Consultation Meeting on Saline Agriculture

ICBA: Sustainable, Climate-smart Agriculture in Marginal Environments

Dr. Ismahane Elouafi
Director General

ICBA
AGRICULTURE FOR TOMORROW

Overview

- Steady growth of global population and changes in living standards
- Growing freshwater scarcity
- Accelerating climate change
- Loss of biodiversity

All these factors will have impact on agriculture and food security, economic development, etc.

ICBA
AGRICULTURE FOR TOMORROW

Salinization is a global concern

- About 11% of the world's irrigated areas are already affected by some degree of salinization (FAO, 2012)
- Globally 1 billion hectares of lands are salt-affected
- Estimated loss of land due to soil salinization annually could reach 0.5 million hectares

As a consequence thousands of farmers go out of business annually

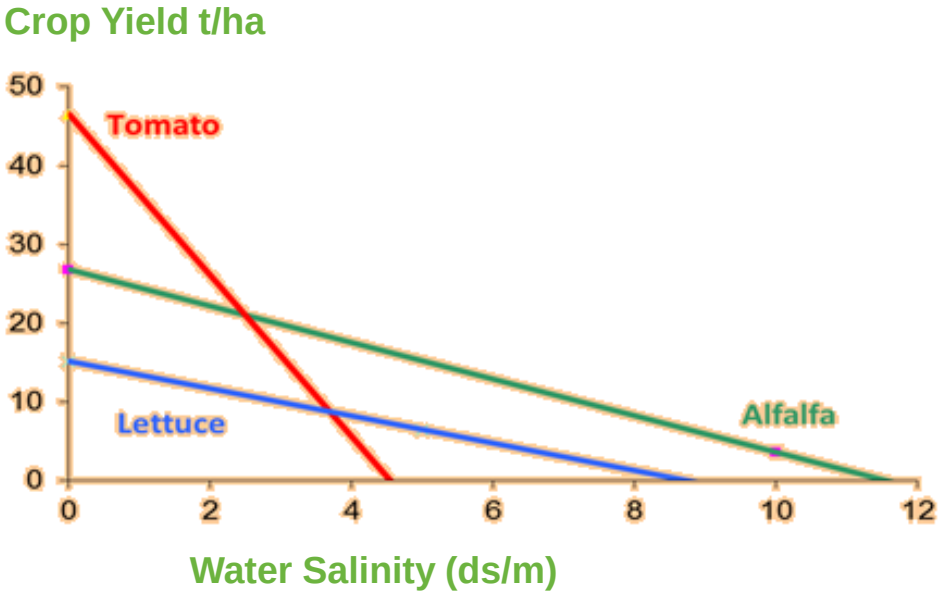
ICBA
AGRICULTURE FOR TOMORROW

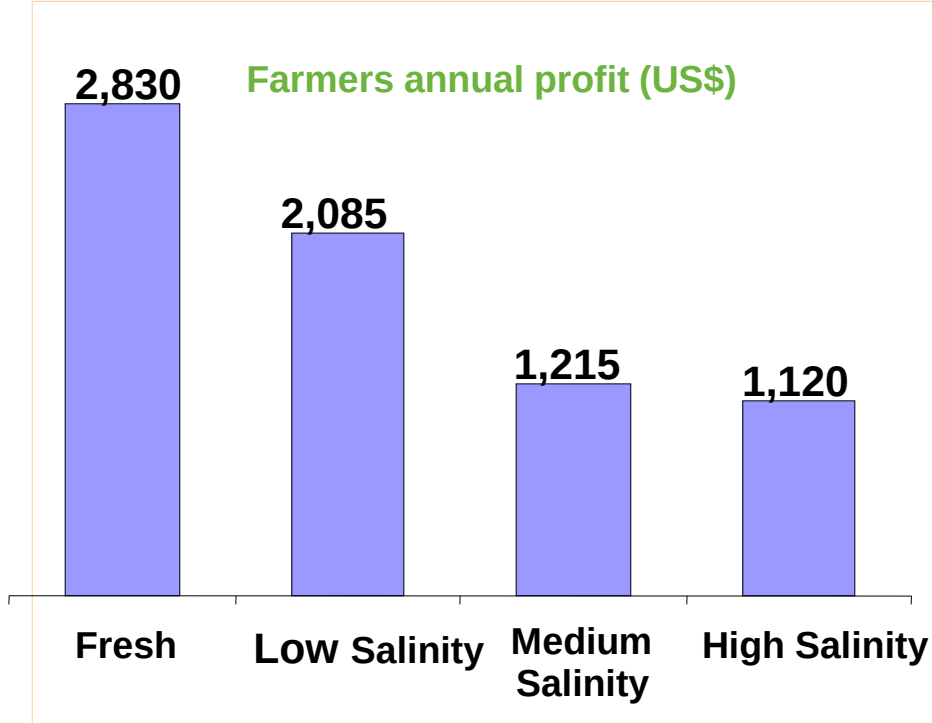
Global salinity map

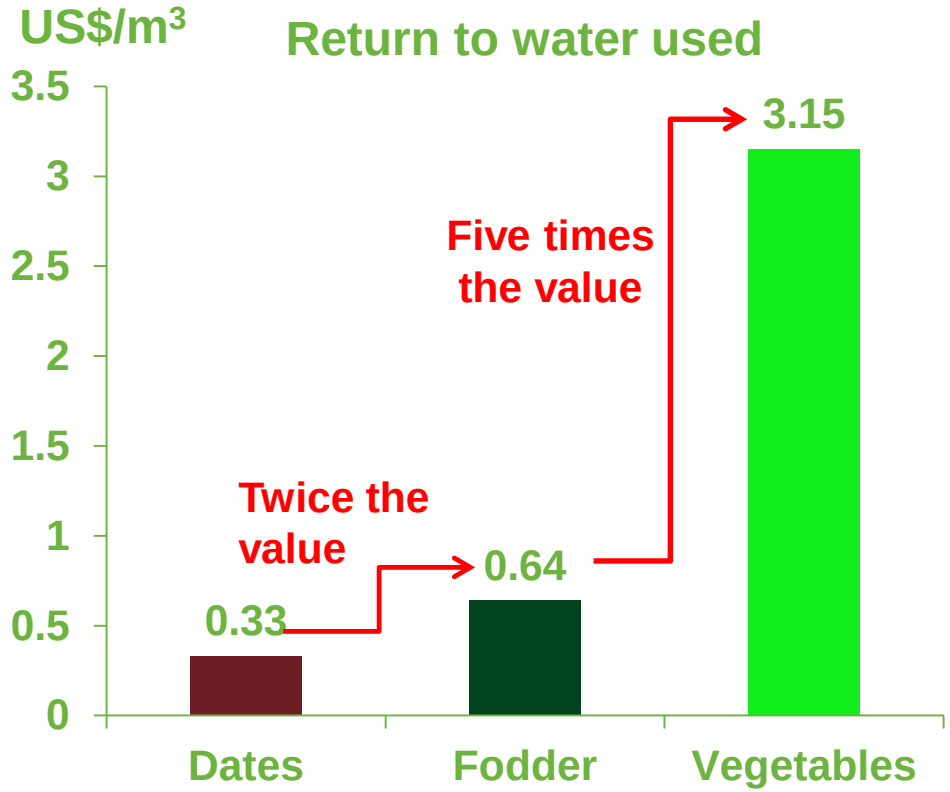
https://salcc.databasin.org/maps/new#datasets=2456df2b123f4f979444139f11f88233

ICBA
AGRICULTURE FOR TOMORROW

Impact of increasing salinity





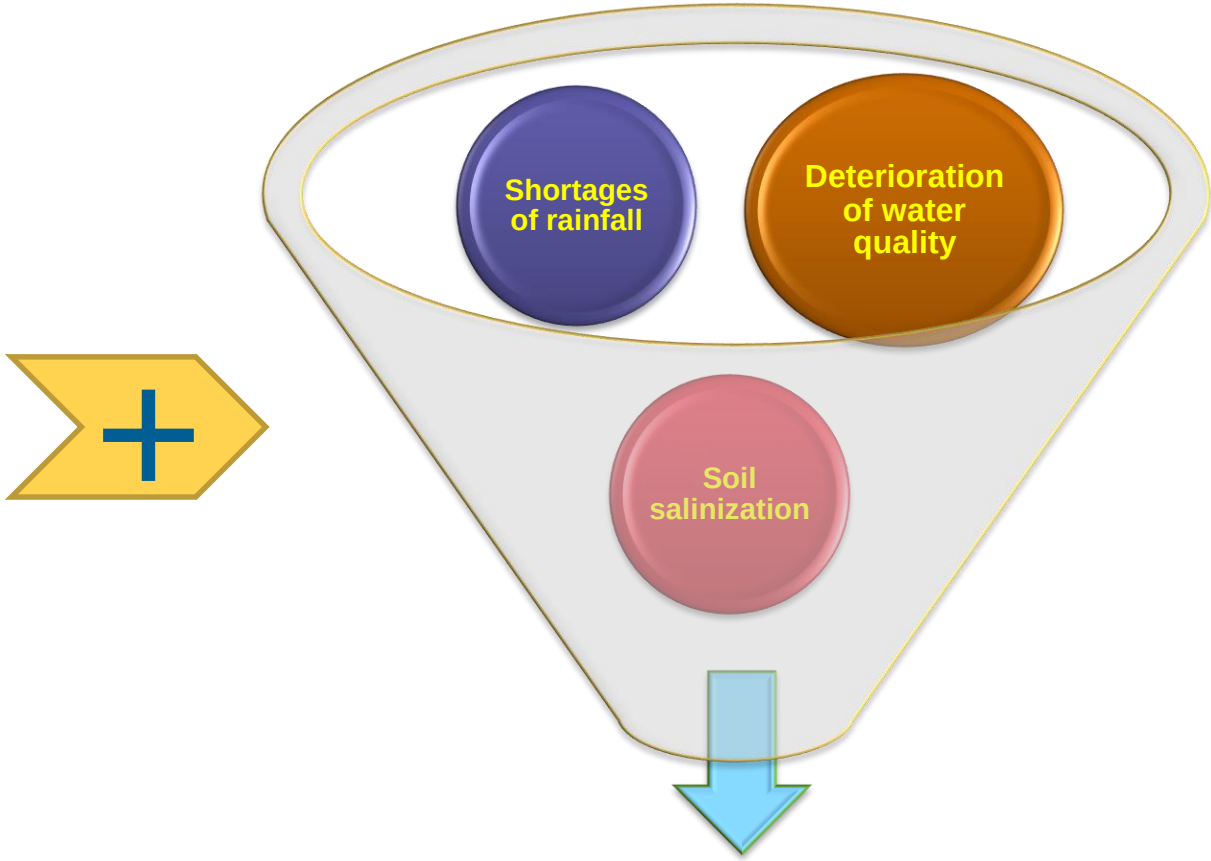


ICBA
AGRICULTURE FOR TOMORROW

Climate & topography in most Arab countries

Subtropical-arid to hot with little rainfall

Desert lands



- Underutilized, abandoned lands
- Depletion of natural resources
- Sea water intrusion
- Salinization of farms

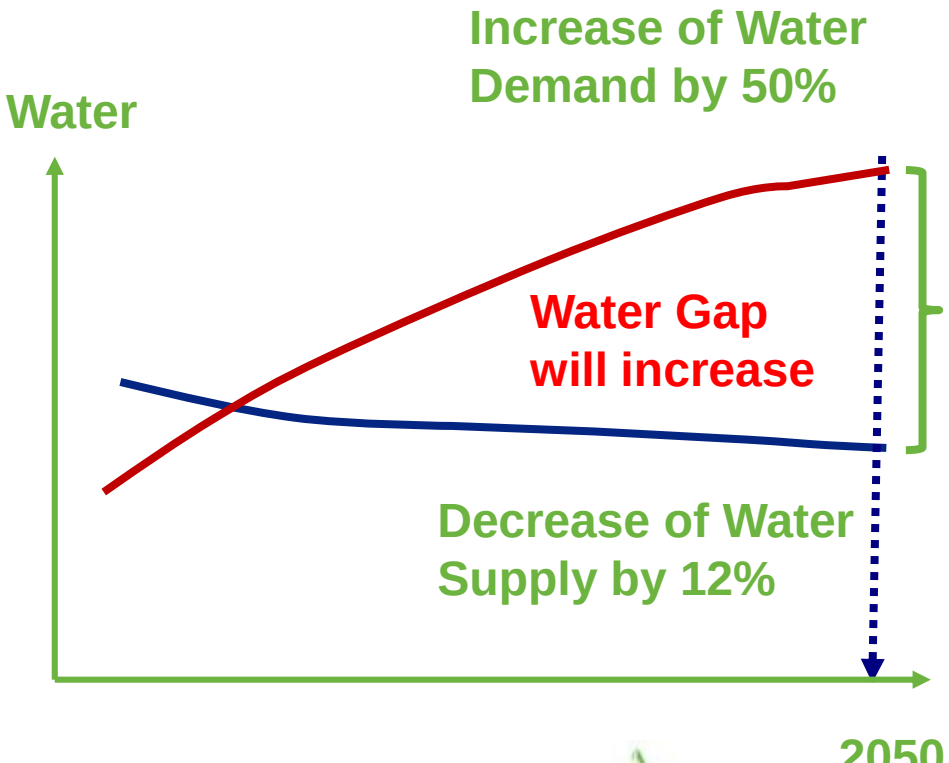
ICBA
AGRICULTURE FOR TOMORROW

Water scarcity & effect of climate change in marginal environments

- By 2080, 43-50% of the global population will be living in water - scarce countries

- Marginal water resources have potential to supplement fresh water resources and reduce expected future fresh water gap

- By 2050, MENA region
  - Hotter and drier
  - Drought will be increasing



ICBA
AGRICULTURE FOR TOMORROW

Why biosaline agriculture?

- It releases pressure from good quality water and land resources
- Utilizes wastelands and poor quality water resources
- High potential to bring back salinized farms to agricultural production
- It provides new sources of food, fodder, fuelwood, fiber
- It creates CO_2 sinks
- It can sustain local communities

ICBA
AGRICULTURE FOR TOMORROW

Good progress in biosaline agriculture ***but not enough***

- ICBA succeeded in introducing climate-resilient crops

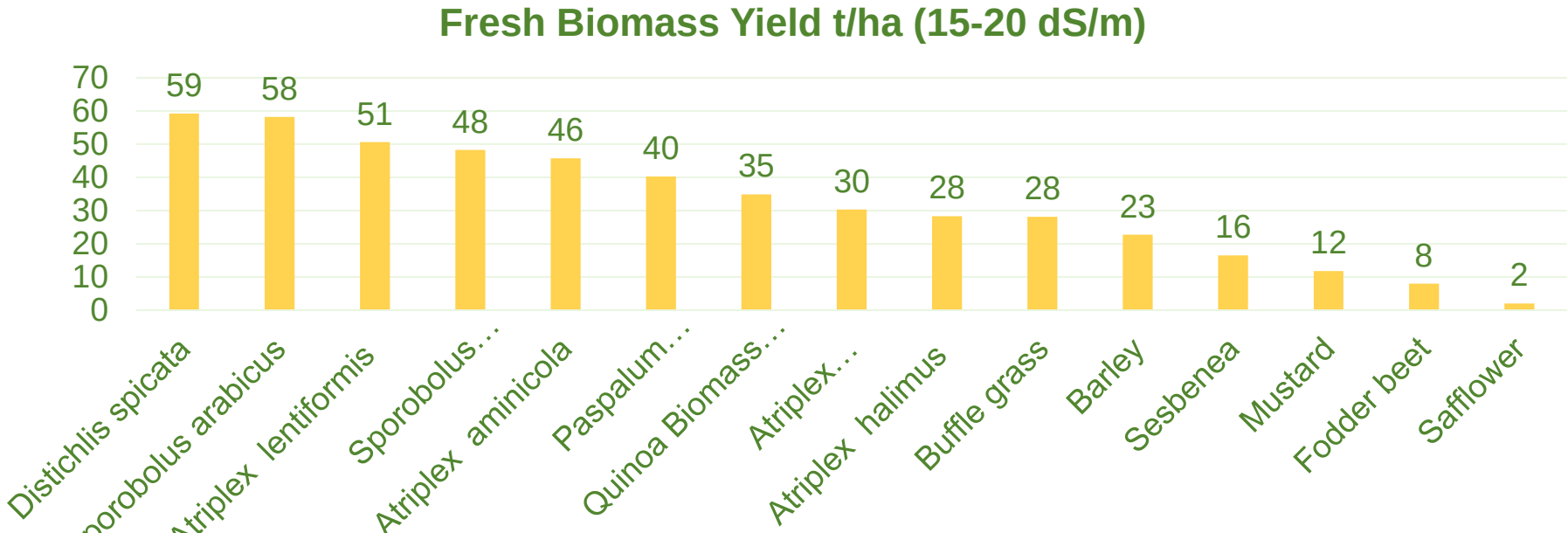
ICBA
AGRICULTURE FOR TOMORROW

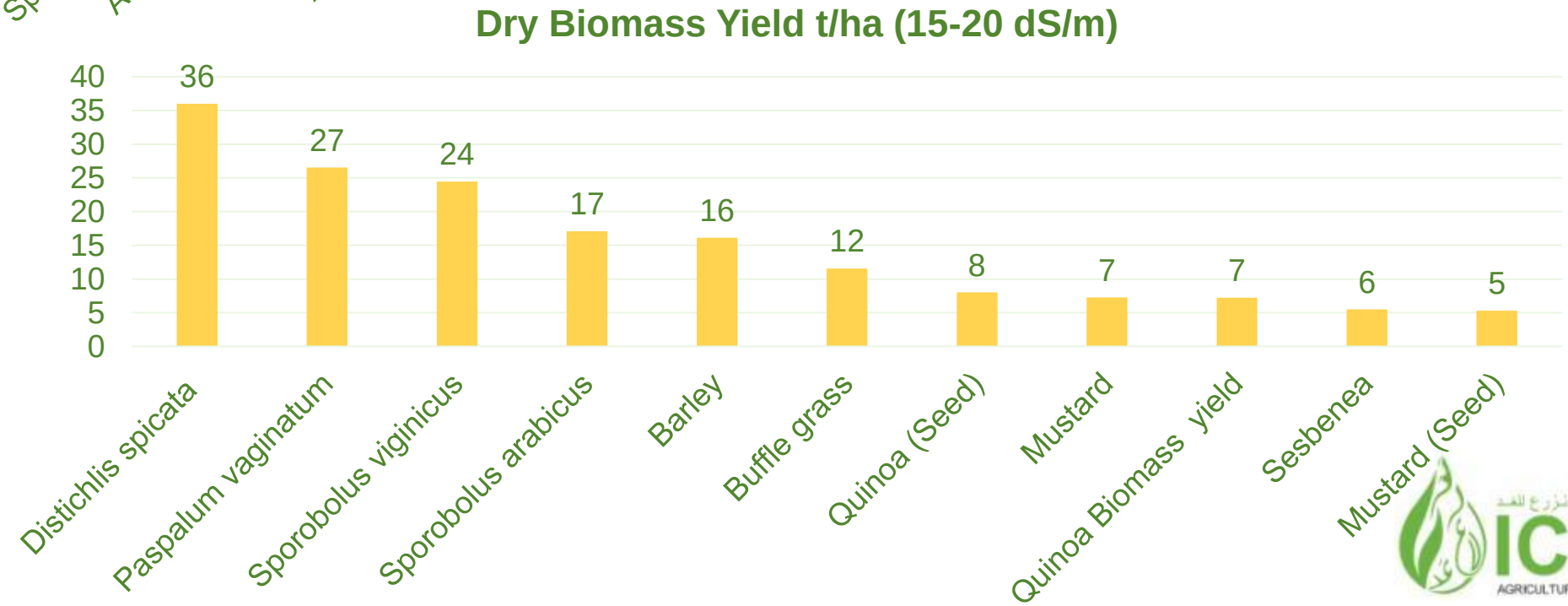
Alternative salt-tolerant forages

- Farm status: Abandoned due to high salinity of irrigation water, which ranged between 15-18 dS/m
- Four salt-tolerant perennial grasses were planted:
  - ✓ *Distichlis spicata,*
  - ✓ *Sporobolus virginicus*
  - ✓ *Sporobolus arabicus*
  - ✓ *Paspalum vaginatum*
- Fresh biomass yields determined for the four grasses after one year of growth ranged between 75-150 t/ha/year, which is 66% more compared to Rhodes grass (low salinity 2 ds/m)
- Saved 44% of water use compared to traditional forages

ICBA
AGRICULTURE FOR TOMORROW

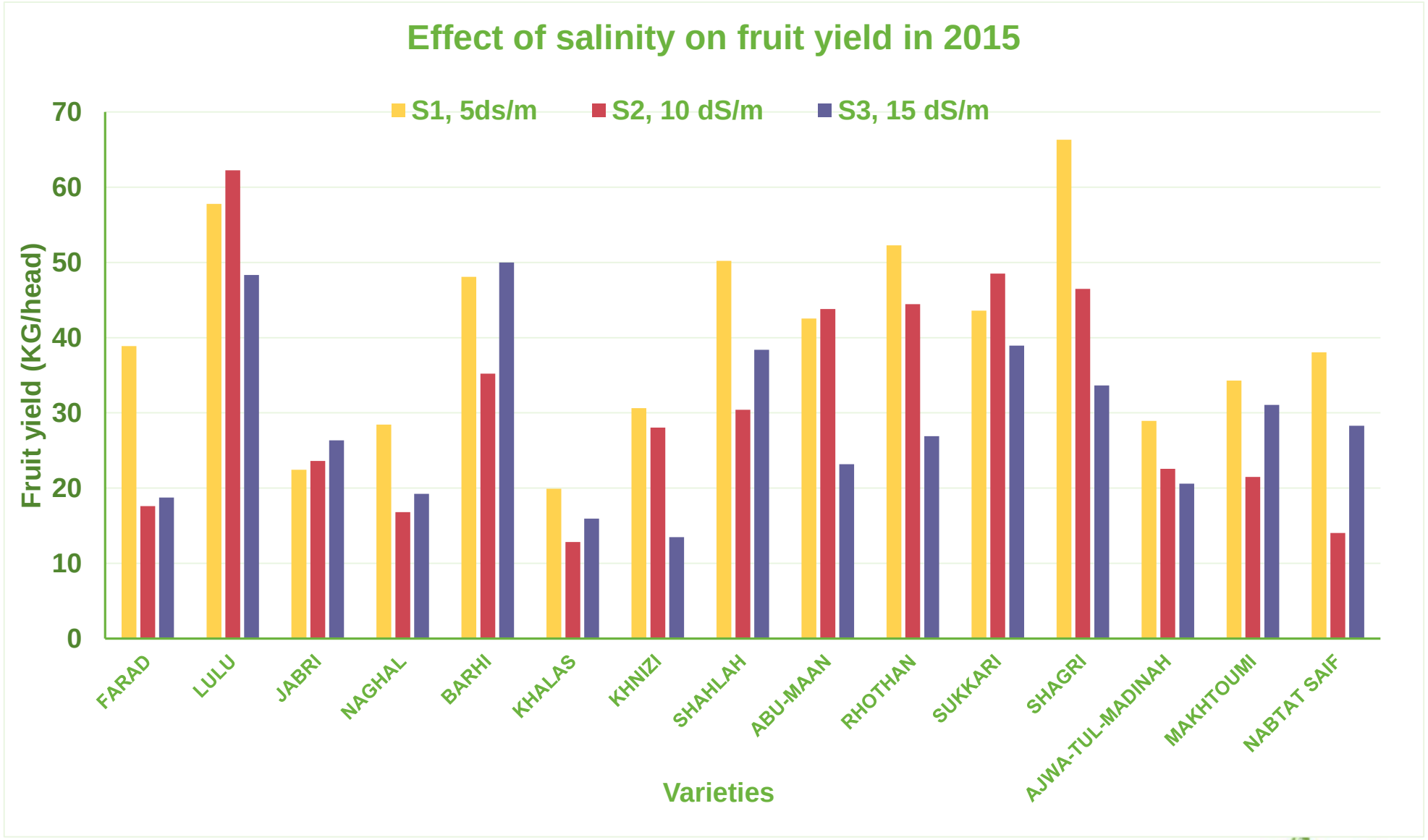
Forage yield t/ha (15-20 dS/m)





ICBA
AGRICULTURE FOR TOMORROW

Date palm trees



ICBA
AGRICULTURE FOR TOMORROW

Breeding salt-tolerant barley

- Crosses between elite barley cultivars adapted to Arabian Peninsula environments and highly salt-tolerant genotypes of wild barley (*Hordeum spontaneum*) have been selected for planned crosses

Wild barley (*H. spontaneum*)

Cultivated barley (*H. vulgare*)

Supply of salt-tolerant barley seed to the farmers of salt-effected agricultural lands and the areas where only saline water is available for irrigation

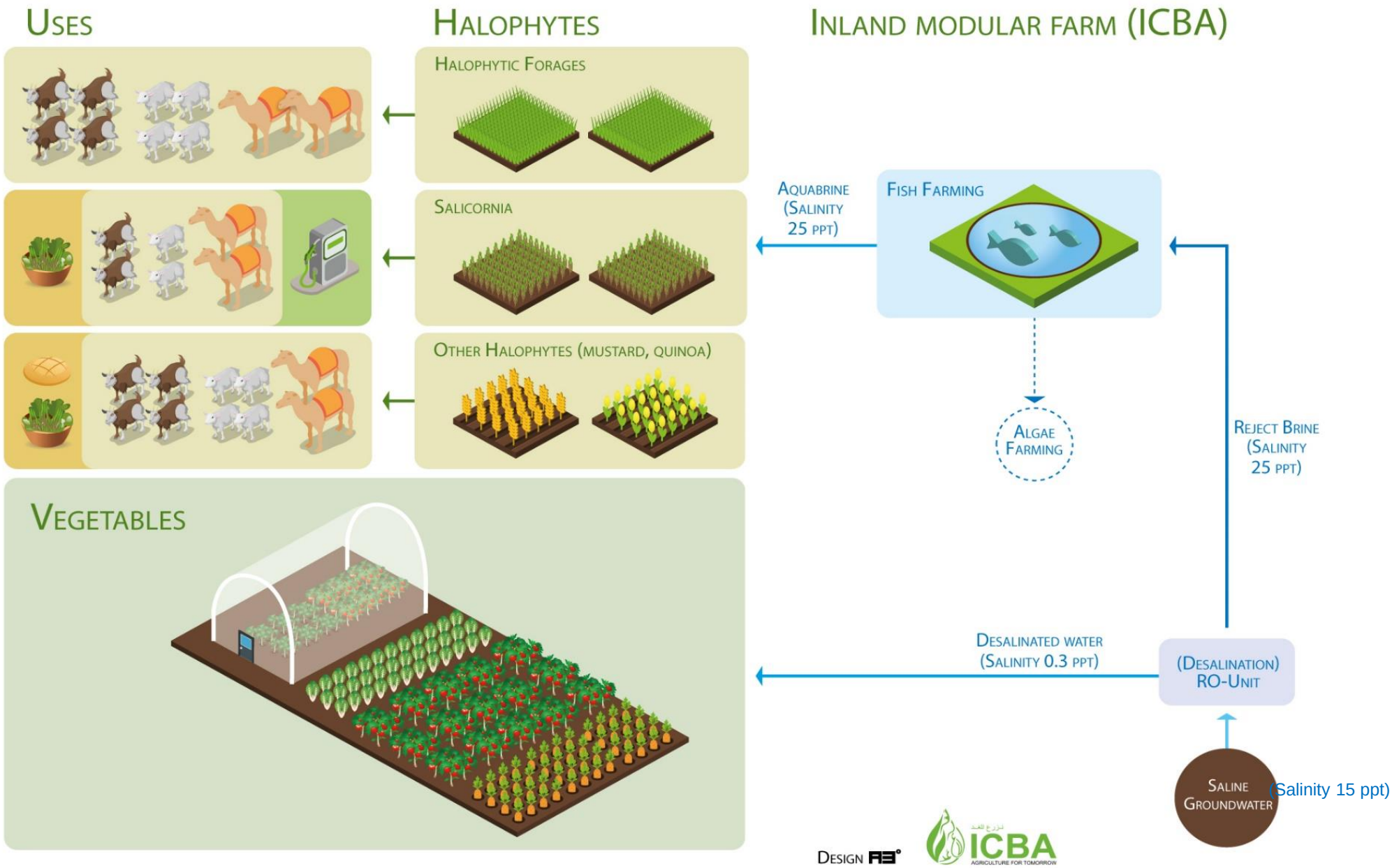
Salinity tolerance study on tomato

- *Solanum pimpinellifolium*, a wild relative of cultivated tomato, offers a wealth of breeding potential for salt tolerance
- At ICBA, 389 lines of 4 species of tomato were grown at low (0.3 dS/m) and high (17 dS/m) salinity levels to study the salt-tolerant mechanism at molecular levels in tomato

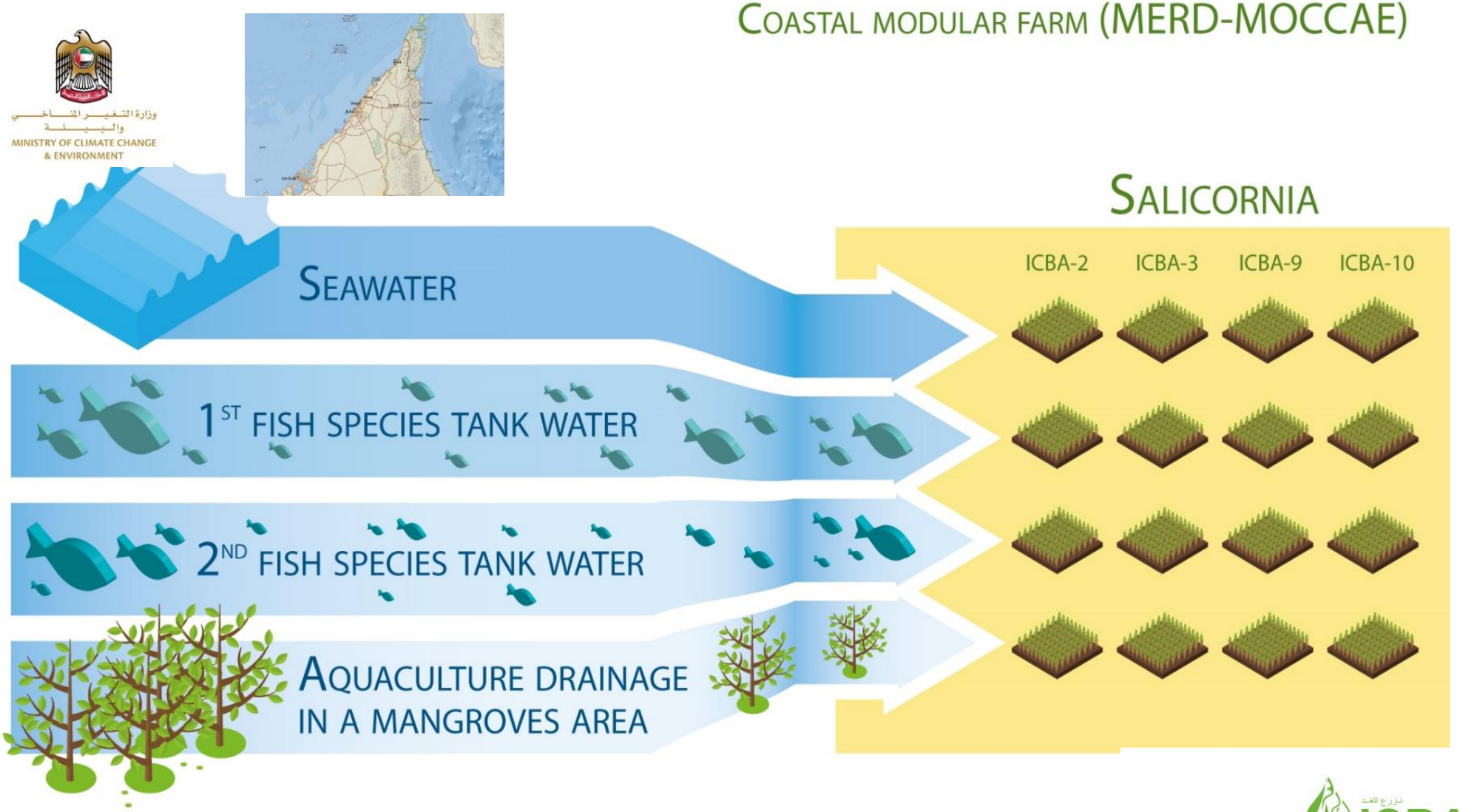
Tomato salinity tolerance study at ICBA

ICBA
AGRICULTURE FOR TOMORROW

Inland modular farm



Coastal modular farm



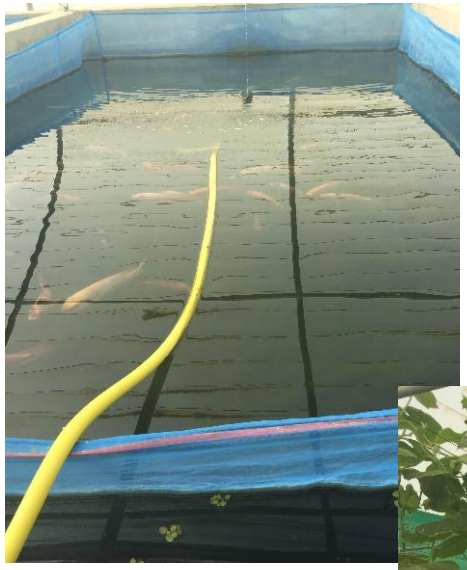
Sustainable integrated solutions

Pilot integrated farm at ICBA

Farm in Al Dhaid (UAE)

More profitable use of desalinated water and integrated solutions for the reject brine use

Farm in Al Wagan (UAE)

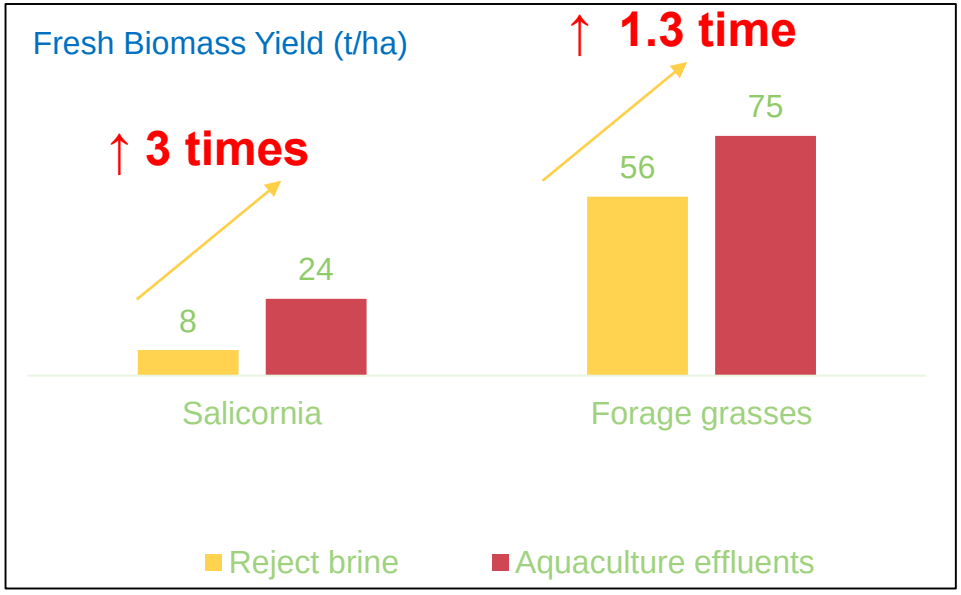


Better management of the available water resources – Introduction of halophytes irrigated with reject brine

Performance to date: return on investment

Inland farm

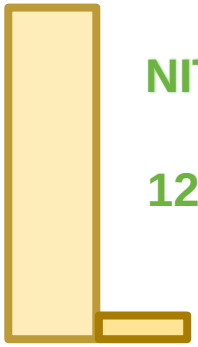
uses of reject brine



Salicornia (samphire) = a multi-use halophyte

Coastal farm

Aquaculture drainage



NITRATE

12 times ↑

Seawater

Seed yield = 3.25 t/ha

ICBA
AGRICULTURE FOR TOMORROW

Halophyte-based products

Rock samphire smoked tilapia with quinoa

Jelly of Salicornia

Crackers of Salicornia and rock samphire

Salicornia and rock samphire bread

EXPO 2020 DUBAI UAE

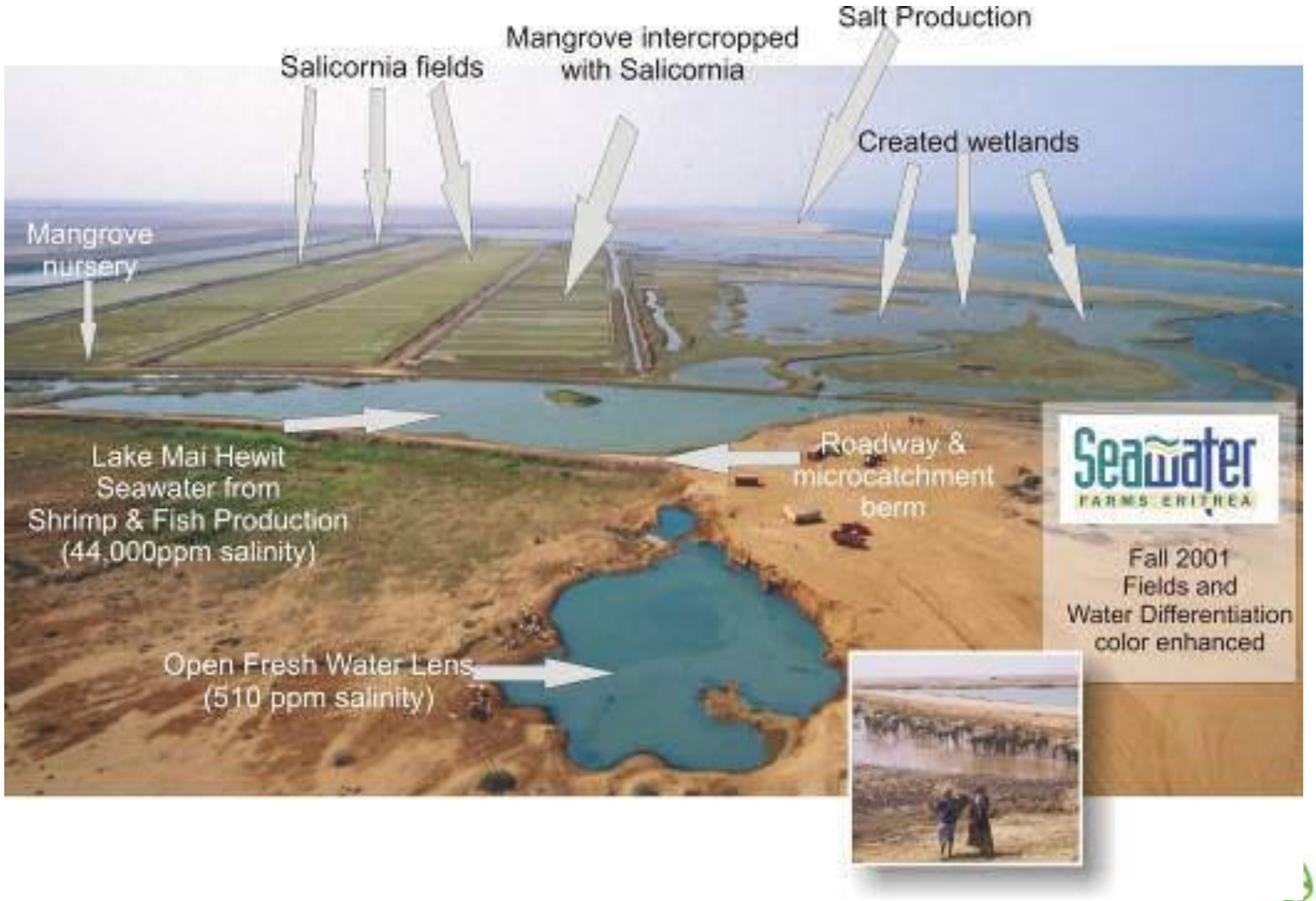
EXPO LIVE

Expo Live Innovation Impact Grant Program

ICBA
AGRICULTURE FOR TOMORROW

Global success stories

1. Greening Eritrea project



https://www.youtube.com/watch?v=ibWYfC8z9co

ICBA
AGRICULTURE FOR TOMORROW

Global success stories

2. Behar (Ras-Al-Zawr project) Saudi Arabia

- Giant pivot-irrigation arms sprayed seawater pumped straight from the Arabian Gulf to produce the initial *Salicornia* crop in five 50-hectare circles
- Based on feasibility study, circles of *Salicornia* could one day cover up to 200,000 hectares along both coasts of Saudi Arabia, providing up to 120 million kilograms (34 million US gallons) of vegetable oil a year

ICBA
AGRICULTURE FOR TOMORROW

Global success stories

3. EU project “Saline crops. A contribution to the diversification of the production of vegetable crops by research on the cultivation methods and selection of halophytes (1993-1996)

- Domesticate a number of plant species, naturally growing in saline or brackish soils that are locally gathered for consumption as a vegetable in the EU

The company (spin-off) is active (Belgium): http://www.scrops.com/seeds.html

https://www.scribd.com/doc/102170797/Saline-Crops-From-Halophyte-Research-to-Sea-Vegetable-Markets

Global success stories

4. Salt Farm Texel - Netherlands

http://www.saltfarmtexel.com/

Screening salt-tolerant varieties of conventional crops and halophytes for commercial production

Salt-tolerant potato varieties

http://www.saltfarmtexel.com/projects/salt-tolerant-potato-to-feed-the-world

Project in Bangladesh:

https://www.youtube.com/watch?v=JahZsRaK_S0&feature=youtu.be

ICBA
AGRICULTURE FOR TOMORROW

Global success stories

5. Sun drop farm – Australia (2010)

http://www.sundropfarms.com/

- Applied in the desert
- Desalination of seawater through solar tower
- Solar tower is also used to produce energy to power the plant growing systems and to heat and cool the greenhouses

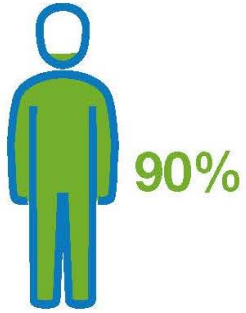
ICBA
AGRICULTURE FOR TOMORROW

Major crops in human diet

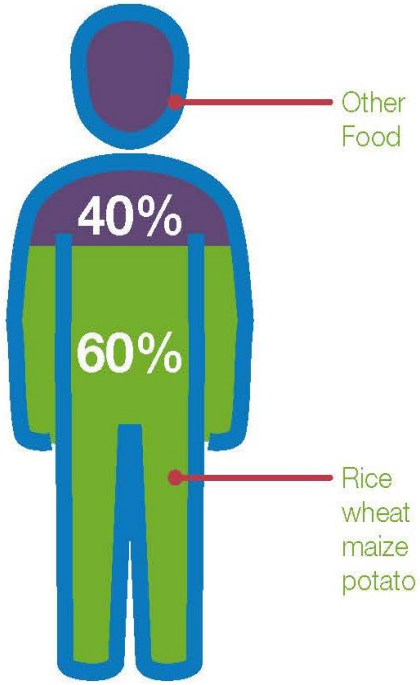
Roughly 30,000 palatable plant species have been identified throughout the world,

Just 150 plant species are cultivated

More than 7,000 crop species have been used in the human history for food



Around 100 crops supply about 90% of the calories in the human diet



Rice, wheat, maize and potato alone provide 60% of human energy source.

ICBA
AGRICULTURE FOR TOMORROW

The way forward

- Biodiversity of crops is very important and can help in coping with biotic and abiotic threats to agricultural production. Introducing and scaling up proven salt-tolerant crops and conserving local varieties is a priority
- Breeding for salt-tolerant crop varieties is relatively new and needs to be expanded
- Innovative technologies: genomics, metabolomics, nanotechnologies, precision agriculture, drones, remote-sensing applications, sensors, other water-saving technologies

ICBA
AGRICULTURE FOR TOMORROW

Center of Excellence looking at Agriculture for Tomorrow

Thank you

www.biosaline.org

ICBA is a founding member of the Association of International Research and Development Centers for Agriculture (AIRCA)

AIRCA
Association of International Research and Development Centers for Agriculture