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المرحر الوطني للبحوت الرزاعيـه National Agricultural Research Center





#### Water-efficient Innovative Solutions Portfolio for Enhancing Resilience (WISPER) ENI/2020/417 630

Implemented by Istituto per la Cooperazione Universitaria (ICU) - ITALY in partnership with National Agricultural Research Center (NARC) - JORDAN and

Institut National des Recherches en Génie Rural, Eaux et Forêts (INRGREF) - TUNISIA

## **OVERALL**

#### Countries involved: Tunisia and Jordan

WISPER project works to introduce <u>modern and innovative</u> <u>technologies</u> in the partner countries. These technologies are known to be scarce in partner countries and to contribute to raising the water use efficiency to the optimum level.

Project seeks to introduce modern technologies that save water, while at the same time making sure to introduce low cost technologies to achieve the possibility of acceptance and application by farmers.



# **OBJECTIVES**

GO: To contribute to the promotion of <u>efficient use of water in</u> <u>rural areas</u> in Tunisia and Jordan in order to adapt and enhance resilience to water related impacts of climate change.

SO: <u>Improved technical and institutional context that supports</u> <u>the adoption and scaling-up of innovative solutions</u> leading to efficient use of water in agricultural irrigation in Nabeul Governorate in Tunisia and in Balqa, Karak, Mafraq and Jerash Governorates in Jordan.



## WIDER PROGRAM

WISPER is part of a wider program leaded by ICU in Jordan, Tunisia, Lebanon, Syria and southern Italy (EVE, PRESTo, PROSIM) and financed by various donors: EU, Italian Cooperation Agency and other public bodies and private foundations.



# EXPECTED RESULTS

Identified, tested and showcased a portfolio of water-efficient innovative solutions at different maturity stages, that have the potential to be scaled up.

Improved institutional context to facilitate the local upscale of the innovative solutions of the portfolio.



# JORDAN

- 1. TWW Systems
- 2. Soilless-system prototypes & Fertilizer injector for an existing hydroponic system
- 3. Water-retention polymer
- 4. Sub-surface tape irrigation system
- 5. Water boxes
- 6. Use of brine (desalination-by-product)
- 7. Automated irrigation systems/PV systems



### JORDAN - TWW systems





**PROS**: Decentralized TWW systems using innovative low-cost prototype made from local materials with green energy (PV system).

The system reduces the cost of pumping from the septic tank thus reducing the environmental hazard of groundwater contamination and giving an option for agricultural water reuse (at least 80-90% of the produced WW could be used for agriculture).

**CONS**: At HH level, not more than 1 m<sup>3</sup> treated water per day (low cost/benefices ratio). Not applicable on large scale.



### JORDAN - Soilless-system prototypes & Fertilizer injector for an existing hydroponic system





**PROS:** Simple and "low cost" soilless system prototypes to make this innovation accessible.

3 ways of cultivation: water, volcanic soil and coconut fiber. <u>Save 30/60% water</u> comparing with traditional cultivations.



#### "Low cost" hydroponic greenhouse prototype







Figure 2. Design and Layout of low cost prototype hydroponic Greenhouse

Figure 3. Fertilizer Dosing unite Design and layout

#### **Fertilizer-injector**



### **JORDAN - Water-retention polymer**



**PROS:** Innovative polymer (pollution free and 100% biodegradable). The polymer may retain water for 4 to 6 weeks, tested in an open field of 1 dun and 240 m<sup>2</sup> greenhouse. <u>About 20%</u> water saving in open field, <u>about 30%</u> in greenhouse

**CONS**: Biodegradability level still under verification.



### JORDAN - Sub-surface tape irrigation system



**PROS:** Sub-surface drip irrigation tape system on 1 dunum open field in NARC Deiralla Research Center thus decreasing the evaporation losses of water. <u>About 30%</u> water saving.



### JORDAN - water boxes



3 different cultivations (20-30 trees each) at different sites: ziziphus in Karamah, almond trees in Salt and olive trees in Karak.

**CONS:** Bad quality of boxes (mold) provided by Jordan Ministry of Agriculture (Chinese technology). New boxes will be purchased.



#### Water boxes (cocoon)

#### **Cocoon technology**

#### What is a cocoon?

A sustainable innovative solution to support tree growth and survival.

A cocoon consists of three parts a water reservoir, lid, and a protective tree shelter



#### Why Use cocoons?

- Low cost tree planting
- Little irrigation required
- High water storage capacity (~25 liters)
- High survival rate of seedlings (75-95%)
- Supports critical first year of plant growth
- Is 100% biodegradable

#### Benefits to the land

- Erosion control
- Restoration of topsoil (soil conservation)
- Cocoons serve as micro-water catchments
- Increase in soil water retention and infiltration
- Increase in biodiversity value
- Economically and ecologically sustainable







### JORDAN - Use of brine (desalination-by-product)



Experiment to be launched at Al-Karamah Research Station (reverse osmosis desalinization plant with capacity of 5 m<sup>3</sup>/day). Rejected brine can be used for aquaculture, to cultivate spirulina and to irrigate forage shrubs and crops. **PENDING RESULT**: Experiment not yet started.



### JORDAN - Automated irrigation systems/PV systems



30 irrigation systems alimented by PV units will be implemented in the highlands (Mafraq). Farms with 5 dun each will benefit from the integrated pumping, irrigation and fertigation system powered by PV technology

# **PENDING RESULT**: Activity not yet started.



# TUNISIA

- 1. 20 improved PV systems for pumping water from private wells with salinity rate between 1,5 and 3 g/L in 4 GDA
- 2. 3 agrometeorological stations and sensors
- 3. Technology to measure the variability of soil salinity: CMD mini explorer
- 4. Experimental greenhouse for recovering rainwater and evapotranspirated water
- 5. PV station (100 kW) for pumping treated waste water in SE4 station
- 6. Experimental study on use of brine (desalination-by-product).
- 7. Experimental study to test different water mixes for irrigation and aquaculture.



### **TUNISIA - 20 improved PV systems for private wells**





**PROS:** Reduces the cost of pumping from the wells by reducing the use of fossil energy thus reducing the environmental hazard and increase farmer incomes.

**CONS:** Increase of groundwater salinity



### **TUNISIA - 3 agrometeorological stations and sensors**



**PROS:** Agro-meteorological stations measure meteorological data such as temperature, rain, air humidity and are equipped with special sensors such as those for leaf wetness. All data collected by the agrometeorological stations allow a more targeted intelligent irrigation which improves the quality of the cultivation and which saves water and therefore costs for farms (<u>about</u> -30% water).



# TUNISIA - Technology to measure the variability of soil salinity: CMD mini explorer

The measurement of soil salinity is crucial because salinity impact the nutritional balance of plants and make it more difficult for the plant to extract water and thus grow healthy. The portable solution provided by the project measures soil salinity at different level of depth.

**PENDING RESULT:** CMD still blocked at the Tunisian custom for bureaucratic reasons.





### TUNISIA - Experimental greenhouse for recovering rainwater and evapo-transpirated water



After 1 year assessment, the involved stakeholders asked to install a greenhouse with rainwater collection and reuse system at the INRGREF station in Oued Souhil (Nabeul). It will be useful for crop response tests to different levels of salinity and will be used for training and demonstration to local farmers.

**PENDING RESULT:** The preparation of the technical specifications was very complex and long even because it is a truly innovative solution. The contract was signed in April 2023.



#### TUNISIA - PV station (100 kW) for pumping treated waste water in SE4 station



A solar-energy pumping station to pump treated water from ONAS station at CRDA HQ in Beni Khiar (Nabeul) will established.

**PENDING RESULT:** The preparation of the tender was very complex and long even because CRDA asked for some important changes (from 80KW to 100 KW).



### TUNISIA - Experimental study on use of brine (desalination-by-product)

The experimental study (called "mixing water) is carried out by INRGREF. The purpose is to study how to minimize the effect of salinity water for 3 different crops and plants and to find solutions to save brackish water pumped from wells.

**PENDING RESULT:** Activity not yet started.



### TUNISIA - Experimental study to test different water mixes for irrigation and aquaculture



**PROS:** Physio-chemical and biological study of the brine recovered from the desalination process; Trial of the most appropriate technical solution on a small scale and suggest solutions for the reuse of the brine (cultivate spirulina and to irrigate forage shrubs and crops). In aquaculture, brine could be used to increases fish biomass.

**CONS:** Not yet fully implemented



### Next:

### Training & Capacity Building Activities



## Questions & Answers



# Thank you!

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