climate Change in Marginal Environments (ACCME) project aimed to introduce resilient forage and crop production and management systems that are biologically suitable for use of saline and wastewater, so as to bring back and increase productivity of such degraded and lost lands.

Abu Rafee, a farmer from Jordan, shares his story! Farming is my main source of living, and within my community I am known to be pioneer in acquiring new innovations in agricultural technology. Back in 2010, I received 20 kg of barely from ICBA's project in Jordan that is conducted in collaboration with the National Center for Agricultural Research and Extension (NCARE). I used these seeds to plant 0.2 ha at the side of my field. I also accepted to irrigate them with treated wastewater from a nearby treatment station, as was recommended by the project experts. I found out that their productivity was excellent and reached 4.5 t/ha of seeds and about 8 t/ha of green matter.

This encouraged me to acquire more crops from ICBA's project through NCARE and used my production to widen the area planted with these new crops. Now, I plant Triticale and barley in winter and pearl millet and sorghum in summer across 45 ha of my land. My land is considered marginal and below normal for agriculture production. It has no water source except rain fed. But with the crops I was provided with and the use of treated wastewater I was able to turn a large area of my land productive throughout most of the year and this provided me with a great profit.

I am a pioneer farmer because I believe that "Trust builds confidence". I trusted ICBA and I am now confident that their management practices are trustful.

VOICES FROM THE FIELD

ICBA and IFPRI sign a Memorandum of Understanding

Both ICBA and IFPRI work on aspects that aim to fight hunger and malnutrition, and the latest appointment of Dr. Ismahane Elouafi, ICBA DG, as a member of the IFPRI Board of Trustees will further strengthen the collaboration efforts between both organizations as well as between CGIAR[1] and AIRCA[2] to benefit poverty alleviation and food/nutritional security achievement.

On 20 March 2015, ICBA and IFPRI signed a Memorandum of Understanding (MoU) following a series of deliberations during which both organizations agreed that they have a common objective of contributing to agricultural research and development to improve food and nutritional security through encouraging utilization and management of natural resources in a sustainable manner, each in the context of their respective manadate.

The MoU intends to facilitate collaboration of both organizations in providing research based policy solutions for enhanced food and nutritional security in marginal environments.

IFPRI is an international organization founded in 1975 that seeks sustainable solutions for ending hunger and poverty. A member of the CGIAR consortium, a global research partnership for a food secure future. It undertakes research that helps shape policies, investments, and programs, thus contributing to a productive, sustainable and resilient agricultural and food system.

This partnership strengthens ICBA's commitment in pursuing its ambitious strategy for 2013-2023 that focuses on building and strengthening partnerships to deliver agricultural and water scarcity solutions in marginal and saline environments.

1. CGIAR is a global partnership that unites organizations engaged in research for a food secure future.

2. AIRCA (Association of International Research and Development Centers for Agriculture) is a nine-member alliance focused on increasing global food security by supporting smallholder agriculture within healthy sustainable and climate-smart landscapes.


IFPRI aims to provide sustainable solutions for ending hunger and poverty

Introducing new irrigation technologies and crop management practices in Sub-Saharan Africa

The 'Improving Crop and Seed Production Systems under Water/Irrigation Management in Sub-Saharan Africa' project that ICBA is implementing in seven Sub-Saharan African countries (Niger, Mali, Burkina Faso, Mauritania, Nigeria, Senegal, and the Gambia) aims to increase farm productivity and the overall livelihood of the smallholders. Through this project, financed by the Ismalic Development Bank, ICBA is providing small-scale irrigation technologies to the farmers to increase their accessibility to available water. ICBA is also assisting farmers to select the right crops and best management practices to increase water productivity, hence increasing the crop return per drop of water used. As a part of this project, ICBA established model seed farms to increase the proximity between the source of seeds and the farms that require it, and to decrease the cost.

The annual progress review and planning meeting that brings together the focal persons from all participating countries was held in ICBA during February 2-4, 2015. During this 3-day meeting, main achievements and progress made during the last year was thoroughly reviewed and the work plan for 2015 was discussed and approved. Dr. Ismahane Elouafi, Director General of ICBA, welcomed the delegates and assured ICBA's support for the development of agriculture sector in the African region. Moreover, Dr. Shoaib Ismail, Director of Research and Innovation at ICBA, highlighted the importance of this project for African region.

Dr. Asad Qureshi, Coordinator of the Project from ICBA, highlighted that during the last three years, the project has successfully developed and updated inventories on water, irrigation, crops and baseline socio-economic conditions of the farm communities. The irrigation technologies such as water lifting (i.e. manual, gasoline and solar pumps), water distribution (i.e. canals and pipes), and irrigation methods (i.e. furrow, basin, drip and sprinkler, Californian system) have been demonstrated to farmers. In all project locations, new crops and/or improved varieties of the existing crops have been tested.

To-date, local farmers and extension workers have shown great interest in the newly introduced irrigation technologies and crop management practices for enhancing agricultural productivity. In 2015, ICBA will carry a special survey to document project success and understand farmer difficulties in the adoption of these technologies. This information will be used to develop policy recommendations for scaling up these technologies and management practices to other parts of the target countries and the region.

SSA has a serious overpopulation problem, where population was estimated at 800 million in 2007 and it is expected to grow up to 1.5 billion by 2050. More than 40% of the population in sub-Saharan countries is younger than 15 years old. This puts a huge pressure on food, nutrition, and income security for that region.

Large scale adoption of interventions promoted by ICBA, under the 'Improving Crop and Seed Production Systems under Water/Irrigation Management in Sub-Saharan Africa' project, will directly enhance agricultural productivity and farm incomes thereby eliminating poverty and improving food security and livelihood for the smallholder farmers. The potential of this project is also manifested through its ability to harvest marginal lands and tap on marginal water resources in an economical and sustainable way. Eventually, this project will lead to the achievement of a self-sustained economy and maximizing happiness and quality of life!

The cost of neglect—agriculture, rural transformation and development

It is self-evident that agriculture and rural development contribute to food and nutrition security, but it is often forgotten that they also provide a pathway to employment, wealth creation and economic growth, and are a necessary precursor for global peace and security. Research for development is essential.

This was the focus of a seminar lecture by Dr. Kanayo Nwanze, President of IFAD, at ICBA on the 3rd of March. Dr. Nwanze highlighted the importance of agriculture and research for development and outlined IFAD's experiences in helping poor rural people increase food production while conserving water and building resilient food systems. He stressed that there is evidence that every dollar spent on agricultural research generates US$9 in additional food for developing countries and that this is particularly important in dryland areas in this era of climate change.

In his speech, Dr. Nwanze stated that "ICBA and IFAD have long shared an understanding that water is a precious resource. It is particularly valuable in drylands, where ICBA focuses, and in the fragile areas where IFAD does most of its work. Indeed, 61% of IFAD projects have a water component. With climate change now threatening agricultural systems the world over, our work has taken a new urgency."

He went on to stress that the world can no longer afford to ignore agriculture for development. Its persistent neglect has created a world where more than 800 million people suffer from chronic under-nutrition; a world where 160 million children younger than five are stunted.

Adults who are under-nourished cannot fully contribute to their local or national economies. Children who are stunted never achieve their potential as adults. When these children reach working age, the income gap between them and their better-nourished counterparts is US$125 billion, every year. This has dire humanitarian and economic consequences with a huge cost to global economies.

To demonstrate how the benefits of research spreads to the poor and beyond. Dr. Nwanze cited research on salinity-resistant forage plants carried by ICBA and supported by IFAD. The research helped raise the incomes of poor people in poor countries, but it also helped farmers in wealthier arid and semi-arid nations such as Oman and the UAE.

Yet investment in agricultural research and development continues to lag. According to IFPRI, spending needs to increase at least 5% a year over the next decade for low- and middle-income countries to meet the post-2015 development goals.

Dr. Kanayo Nwanze, giving a presentation on 'The cost of neglect - agriculture, rural transformation and development' at ICBA on 3 March 2015

The annual meeting, held at ICBA on 15-19 February, for the project on 'Developing effective practices for combating desertification–ARAISA–RAS5068'

Developing effective practice for combating desertification

Drought caused by climatic change coupled with considerable shortages of fresh water supply is an expanding phenomenon in all over arid region countries of the Middle East. Consequently, the entire area witnessed rapid advancement of desertification process over arable fertile land.

Improper agricultural practices and bad management of soil and water resources converted what were previously fertile soils into depleted soils of extremely low productivity. Furthermore, most of the soils, 70-80 % of the total area of Lower Mesopotamian Plain has been converted to saline alkali soils of large salts content distributed along soil profile. Therefore, large number of farmer families abandoned their farms which resulted in sever socioeconomic impact.

Accordingly, rehabilitation of such vast area and re-habituated farmers is of considerable importance to all concerned countries. Large quantities of underground brackish water available in the area may serve as a possible water resource. Agricultural practices and cropping systems may be needed to be modified for sustainable cropping of the area.

These issues are being addressed under the research project 'Developing effective practices for combating desertification' to achieve the objectives through: the use of best practices for cropping of salt affected soils; utilization of saline ground water in the cropping system under sustainable form of agriculture; the use of chemical amendments to reduce sodium hazardous effects on soil and plant; and securing reasonable market for the farm product for family settling in the area.

During February 2015, ICBA hosted the annual project meeting on the IAEA[1] coordinated project on 'Developing effective practices for combating desertification–ARASIA–RAS5068', which included representatives from Iraq, Jordan, Lebanon, Oman, Syria, UAE and Yemen. The participants discussed the various milestones that have been achieved in the aim of fulfilling the overall objective of this project. Where this project seeks to develop effective practices for combating desertification depending on the main factors of desertification such as soil salinity, low productivity and shortages of water supply. In addition, future action plans have been agreed upon among which, Dr. Shoaib Ismail, Director of Research and Innovation at ICBA, discussed a new proposal that will help in enhancing the use of salt-affected soils and saline water for crop and biomass production and reducing land and water quality degradation in ARASIA[2]; for which, ICBA will provide the technical assistance during 2016-2017.

1. International Atomic Energy Agency (IAEA): The IAEA works for the safe, secure and peaceful uses of nuclear science and technology. Its key roles contribute to international peace and security, and to the world›s Millennium Goals for social, economic and environmental development.

2. ARASIA is the Cooperative Agreement for Arab States in Asia for Research, Development and Training related to Nuclear Science and Technology and included the following countries: Iraq, Jordan, Lebanon, Saudi Arabia, Oman, Qatar, Syrian Arab Republic, United Arab Emirates and Yemen.

Enhancing crop mapping and modeling capabilities


ICBA organized a training on enhancing crop mapping and modeling capabilities, 19-23 April 2015

With ever growing demand for food in the Middle East and North Africa region and declining water availability, decision-makers needs to balance the consumption of their natural resources. They need to understand the different crop production areas and the management systems used including the contribution of irrigation. Yet, up-to-date data, on crop or irrigation maps or models to simulate the varieties and management systems, exist in very few countries.

ICBA, in collaboration with the USAID, organized a workshop on “Enhancing crop mapping and modeling capabilities” from 19-23 April 2015 at ICBA headquarters in Dubai, United Arab Emirates. The participants came from four countries: Iraq, Jordan, Morocco, and Tunisia.

“This course helped in filling these knowledge gaps by taking participants through the practical steps to generate these new data. It aimed at enhancing the skills in using satellite imagery for crop mapping and to crop modeling using DSSAT for exploring management and climate change impacts on agricultural production systems”, said Mr. Rashyd Zaaboul, Climate Modeling Scientist at ICBA.

Rashyd was one of the five instructors from ICBA, others included Dr. Rachael McDonnell, Leader of the Modeling and Monitoring Agriculture and Water Resources Development (MAWRED) program at ICBA; Dr. Adla Khalaf, Remote Sensing Scientist; Mr. Karim Bergaoui, Climate and Water Modeling Scientist; and Dr. Makram Belhaj Fraj, Agronomy Scientist.

The five-day workshop focused on understanding satellite imagery, sources, downloading and pre-processing. In addition, it focused on developing field data collection exercises to support crop mapping from satellite images. Also, participants were given an introduction on image classification combining satellite imagery and field data to derive crop maps and to assess the accuracy of the resulting crop maps.

Participants learned about the DSSAT and its use in crop management and food security planning under climate today and in the future. They prepared daily atmospheric data from global data sets to input to DSSAT and assessed variation in crop production using simulation model.

Participants feedback

I am glad to have participated in this training course. Many thanks to each member of the training faculty for their great ability in getting through the knowledge to us especially with respect to DSSAT and ERDAS and hope that I could apply it in my country to assess agriculture production and optimize its benefits. ***Ola Nouri Ibrahim, Iraq***

In this training, we had a heterogeneous group of people coming from various backgrounds and different government entities that are the potential end users of climate downscaling data. This training helped us learn about the available tools such as the DSSAT… to learn about the importance of the generated data, its precision, and its availability… as well as, the utilization of remote sensing in irrigation maps… I look forward to a second phase of this training that could go into more details and create a continuity to the current workshop. ***Thouraya Sahli Chahed, Tunisia***

This training was a good opportunity for me to brush up my knowledge in crop modeling and crop mapping. It was a very interesting training that allowed me to ameliorate my skills in these two topics. We had a great support from the trainers in practical sessions that helped us in producing cropping maps. ***Najeh Al Sayah, Tunisia***

The training was excellent and was led by a highly qualified team of instructors. They have a special capability in communicating with the participants and in passing knowledge in a very smooth and effective way. ***Ahmed Abdel Gader, Jordan***

I came here to learn more on the DSSAT model, because in my work we remote sensing mapping for agricutlural production. I have learned a lot during this workshop with this regards... I would like to sincerely thank the trainers for their professionalism and ICBA for the excellent organization. ***Hafiza Bouaouda, Morocco***

Everyone appreciates it when learning is fun


Technical Trainers’ Toolbox training by Deborah Laurel at ICBA in Dubai

Along its initiative to enhance the training experience and the knowledge dissemination process, ICBA is implementing a long-term strategy that aims to establish it as a leader in facilitating knowledge and technology exchange.

“Even after all of these years of setting up training rooms to engage as many senses as possible, I still get nervous about how well it will be received by certain audiences,” says Ms. Deborah Laurel, who facilitated a two-day Technical Trainers’ Toolbox in Dubai for ICBA scientists from different countries—Pakistan, Tunisia, Syria, Morocco, Palestine, Saudi Arabia, Greece, and Great Britain.

Deborah aimed to introduce to ICBA trainers various tools and techniques that will enable them to deliver an even more compelling and engaging trainings. One main point that Deborah focused on was to make training fun; everyone appreciates it when learning is fun.

The sessions were highly participative. The trainees built lesson plans for two of their work topics: climate control models and soil salinity mapping. Then they created a variety of learning activities for both lesson plans, including a focus question, questionnaire, and case study. They had a serious discussion concerning what a case study actually was and how it could be used as a learning activity.

ICBA scientists’ interest in participatory learning and how it can be used to further enhance the training offerings of ICBA intensified as the training progressed and new participatory tools were presented and evaluated. Participants utilized the last session of the training to brainstorm the applications of the variety of learning activities that they learned. This was followed by revisiting the flow of content of the ICBA training model. The new ICBA capacity building offerings was developed with interactive learning principle in mind.

Capacity building opportunities at ICBA on innovative agriculture in saline and marginal environments

Capacity building is central to ICBA's activities and spans geographical domains, research areas and methods. ICBA believes that improving its skills as well as those of its partners and stakeholders is key to addressing the challenges affecting agriculture in marginal and saline environments.

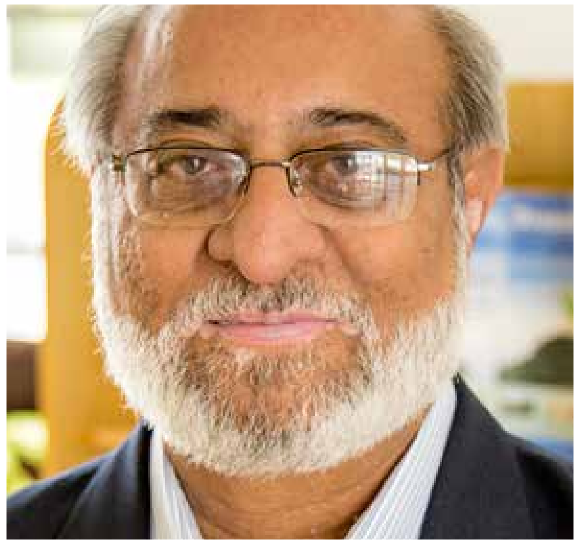
ICBA offers a range of capacity building programs linked to its research programs that include but not limited to: Masters, doctoral and post doctoral research, short training courses, farmer field days, internships, knowledge hubs, and a soil museum.

ICBA's capacity building opportunities are open to an array of audiences that can benefit from the expertise of the Center's international team of experts that includes soil, crop, water, policy and socio-economic experts, in addition to modern research and training facilities.

ICBA's 100-hectare land includes an experimental farm; soil and water, molecular biology and agronomy laboratories equipped with state-of-the-art equipment; nurseries and green houses equipped with modern irrigation systems; and a gene bank that holds more than 12,000 accessions belonging to 225 species of salt-tolerant plants from 120 countries around the world. In addition, there is a soil museum that includes different soil education modules catering to the needs and demands of a diverse range of visitors from school children to professionals.

In this regards, ICBA has recently published a brochure containing details on "ICBA Capacity Building Offerings"; soft copy of the same on ICBA website on http://biosaline.org/Library/ICBA-Capacity-Building-Offerings/index.html

Appointment of Dr Shoaib Ismail as the new Director for Research and Innovation at ICBA



On March 18, 2015, Dr. Shoaib Ismail was appointed as the new Director of Research and Innovation at ICBA. "As you know, Shoaib was acting DRI for the last year and 5 months. I'm glad that he won this competition and that he will continue the great job he started when he took up the acting role", said Dr. Ismahane Elouafi, Director General of ICBA, in her letter that was addressed to all ICBA staffs.

Dr Shoaib Ismail is a research scientist and university educator with more than 34 years experience in saline agriculture research and development. He specializes in the management of saltland agronomy with a special interest in integrated forage production, bioenergy trees for wastelands and seawater-based agricultural system.

He did his Masters and PhD from the University of Karachi in Pakistan and joined the same University as a Lecturer. From his early career he has been working on salinity issues in Pakistan and has been the Lead Scientist in many projects funded by national and international funding agencies.

He joined ICBA in July 2000 as Halophyte Agronomist and later moved to be a Senior Scientist - Halophyte Agronomy in the Technical Division. During his 13 years period, he has been involved in many projects of ICBA as a Lead Scientist and also as a team member. Some of the key research areas developed in ICBA by him and his team members include the work on oil industry rejected water; work on Salicornia and integrated aquaculture-agriculture system; bioenergy projects; model farm approach for integrated forage production system, and many more.

New ICBA members

Redouane Choukr-Allah
Senior Scientist-Horticulture

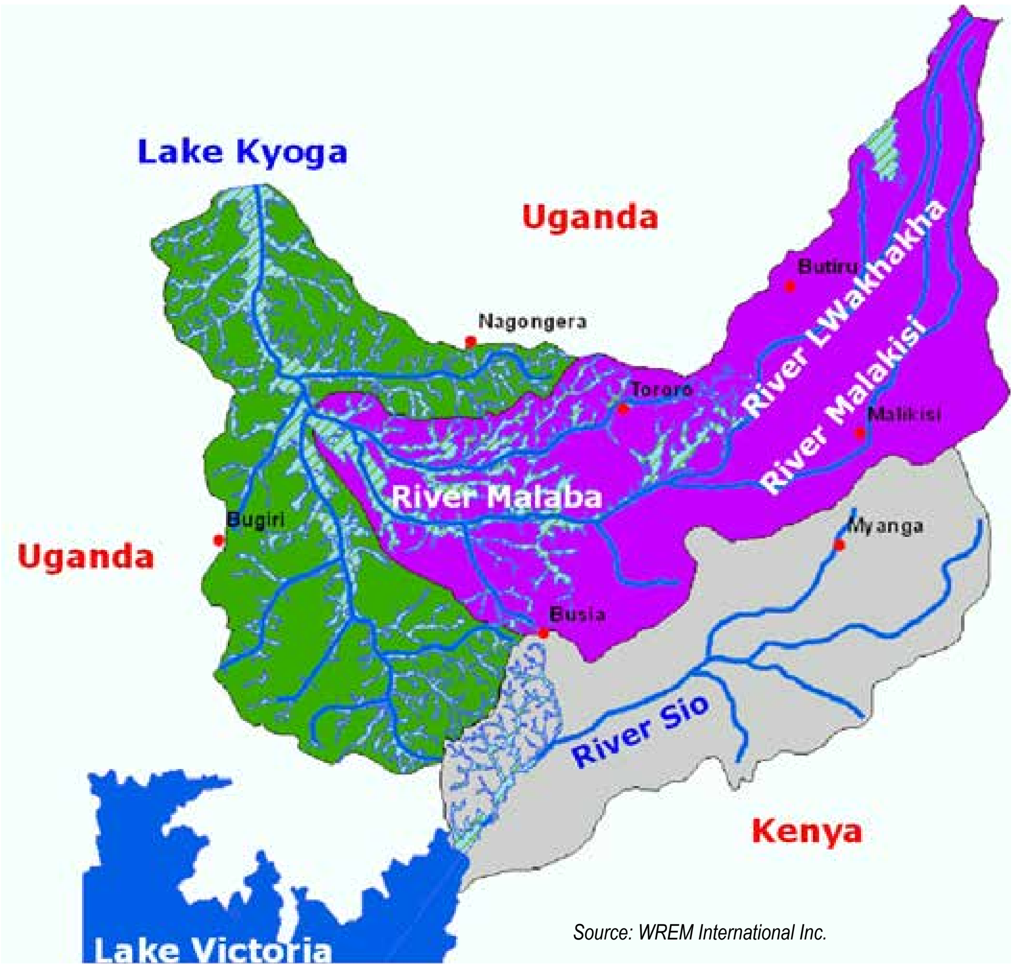
Dima Al-Kahhale
Administrative Assistant/ Translator

Evelyn P. Reyes
Procurement Officer

Marguerite de Chaisemartin
Project Officer

Making markets work for women and youth: Agri-business clusters as motors for high-value AIRCA input packages

A concept note for the Lake Victoria Basin



Source: WREM International Inc.

The Association of International Research and Development Centers for Agriculture (AIRCA) wants to address the most pressing needs to improve agribusiness in the Lake Victoria Basin. The work will focus on combining the existing skill sets and experiences of its members, focusing on proven existing input technologies relevant to the Basin that can be scaled up and out to achieve real impact in agricultural production and nutrition for the farmers and their families. The project focuses on women and youth farmers, using a demand-driven approach that is responsive to local conditions and needs. Knowledge and skills dissemination and transfer through agribusiness clusters will support the utilisation of technologies, through input packages, so that real impact can be achieved by the farming families that live in the Basin.

Our vision of success is to reach 250,000 women and youth who will increase their income by 25%, and 1,000,000 consumers who will have improved access to more nutritious food. The project will focus on 'WINS' (see figure 1), by creating and enhancing market access for women and youth, targeting agricultural sectors yielding high income and better nutrition on a sustainable basis, and by leveraging our combined strengths in input packages through agribusiness clusters. The specific input packages will include: integrated pest management, fertilizers, water, energy, seed, knowledge management/ICT and land management. The agribusiness clusters will combine the input packages with other financial and business support services to enable sustainable business development.

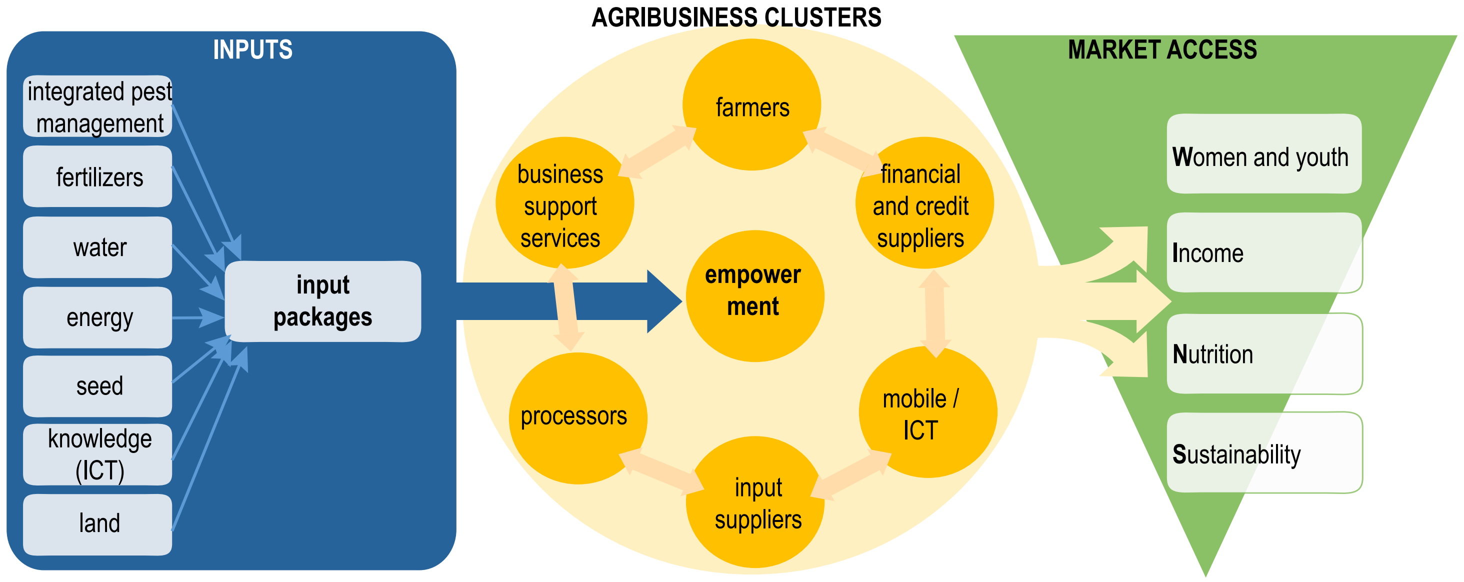


Figure 1: Conceptual framework of making markets work for women and youth

Interview with Dr. Ismahane Elouafi on AIRCA, Director General of ICBA and AIRCA Executive Committee member.

AIRCA was formed in 2012 – what was the motivation behind the creation of this network?

First, I want to reinstate that ICBA is very proud and committed to be a part of the global AIRCA network. The formation of AIRCA was stimulated by the need for integrated action to deliver sustainable agricultural intensification at the landscape level. All like minded AIRCA member organizations have decades of experience in their respective disciplines and geographical areas, and impressive track records of research, development and implementation. By combining our successful approaches we hope to be more effective and efficient in helping farmers and communities to move from poverty to prosperity, as well as reducing transaction costs.

Another key objectives in establishing AIRCA was to enable the founding members to speak with a collective voice and more effectively engage with regional and international networks and policy makers. We need to move away from the piece-meal approaches addressing agricultural problems as isolated commodity-specific, and focus on improving the health of humans, plants, animals and landscapes.

What do you mean by "healthy landscapes"?

AIRCA's mission is "Putting research into use by strengthening capacities for sustainable improvements to incomes, food and nutrition security in healthy landscapes". This is based on the realization that the demand for food, fodder, biofuels and fibre is rapidly increasing while we are facing major challenges such as natural resources scarcity, climate change, and population growth. Higher outputs must be accomplished by increasing the productivity of the agricultural sector, especially for smallholders in developing countries. The landscape approach emphasizes that this can only be achieved sustainably by not only looking at outputs, but also at interactions between air, soils, water, biodiversity and other biosystem services – healthy farming families can only thrive in healthy landscapes.

And how can this be achieved?

Through a collaborative approach and vision for all AIRCA members. Our individual programs on healthy landscapes feed into an overall AIRCA effort that emphasizes on:

- Direct interactions with farmers and their organizations, as well as public extension services, NGOs and the private sector, to promote the successful uptake of new or more sustainable technologies and management practices;
- Scientific assessment of the effectiveness of existing management practices and technologies;
- Research and development on staple and non-staple food crops for diversified and sustainable diets and production systems;
- The need to integrate activities concerning the health of people, plants, animals and landscapes when working to intensify agricultural productivity.

We are currently working on three different concept notes in different geographical areas on three continents (Lake Victoria in Africa, Trifinio in Latin America and Karakoram in Central Asia), and we hope that with these projects, we can prove that landscape-oriented projects are an efficient and effective means of having long-lasting beneficial effects on farmers' lives.

AIRCA
Association of International Research and Development Centers for Agriculture

ABOUT ICBA

International Center for Biosaline Agriculture - ICBA is an international, non-profit agricultural research center established in 1999 that carriers research and development programs focused on improving agricultural productivity and sustainability in marginal and saline environments.

ICBA takes innovation as a core principle and adopts a multi-pronged approach to address the closely linked challenges of water, environment, income, and food security. ICBA's research innovations include assessment of natural resources, climate change adaptation, crop productivity and diversification, aquaculture and bio-energy and policy analysis. The Center is working on a number of technology developments including the use of conventional and non-conventional water (such as saline, treated wastewater, industrial water, agricultural drainage, and seawater); water and land management technologies and remote sensing and modeling for climate change adaptation.

Improving the generation and dissemination of knowledge is an important strategic objective of ICBA and the Center is focusing on developing itself as a knowledge hub on sustainable management and use of marginal resources for agricultural production and environmental protection in marginal environments. With the help of its partners, ICBA innovates, builds human capital, and encourages the learning that is fundamental for change.

ICBA's work reaches many countries around the world, including the Gulf Cooperation Council countries, the Middle East and North Africa, Central Asia and the Caucasus, South and South East Asia, and sub Saharan Africa.

ICBA is mainly sponsored by three core donors: the Ministry of Water and Environment of the United Arab Emirates, the Environment Agency - Abu Dhabi, and the Islamic Development Bank. We gratefully acknowledge their support as well as the support of many other bilateral and multilateral agencies that have sponsored components of our work over the years.