

CLIMATE-SMART SOLUTIONS FOR MENA's FOOD SYSTEM - FROM FRAGILITY TO RESILIENCE

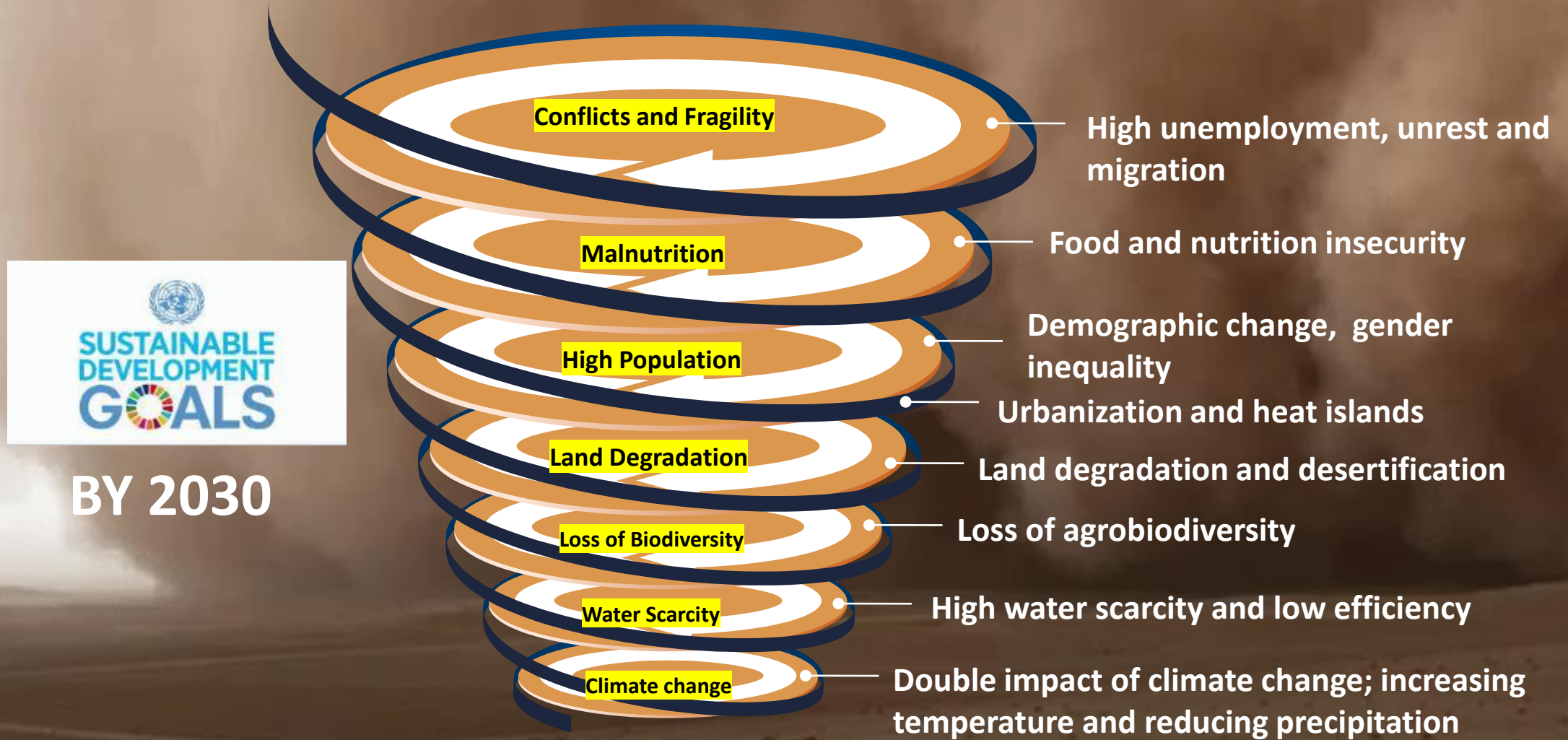
ONE CGIAR – WORLD BANK MENA SEMINAR

Mr. Aly Abousabaa

CGIAR Regional Director CWANA

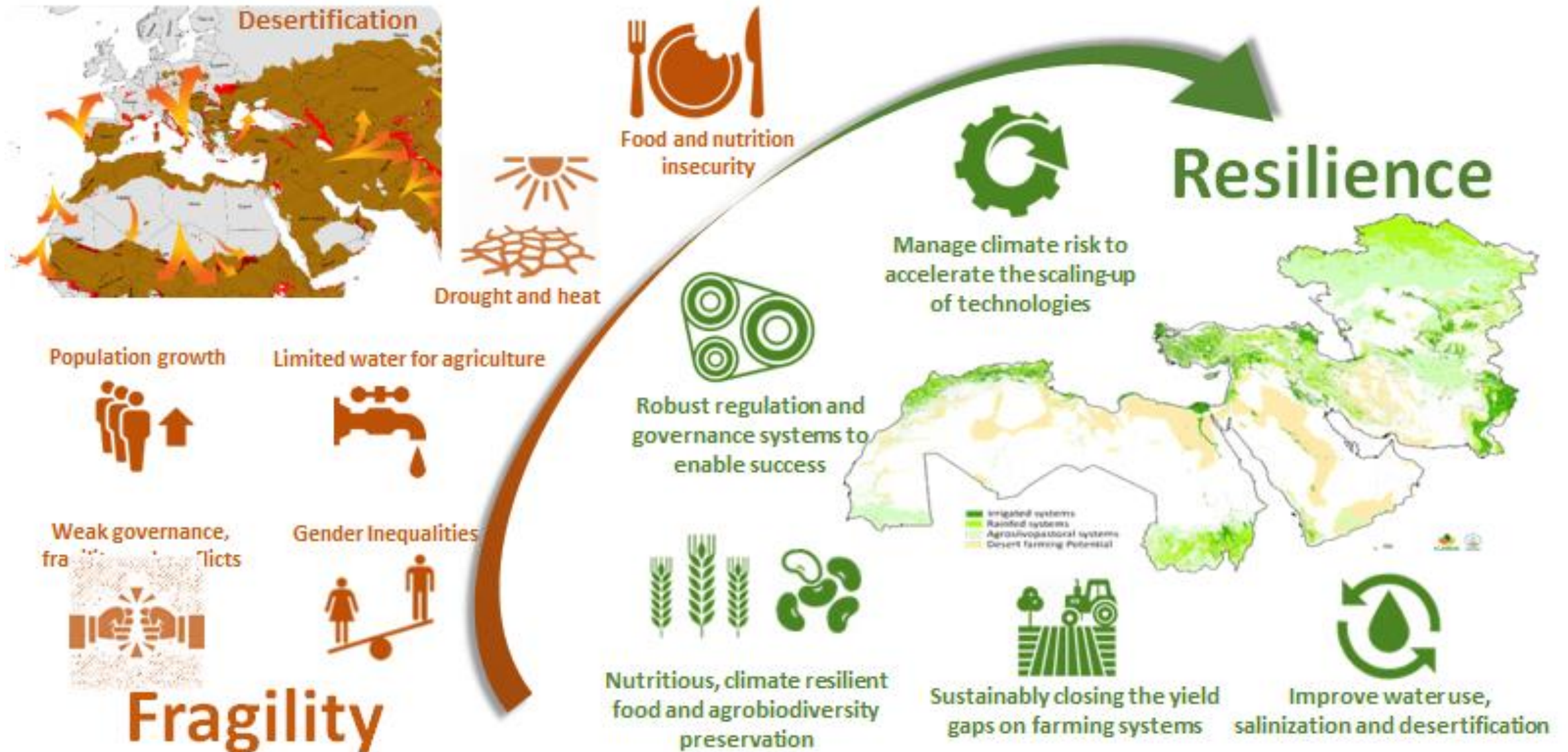
Director General ICARDA

The Perfect Storm



With only eight harvests left, we need to move fast to accomplish our vision of thriving and resilient dryland livelihoods

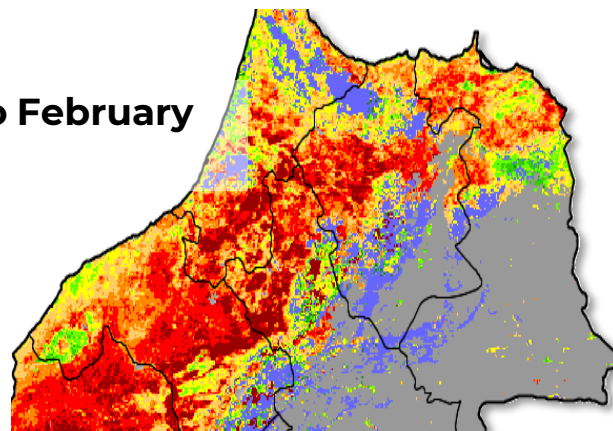
From Fragility to Resilience in the Middle East and North Africa (MENA)



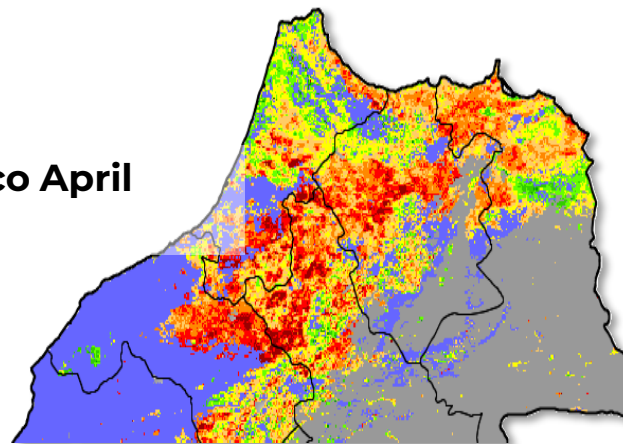
Breeding for climate change adaptation: Deep roots and root angle



Morocco February
2016



Morocco April
2016



A drought tolerant variety at its best

The ICARDA/INRA variety '**Nachit**' was released in 2017 for drought adaptation: deep roots and large grains. In **season 2018-19 at Marchouch (Rommani)** it produced **5.1 t ha⁻¹** over 3 ha with **conservation agriculture** against 2.9 average on farm yield for Karim.

Nachit



Louiza



Karim

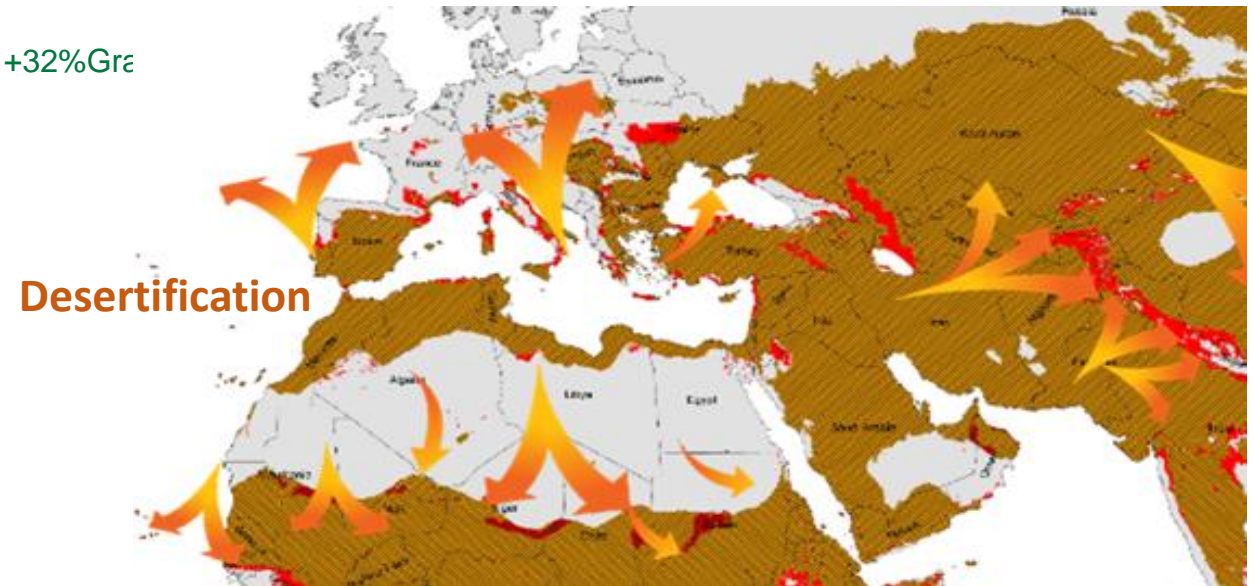
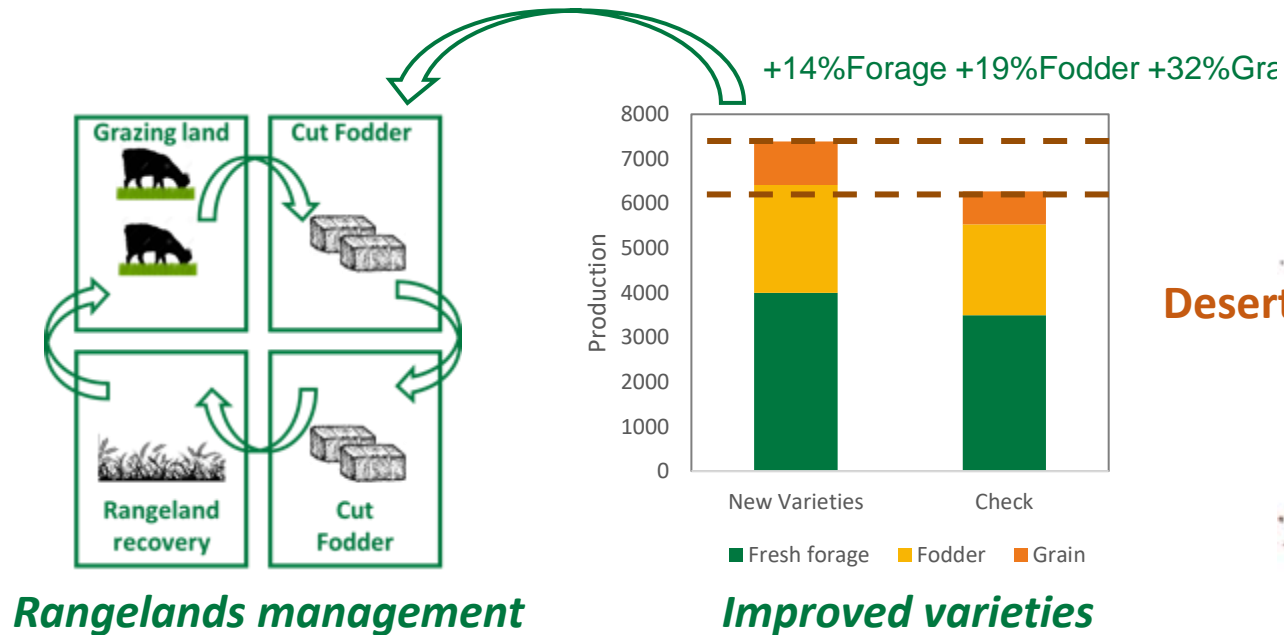


Testing **on 5 farms** revealed that:

- **+23% yield** was achieved combining 'Nachit' with better fertilization
- G3 seeds will become commercially available in October 2020

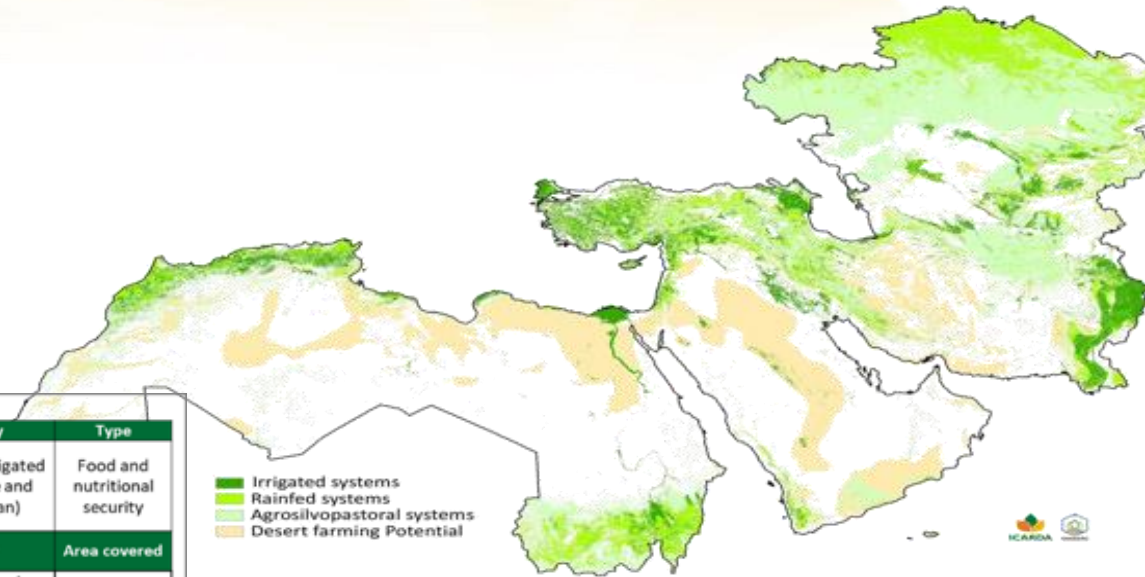
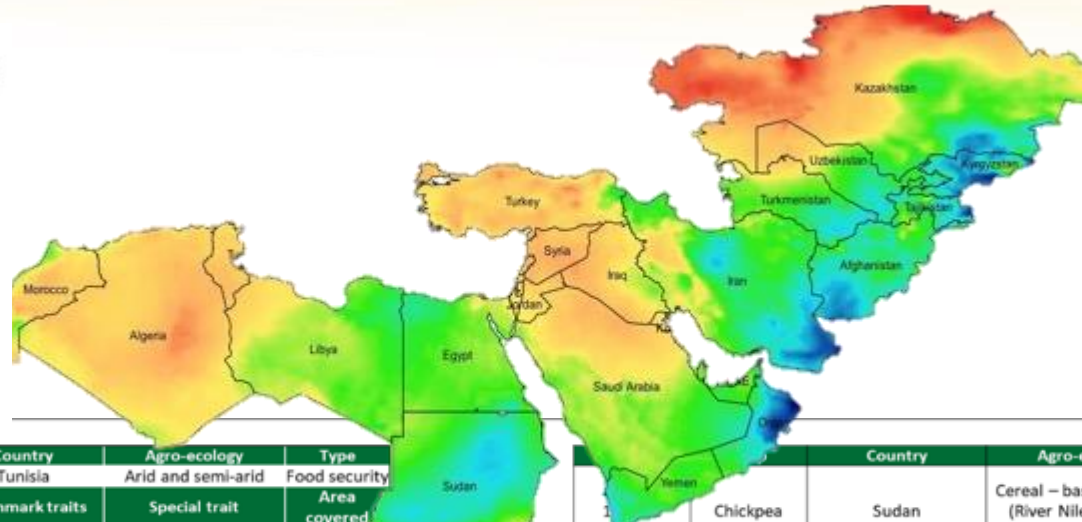
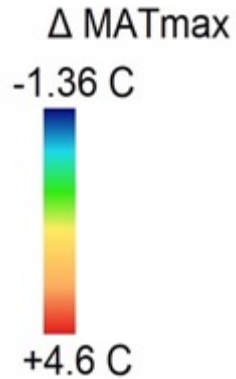
Feed and fodder crops for the MENA

- **Multi-purpose** crop: Feed, Forage and Food
- **Added value** as direct (grain and straw) and indirect product (healthier livestock)
- Highly **inclusive crops** for the poor and women
- High potential in rangeland restoration strategies: **Great Green Wall**



Revert Decreasing Vegetation Dynamics

Product profile development



- Following the same principle, product profiles were developed for the whole target region of the CWANA region
- Better models will allow better breeding targeting and stronger impact

EIB ID	Crop	Country	Agro-ecology	Type
100357	Barley	Tunisia	Arid and semi-arid	Food security
Benchmark cultivar	Height (cm)	Benchmark traits	Special trait	Area covered
Rihane	NA	Earliness, drought tolerance, spike length, cold tolerance, scald and net blotch resistance	Protein content in grain and straws, food quality	

EIB ID	Crop	Country	Agro-ecology	Type
100357	Chickpea	Sudan	Cereal – based irrigated (River Nile State and Middle of Sudan)	Food and nutritional security
Benchmark cultivar	Height (cm)	Benchmark traits	Special trait	Area covered
Salwa	45	Extra- largeseed, Resistance to CDV	Resistance to Fusarium Wilt, Large seed	90,000

EIB ID	Crop	Country	Agro-ecology	Type
10339	Durum wheat	Lebanon	Supplemental irrigation	Poverty reduction
Benchmark cultivar	Height (cm)	Benchmark traits	Special trait	Area covered
Miki3	75-90 cm	Grain size, Yield potential, Stem rust resistance, Quality	Black awns	45,000

EIB ID	Crop	Country	Agro-ecology	Type
100089	Bread wheat	Morocco,	Rainfed with terminal moisture stress	Food security
Benchmark cultivar	Height (cm)	Benchmark traits	Special trait	Area covered
Achtar	Medium	Dynamic Stability Bread Making Quality; White Seed colour; Medium height; Medium seed size; Good tillering	rust resistance (100%+ Benchmark); drought tolerance: (10%+ benchmark); seed size (10%+ benchmark)	1.5Mha

EIB ID	Crop	Country	Agro-ecology	Type
100103	Faba bean	Sudan	Cereal based irrigation	Food and nutritional security
Benchmark cultivar	Height (cm)	Benchmark traits	Special trait	Area covered
SML	80- 90 cm	Orobanche resistance, Tolerance to heat stress, large seeded size	Grain nutritional quality, Resistance to aphid, high degree of auto fertility	

Optimization of speed breeding protocol for legume crops: From seed to seed in 60 days



Cost: <30 US\$

25 °C and 22 hours light/day



20 days



25 days



30 days



35 days

Chickpea



44 days after sowing
Short PLHT



Faba bean



26 days



29 days



32 days



50 days

Lentil



Scale up speed breeding

Excellence in Agronomy Initiative

ICARDA leading MENA Regional Team



Purpose: 'To galvanize an **integrated framework** to identify, diagnose, and resolve yield limiting factors using **data-driven solutions** and innovations **at scale** for **smallholder farming systems** in the Global South, in cooperation with and response to **demand from public and private** initiatives investing in the **Sustainable Intensification** of these systems'

Targeting specific agro-ecologies/countries in the Global South with a set of goals aiming at Sustainable Intensification:

1. **Increased yields/profitability** for key crops → SS-Africa, S-Asia
2. Improved **resource use efficiencies** → areas with relatively good yields
3. Increased **yield stability** → areas affected by climate variability
4. Improved **soil health** → addressing soil degradation



Profitable Diversified Cropping Systems

In **Morocco**, system level gross margin was greatest under:
Lentil+onion system: \$ 11,104/ha
Lentil+quinoa: \$ 10,726/ha
Lentil+chickpea: \$ 1391/ha
Lentil+bean: \$ 1219/ha
Wheat: \$ 809/ha
Lentil: \$ 633/ha

Diversified cropping systems provide nutritious diets through climate-smart and sustainable production systems.



Relay-cropping: a second crop is planted before the first crop is harvested

Crop diversification for improved farm income, food security and resilience



Crop Rotation: Different crops types crops are rotated in a set seasonal order



Intercropping: Two or more crops or trees are grown simultaneously with or without a row arrangement.



Scale-appropriate Mechanization for Resilience and Profitable Farming Systems

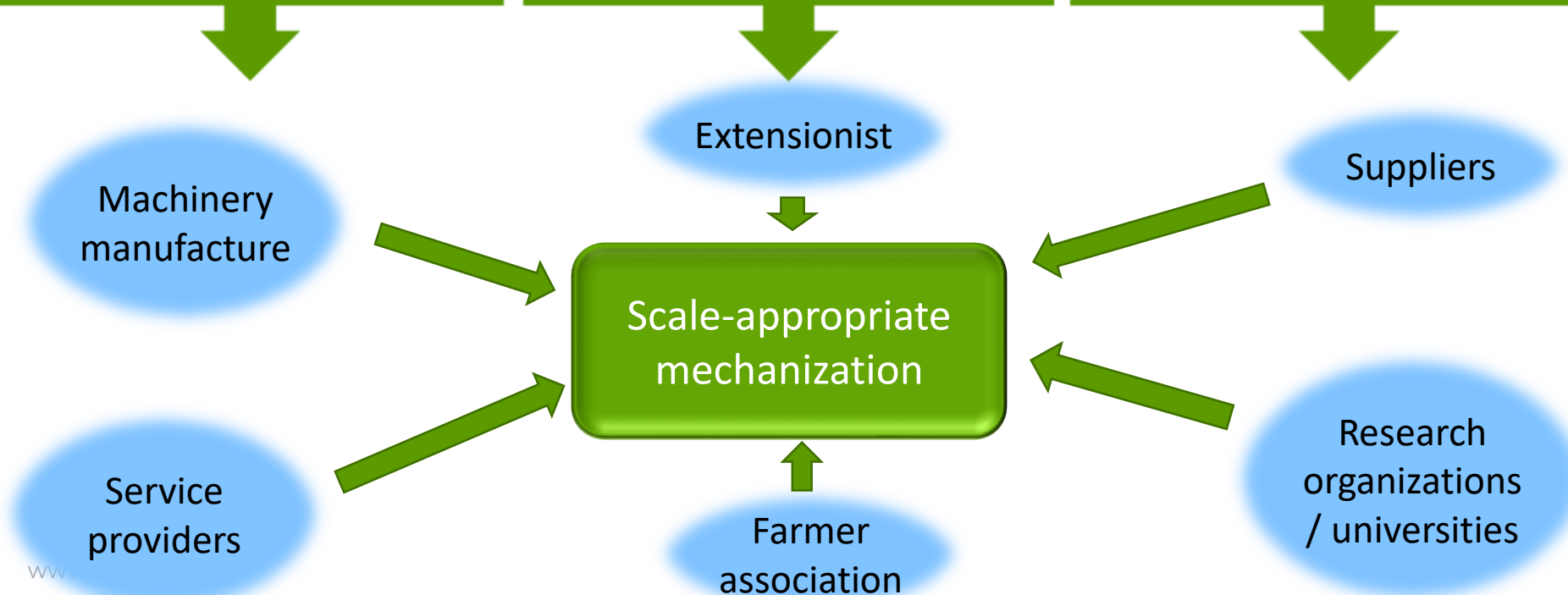
For improving efficiency in agriculture, it is important to develop scale-appropriate mechanization sector in the region

Most of the available machinery are large in size which needs high power tractors to operate, need high initial investment and operational cost

Generate solutions working with different sector-holders

Develop farmer-centric business models for scaling mechanization

Research for improving context-specific machinery solutions

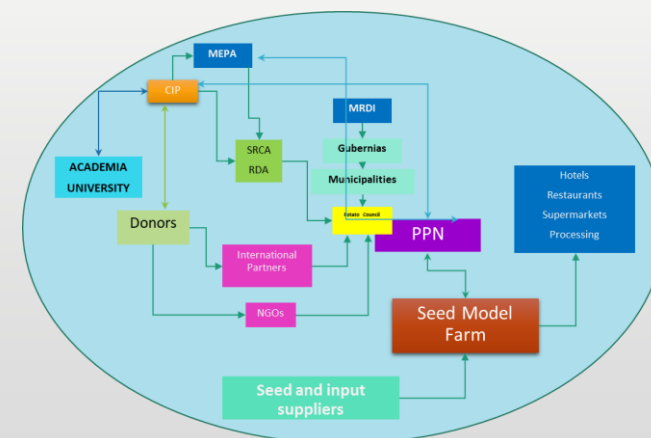




Technological Innovation

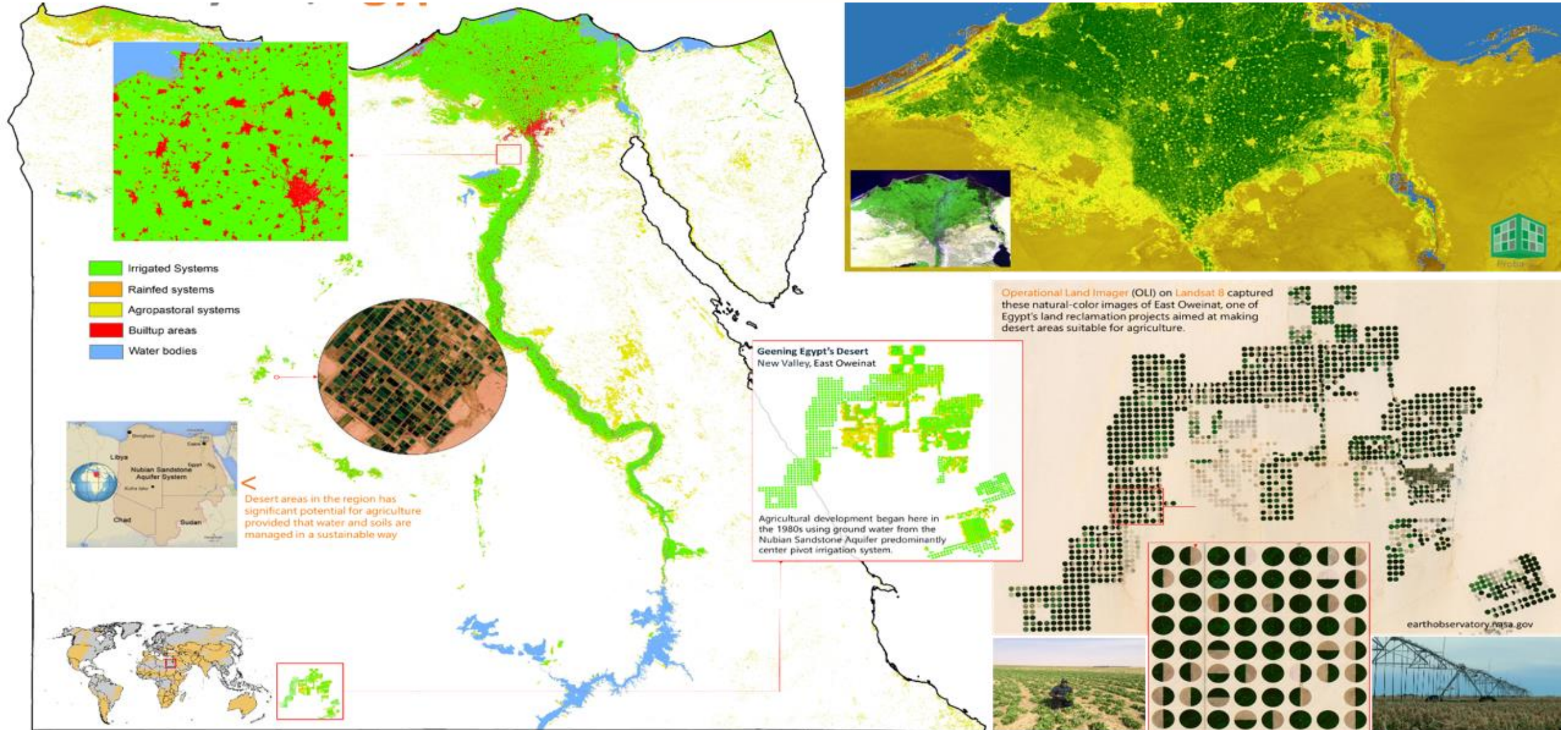


Commercial Innovation



Institutional Innovations

Scaling digital innovations to build Climate Resilient Agricultural Value Chains



Empowering farmers and digital extension services

Geotagging and Agrotagging for systemic innovations



BigData and Satellite
RS derived indices

Coordinated Activities
Centers and Partners

Send final version of Data
collection forms for each
activity to SES Lead



Geotagging and Agrotagging
Field boundary



Smart Extension
Systems (SES) for
agronomic technology
diffusions cgiar.org



Web-analytics:
Reports, Real-time
analytics and
Advisory



Activity-wise dBase
Unified, Curated, Mapped
Shared with Activity Leads
for analyses



Unified Single Mobile
APP with activity wise
data collection



Improving productivity of salt affected soils in Egypt

- Rice is an important food and economic crop in Egypt, mostly being produced in the delta region, where salinity is building up
- Rice is an excellent choice for reclaiming and use of salt affected soils because of its adaptation to grow in standing water
- Even though rice is one of the most sensitive cereal crops, considerable variation in salinity tolerance was discovered in cultivated and wild relatives, and extensively exploited to develop salt tolerant varieties for Asia and Africa



Farm to basin smart tools for water efficiency and management

Smart tools for irrigation scheduling

Smart phone App for irrigation scheduling-
IRWI Application

On farm water accounting

for farm monitoring and management

Smart tools for fertilizers scheduling

4Rs Fertilizers system

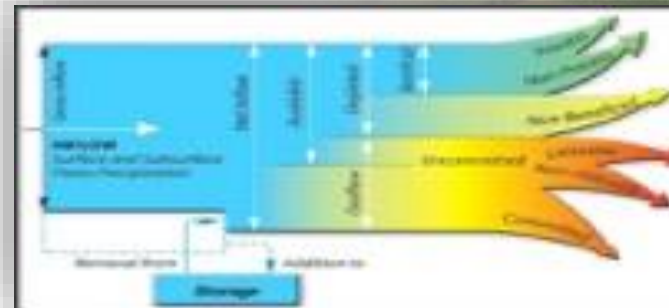
Fertilizers application using 4Rs: right source, right rate at the right time and the right place

Basin water accounting and assessment

for basin planning and policy

Water auditing

Water governance analysis



Climate-smart Agricultural Water Management

Solar-Powered Ultra-Low Energy Drip Irrigation

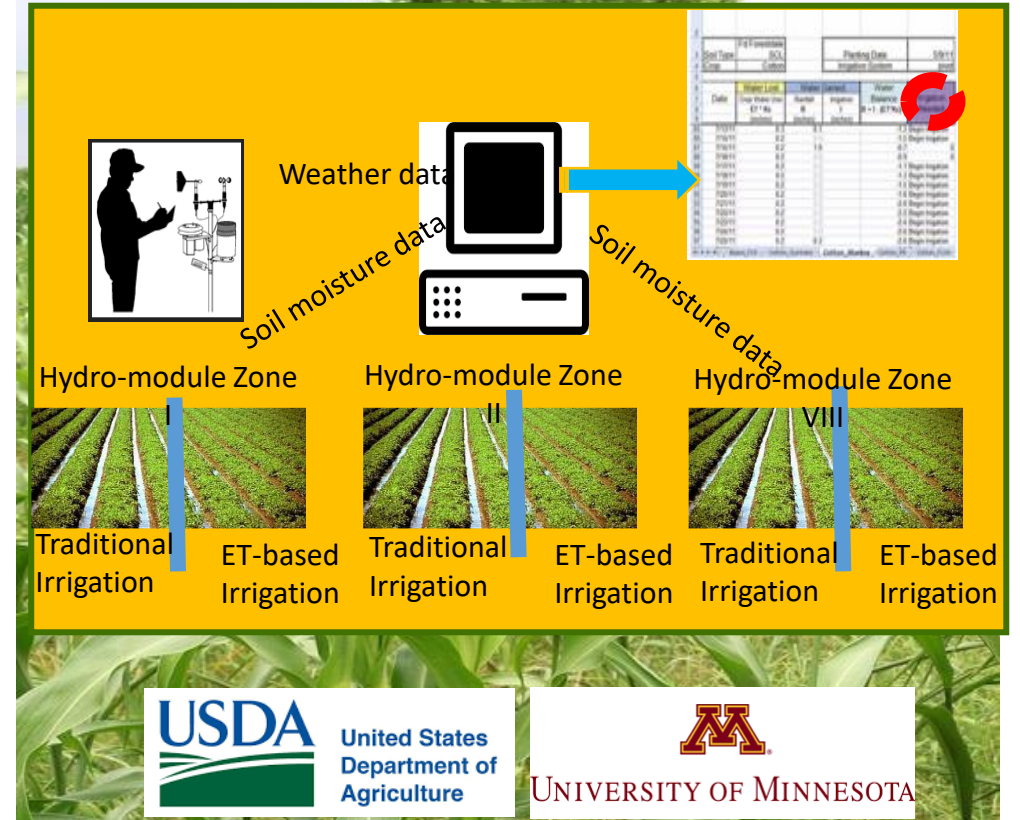
Drip irrigation, compared to flood irrigation, has been shown to increase crop yields by 8–29% while reducing water consumption by 9–70%.

ULE drippers have an activation pressure of 0.15 bar, which require 50% less overall system pumping power than existing products and lowers the capital cost of a solar-powered drip irrigation system by 42%.



Smart Sensor-based Irrigation Scheduling

In Uzbekistan, switching from traditional flood irrigation scheduling method to ICARDA's smart system, there was on average 32% saving of irrigation water and 50% increase in water productivity



Integrated food, land, water, and energy systems for climate resilient landscapes

Support communities and stakeholders for more sustainable, resilient and inclusive water, energy and landscape management policies, design and practices at the regional, national, and landscape scales

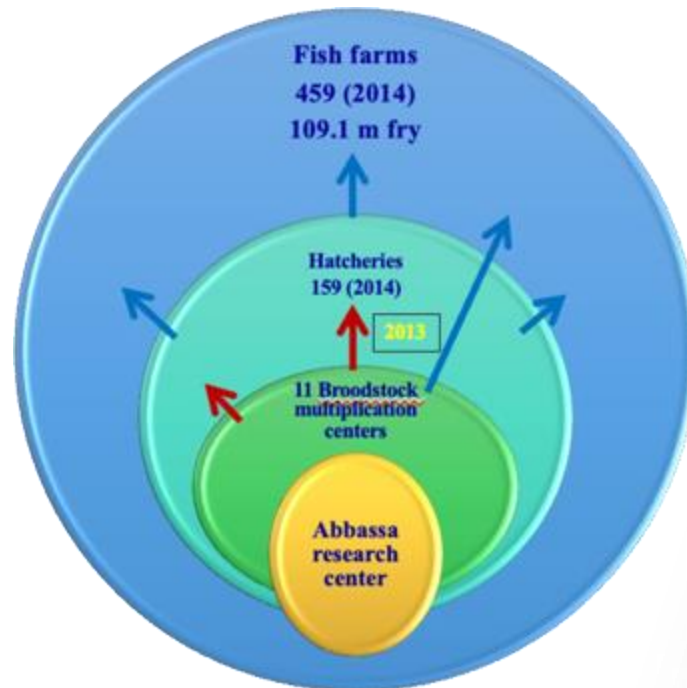
- Integrated approaches to storing more water in natural and built systems at multiple scales, and increasing the productivity and value of that water
- Strengthening inclusive policies and governance for integrated management across the food-land-water-energy nexus
- Maintaining productivity in saline landscapes
- Diagnostics to clarify limits to growth and improve the long-term potential for sustainable livelihood
- Foundations for scaling up access to alternative water resources, including water recycling and re-use



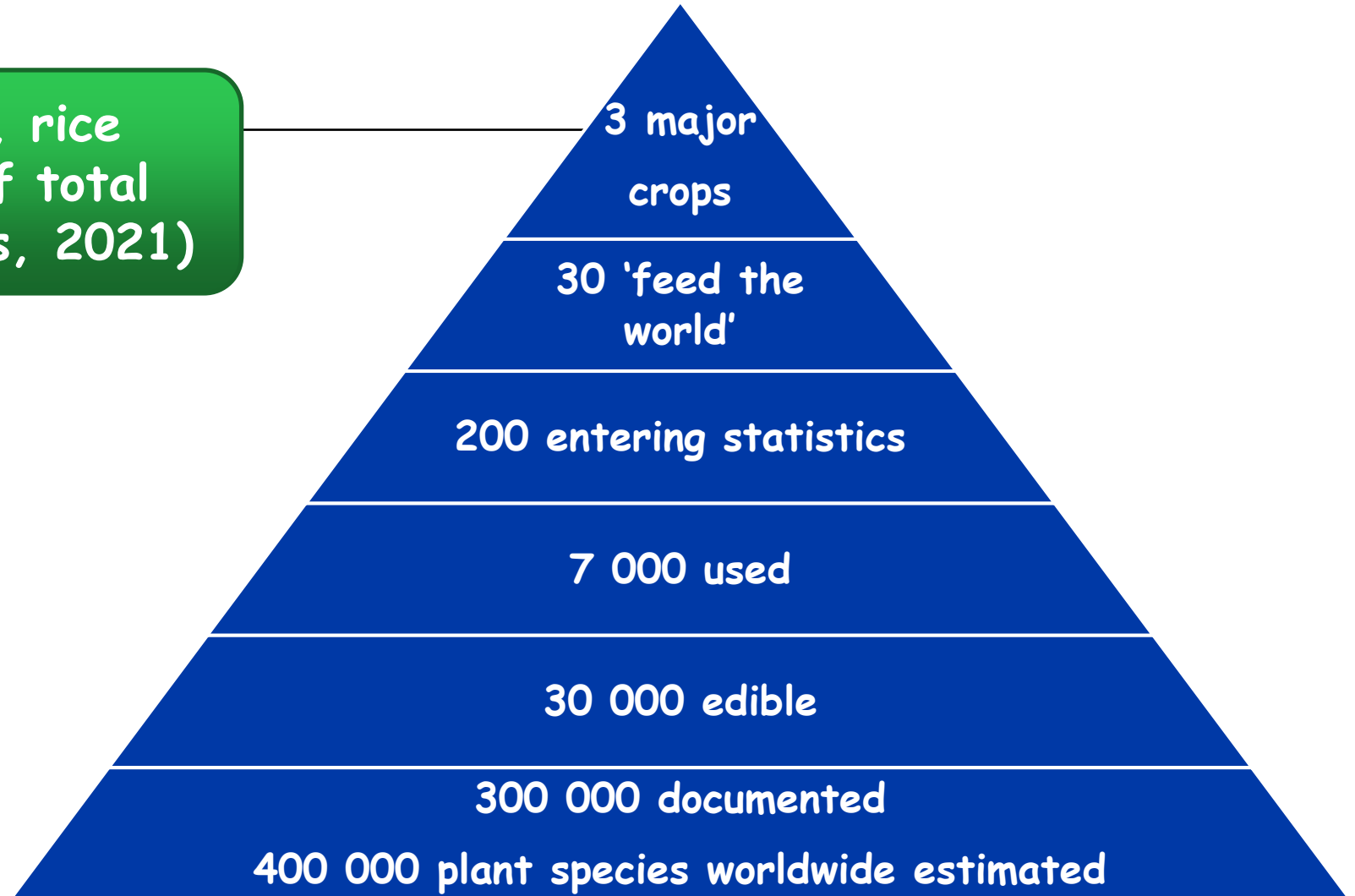
Climate Smart Aquaculture

- Higher yield / unit of land and **water**, **food security**
- Produce high quality fish and easy to market life product
- Capture of nutrients for removal and use as fertilizers and biogas
- Easier fish health management; and apply biosecurity measure

Tilapia Genetics
improvement program
dissemination of
improved strain
GIANT(G9) in Egypt



Three major crops: maize, rice
wheat are holding >40% of total
crop production (FAOStats, 2021)



source: FAO, 1996

F2R -Central and West Asia and North Africa



WP1

Innovations in partnerships, policies and platforms for agrifood systems transformation



WP2

Genetic innovations, seed systems, and agrobiodiversity conservation



WP3

Sustainable intensification of farming systems



WP4

Integrated food, land, water and energy systems



WP5

Scaling innovation and digital tools



CGIAR Accelerator and Open Innovation Program

Innovations

Toolbox of Nature-based Solutions for people and planet

Resilient food and feed crops adapted to MENA region

Farm to basin smart tools for water efficiency and management

The Rural Investment and Policy Analysis Modeling Toolkit

Promoting in-situ conservation of CWANA dryland agrobiodiversity

Participatory Product Profile Performances

Weather station-based irrigation advisory system

Scale-appropriate mechanization for CWANA

In 2030:

Farmers

use Best Bet Genetic and Agronomic Innovations developed for CWANA.

adopt best practices for the on-farm conservation of agrobiodiversity.

Government, civil society, private sector and INGOs

work together to create efficient, inclusive and resilient national agri-food systems.

scale up innovations and digital tools for food value chain climate risk management.

work together to scale up bundled solutions to bridge yield gaps.

practice integrated management of food, land, water, and energy systems.

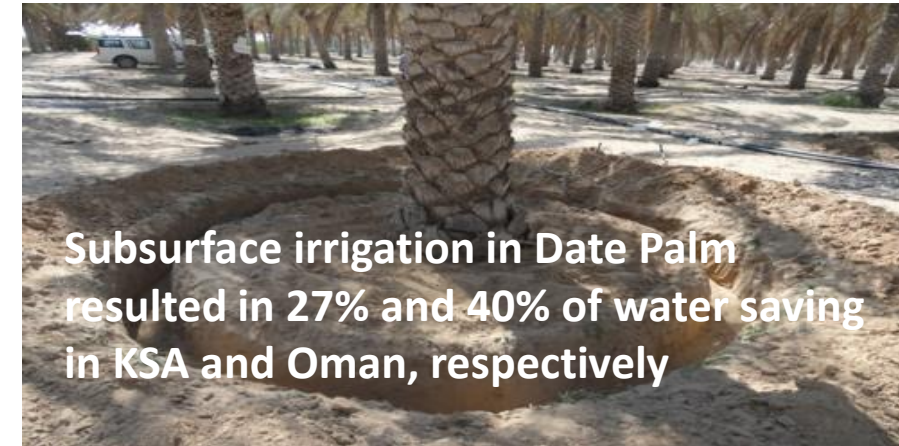
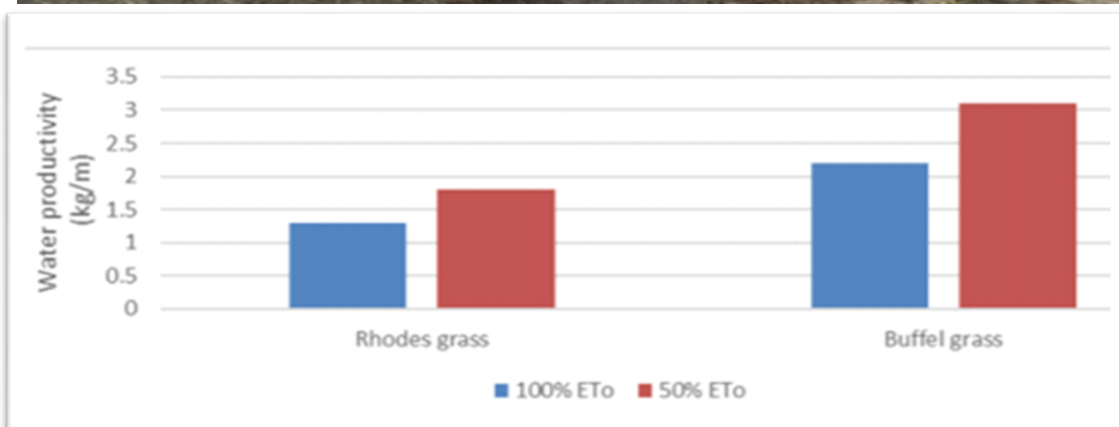
Integrated Desert Family Farming Systems

- ✓ IDFS combine nature-based solutions and traditional farming methods with cheap and appropriate technologies to transform desert agriculture systematically and sustainably.
- ✓ Desert farming includes horticulture production, date palms, irrigated forages, rangeland rehabilitation, protected agriculture, livestock, and fish production.
- ✓ Many innovative technologies used in desert environments, such as net houses, hydroponic and drip irrigation systems, have increased the productivity of crops while decreasing water and energy use.

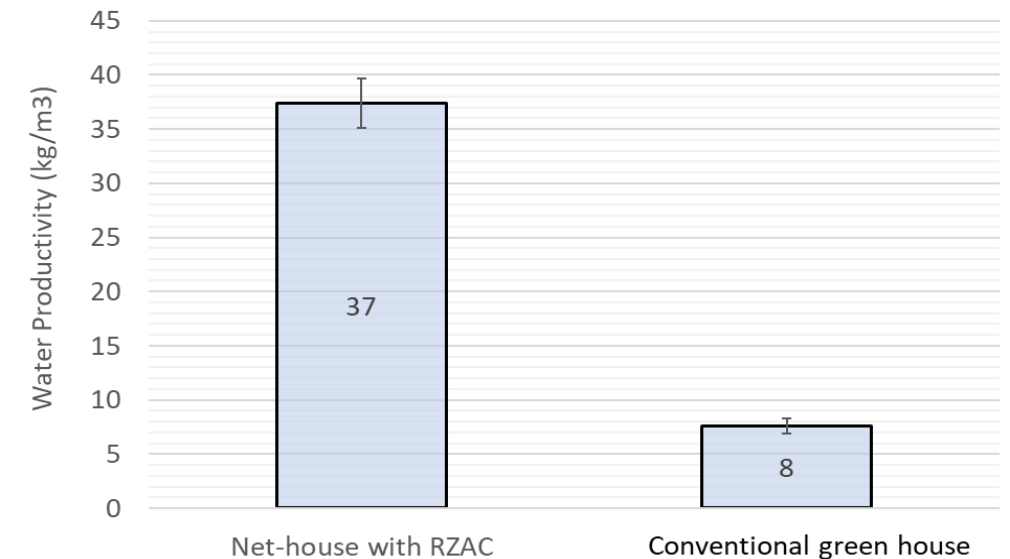


Water research in the Arabian Peninsula Regional Program

- Integrated dry farming innovations generated through the ICARDA/APRP NARS partners cooperation make difference
- Replacement of Tropical Grasses with native plants for fodder production
- Subsurface irrigation for Date Palm
- Root Zone Cooling in protected Agriculture



Water productivity for cucumber under solar energy powered root zone area cooling (RZAC) net house compared to conventional green house



Thank You!