

# Mix water tools for risk reductions when using non-conventional water resources

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# General facts at farm level

Non-efficient irrigation systems

Different water sources, qualities and availability

Multiple crops under the same irrigation regime

Limited reliance on non-conventional waters:

-saline, brackish, brine, reclaimed waste waters...

Predominance of low-cost technologies

Lack of awareness/access to modern solutions



# Characteristic features of irrigation in the Mediterranean Region

- Predominance of smallholdings
- Wide variety of crops grown in one single irrigation zone
- Presence of irrigation channels and drainage ditches where the reclaimed water is mixed with other sources



# A DSS to manage different water sources

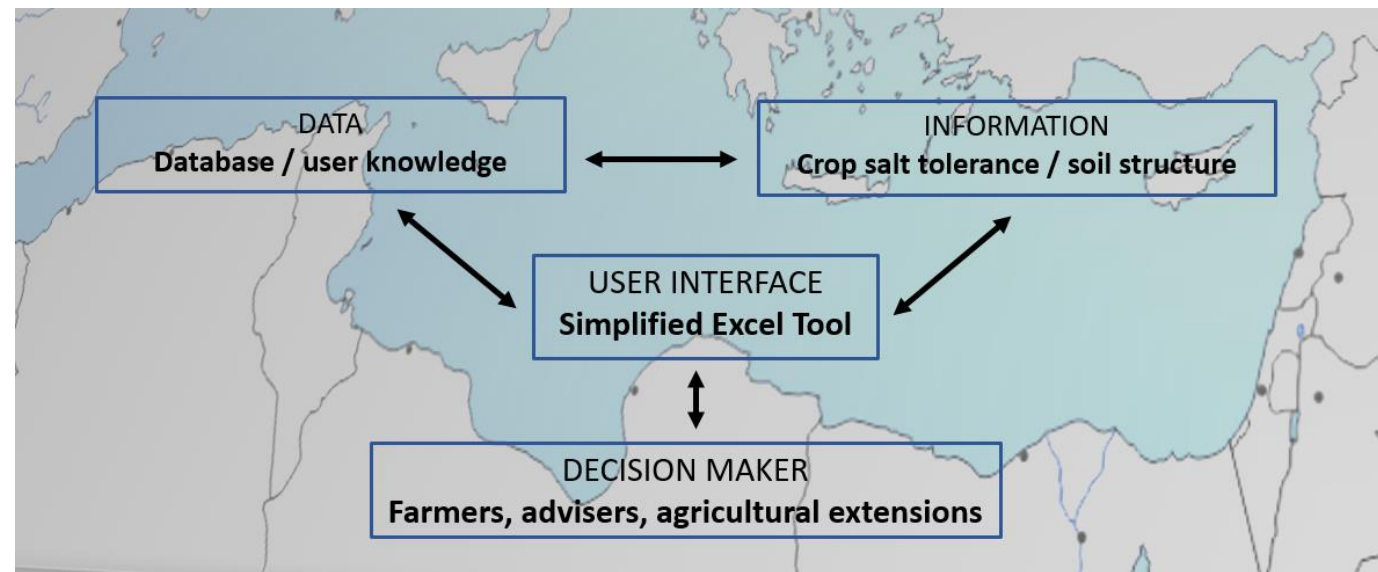
Help farmers to contrast information provided by the system with their personal knowledge and experiences

Examination of multiple alternatives

Identification of unpredicted situations

Better use of data and resources

Reduce cost



# How it works?

## Input parameters

- Crop
- Irrigation method
- Region
- Growing season
- Water analysis
- Blending?
- Leaching?

## Output

- Relative crop performance
- Water quality and soil structure info (SAR/CROSS)
- Fertilizer recommendations and crop water requirements

Farmer data

PROSIM

Crop:  Region:

Irrigation method:

	Salinity	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	NH <sub>4</sub> (mg/L)	NO <sub>3</sub> (mg/L)	P (mg/L)
Water A								
Water B								

Water mixer:  ECw:

Leaching fraction:  ECe (LF):

# Running the tool

- Access at this moment: <http://www.inditech.es/prosim/>

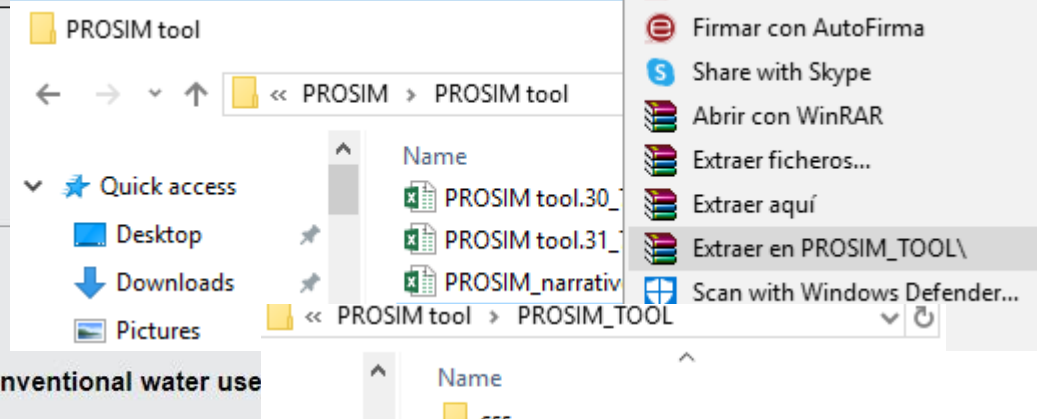
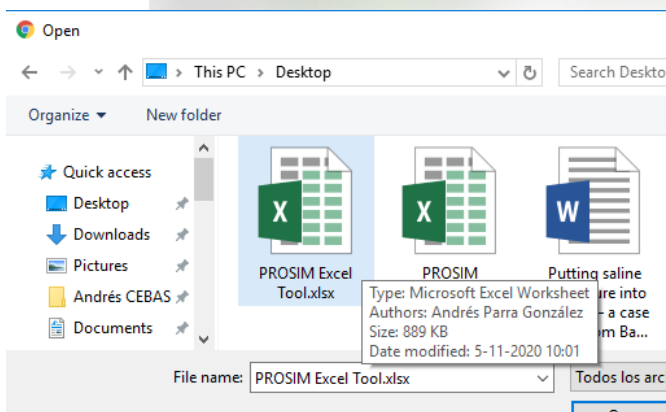
The screenshot shows the PROSIM website interface. At the top, there are logos for ENI CBCMED and the European Union. The main heading is 'PROSIM' with a water drop icon. Below it, the text reads 'Promoting Sustainable Irrigation Management and non-saline soils in the Mediterranean'. There are three circular icons representing the United Kingdom, France, and Spain. A button labeled 'Load Excel Tool and follow the instructions' is visible. An 'Open' file explorer window is overlaid on the right, showing the 'This PC > Desktop' path. It contains three files: 'PROSIM Excel Tool.xlsx', 'PROSIM', and 'Putting saline...'. A tooltip for 'PROSIM Excel Tool.xlsx' is displayed, showing details: 'Type: Microsoft Excel Worksheet', 'Authors: Andrés Parra González', 'Size: 889 KB', and 'Date modified: 5-11-2020 10:01'. The file name field shows 'PROSIM Excel Tool.xlsx' and the 'Open' button is highlighted.

## 2 Options:

- Web version
- Desktop version

## Web version (online)

## Desktop version (offline)



Farmer data

PROSIM

Select your crop

Crop: Select CROP Region: Select Region Select Start Select End

Irrigation method: Select

	Salinity	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	NH <sub>4</sub> (mg/L)	NO <sub>3</sub> (mg/L)	P (mg/L)
Water A								
Water B								
Water mixer	Select A% B%				ECw		ECe	
Leaching fraction	Select LF						ECe (LF)	

Load Excel Tool and follow the instruct

[DOWNLOAD PROSIM TOOL](#)

Farmer data

PROSIM

Select your crop

Crop: Select CROP Region: Select Region Select Start Select End

Irrigation method: Select

	Salinity	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	NH <sub>4</sub> (mg/L)	NO <sub>3</sub> (mg/L)	P (mg/L)
Water A								
Water B								
Water mixer	Select A% B%				ECw		ECe	
Leaching fraction	Select LF						ECe (LF)	

**EC<sub>w</sub>** = Irrigation water salinity (in dS/m)

**EC<sub>e</sub>** = Root zone salinity (measured as saturation extract of the soil, in dS/m)

**EC<sub>e</sub> = EC<sub>w</sub> x 1.5** (assuming 15-20% water surplus )

**Leaching fraction (LF)** = It's the amount of extra irrigation water applied above the amount required by the crop, in order to maintain an acceptable root zone salinity

**dS/m (deciSiemens/metre)** = Standard unit to measure **salinity (conductivity)**. 1dS/m = 1 mmho/cm ~ 550 ppm

Farmer data

Click to check the results

**PROSIM**

Crop: Tomato    Region: Cartagena    March    September

Irrigation method: Drip

	Salinity	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	NH <sub>4</sub> (mg/L)	NO <sub>3</sub> (mg/L)	P (mg/L)
Water A	0.2	11	4	137	12	0.05	18	0.9
Water B	7	143	105	995	68	0.2	11	4.6

Water mixer: 60% 40%

Leaching fraction: 0.3

**EC<sub>w</sub>** 2.92    **EC<sub>e</sub>** 3.50

**EC<sub>e</sub> (LF)** 2.54





# Results

**Farmer data**

Crop: Tomato | Region: Cartagena | Month: March | September

Irrigation method: Drip

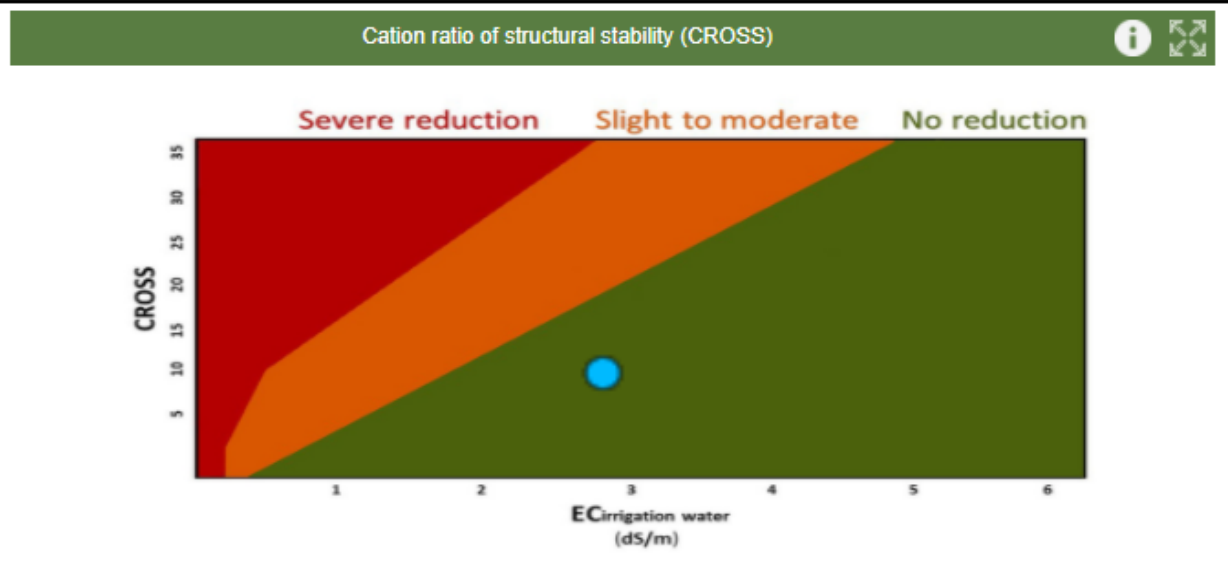
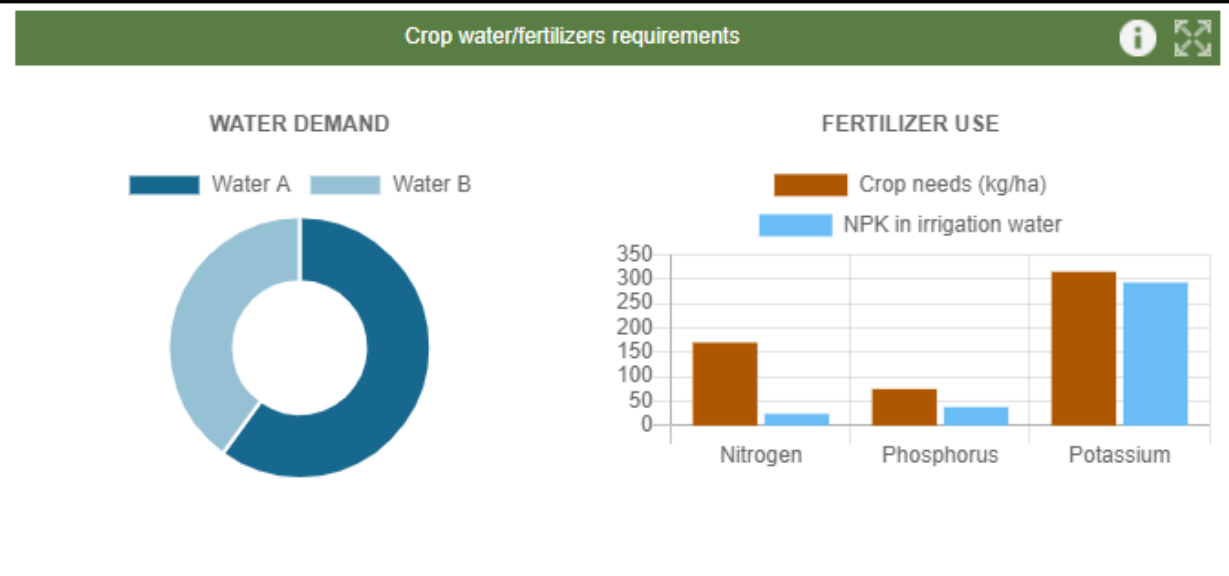
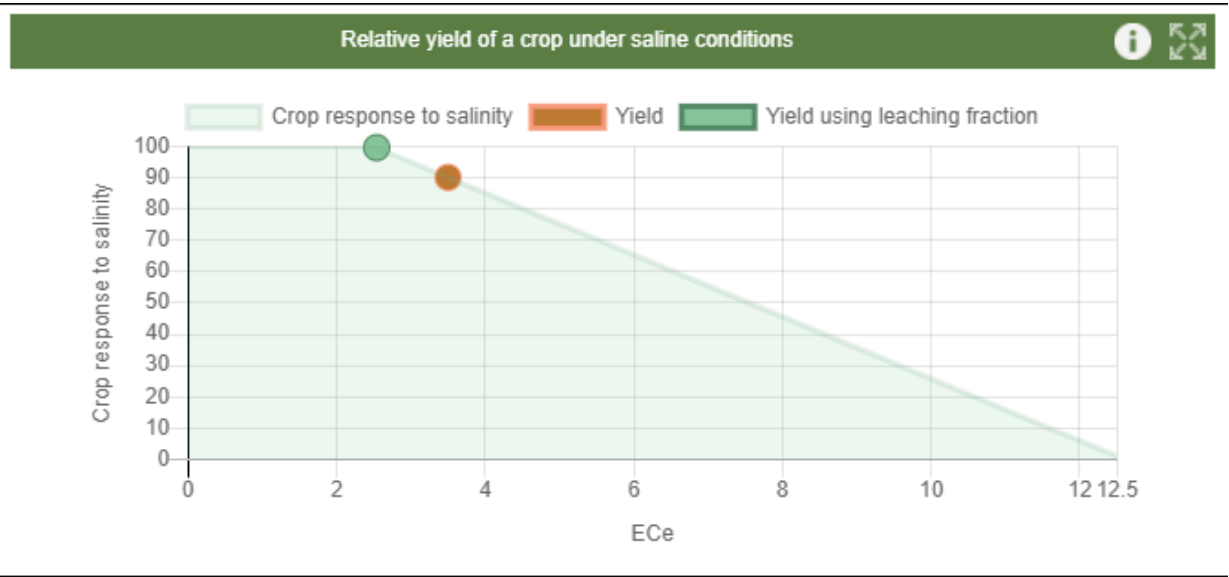
	Salinity	Ca (mg/L)	Mg (mg/L)	Na (mg/L)	K (mg/L)	NH <sub>4</sub> (mg/L)	NO <sub>3</sub> (mg/L)	P (mg/L)
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Water mixer: 60% 40%

Leaching fraction: 0.3

ECw: 2.92 | ECe: 3.50

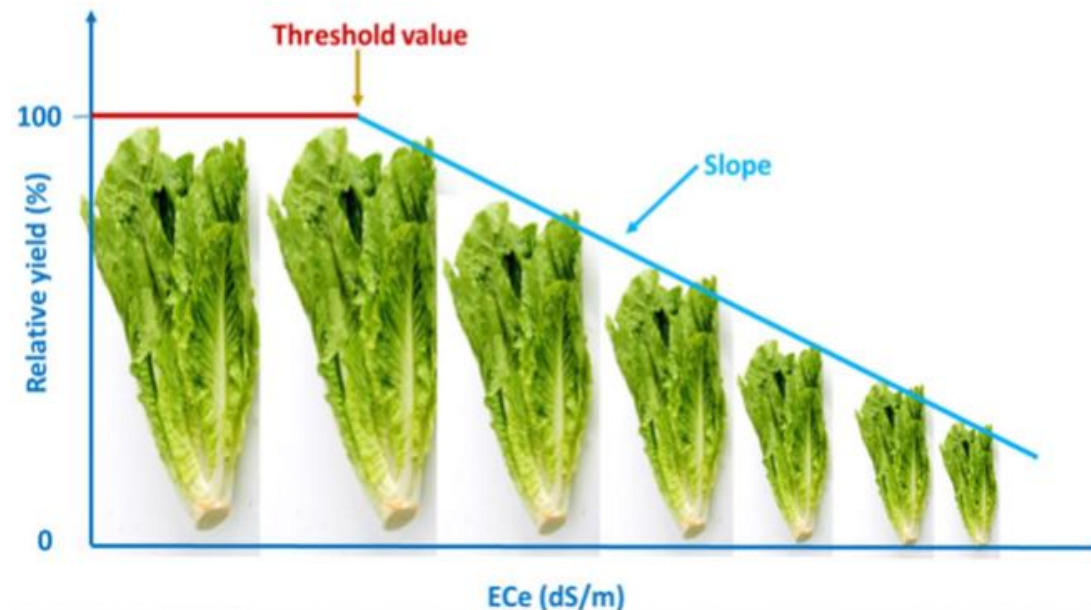
ECe (LF): 2.54



# Relative yield under saline conditions

Generally, **salinity reduces** water availability for crops and consequently the **yield**. Plants are generally **more sensitive** to salinity **during germination and early growth**. **Crop performance under saline conditions might be different among varieties or rootstock of the same crop species.**

The **relative yield** of a crop is related to soil salinity (**EC<sub>e</sub>**). It expresses the yield reduction as a % when EC<sub>e</sub> increases. Results are based on the **threshold** value (salinity level when yield starts to decrease) and the **slope** (% of yield decrease when EC<sub>e</sub> increases by 1 dS/m).



**EC<sub>w</sub>** = Irrigation water salinity (in dS/m)

**EC<sub>e</sub>** = Root zone salinity (measured as saturation extract of the soil, in dS/m)

**EC<sub>e</sub>** = **EC<sub>w</sub>** x **1.5** (assuming 15- 20% LF)

**Leaching fraction (LF)** = It's the amount of extra irrigation water applied above the amount required by the crop, in order to maintain an acceptable root zone salinity

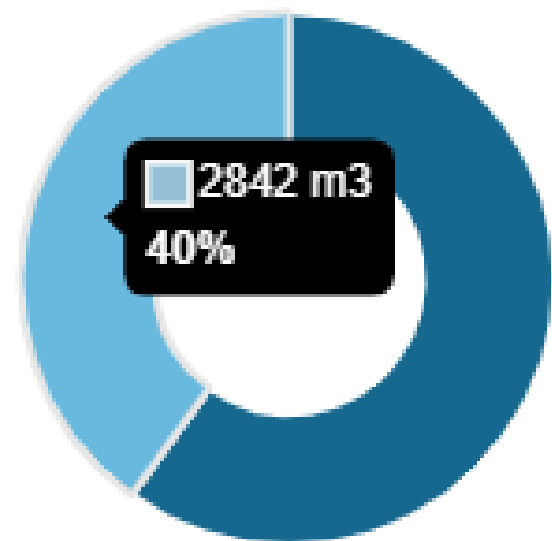
**dS/m (deciSiemens/metre)** = Standard unit to measure salinity. **1dS/m = 1 mmho/cm ~ 550**

# Crop water demand and fertilizer requirements

## Crop water/fertilizers requirements

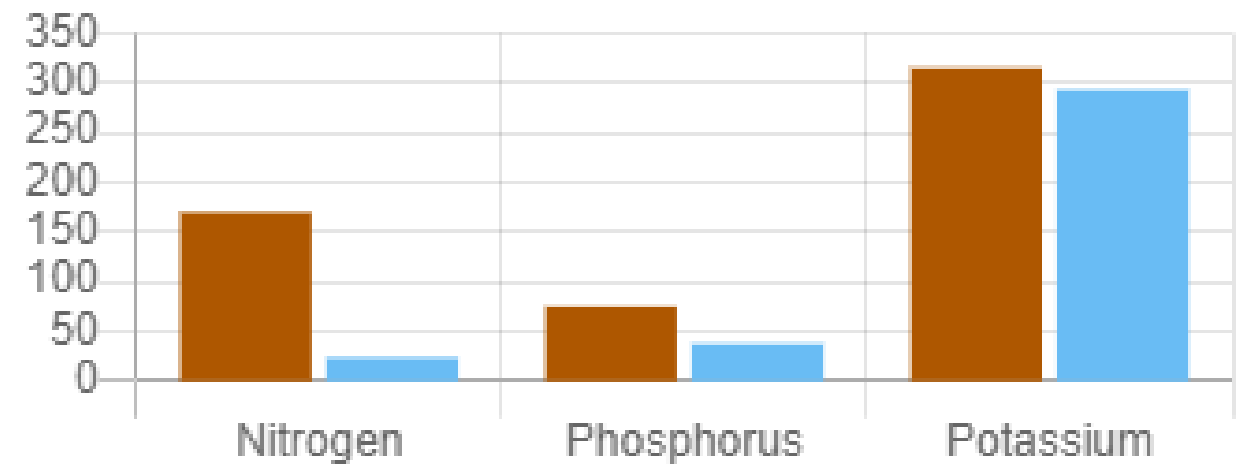
WATER DEMAND

■ Water A    ■ Water B



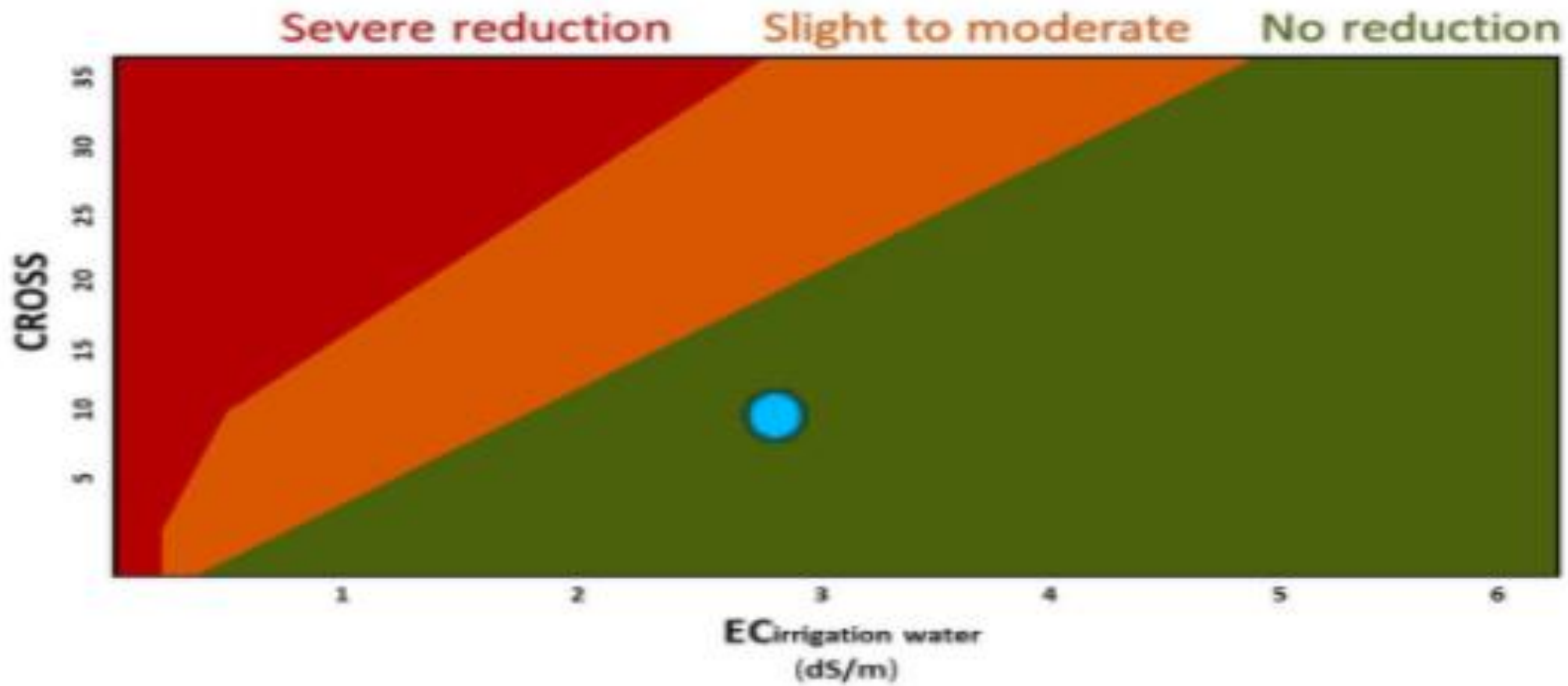
FERTILIZER USE

■ Crop needs (kg/ha)  
■ NPK in irrigation water



# CROSS index

Cation ratio of structural stability (CROSS)

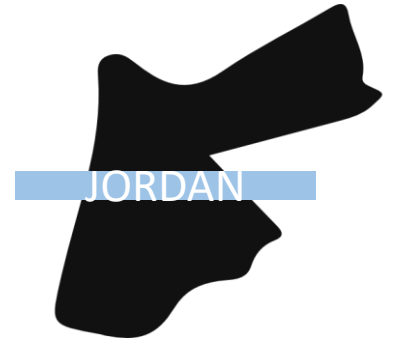


# Experimental farms

- Masghara (31 farmers, 15,5 ha)
- Labwue (20 farmers, 7,5 ha)



- Balqa (55 farmers 22,5 ha)
- Aqaba (15 farmers, 7 ha)



- Madhia (74 farmers, 30 ha)
- Nabeul (40 farmers, 5 ha)



- Marsala (2,5 ha)



# Experimental farms in Spain

- Cartagena-Roldán (WWTP, 0,8 ha)
- Jumilla (1 farmer, 3 has)



# Water and Agriculture Research Platform CEBAS-CSIC



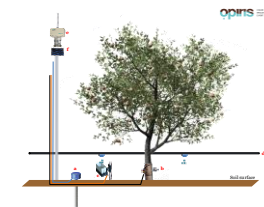
- **Research projects**

- Agricultural reclaimed water use effects on horticultural crops growing on soil and hidroponics.
- Water treatment prototypes testing
- Food safety risk and security studies.
- Emerging contaminants
- Sludge



- **Enterprise collaborations**

- Precision irrigation with soil and environmental sensor integration

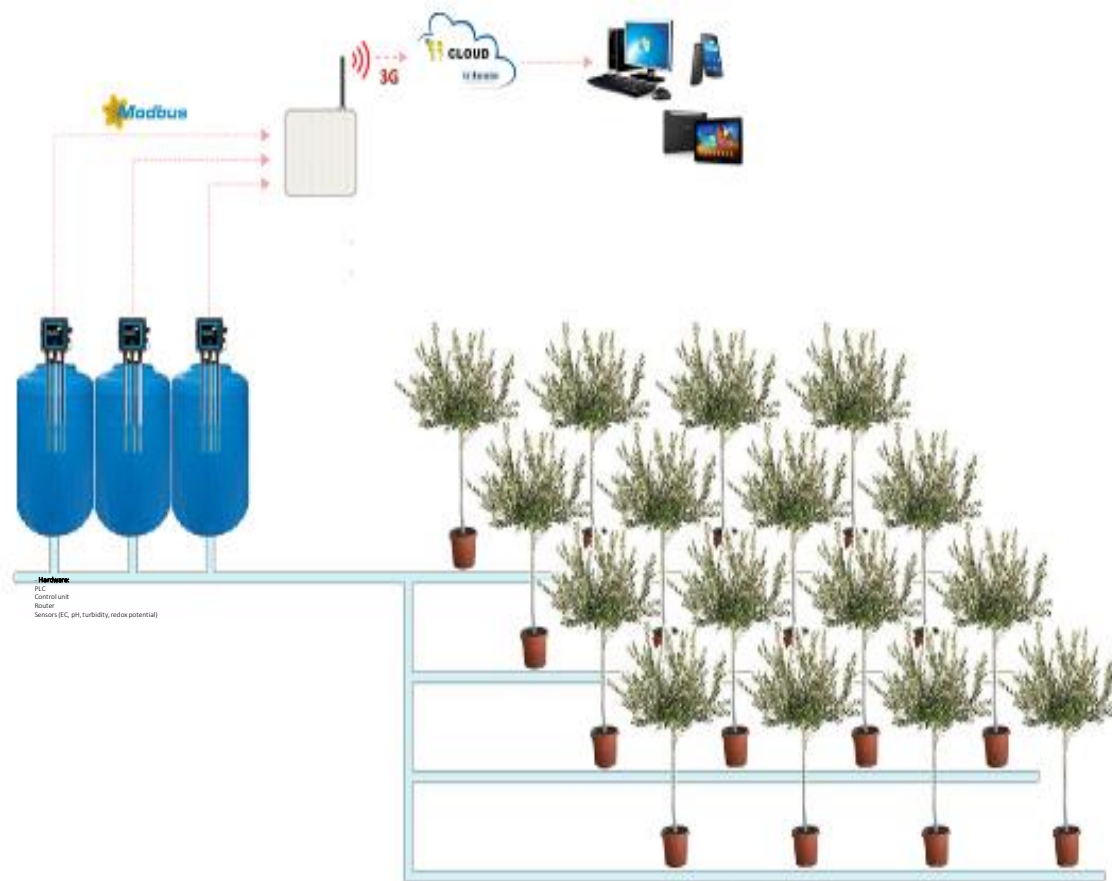


- **Visits, training days, international courses , dissemination, MsC, PhD.**





## Development of advanced DSS for water mix technique and field demonstration



The screenshot shows the RiTEC WATER MIXING control interface. The interface includes a clock showing 11:32 on 15/4/2021. It features two tanks, labeled 1 and 2, with their respective valve opening percentages (100% and 0%) and a scale from 0.0 to 100.0. The interface also displays a TIMING section with Activation Time (1.0 s), Timing Time (15 s), and Full Opening Time (13 s). On the right, there are sections for ACTIVATION and SETPOINTS, showing current and target values for EC, pH, Turbidity, and Redox Potential. A HYSTERESIS section is also present. At the bottom, there are buttons for SCHEDULES, PRIORITY, SETPOINTS, and ALARMS. A Filling pump is shown at the bottom right.

**ACTIVATION**

EC	3.00	mS/cm
pH	8.00	
Turbidity	0.00	NTU
Redox Potential	360.00	mV

**SETPOINTS**

EC	3.00	mS/cm
pH	8.00	
Turbidity	0.00	NTU
Redox Potential	360.00	mV

**TIMING**

Activation Time	1.0	s
Timing Time	15	s
Full Opening Time	13	s

**HYSTERESIS**

EC	0.50	mS/cm
pH	1.00	
Turbidity	0.00	NTU
Redox Potential	50.00	mV

# Miraflores Irrigation Community

- 967 members
- Total surface with irrigation infrastructures: 1515 Ha



Crops (1329 Ha)	% irrigation surface
Pear	45
Peach	32
Apricot	12
Olives	5
Plum	3
Grapes	2
Almond	1

Resource type	Volume (m <sup>3</sup> /year)
Water needs	7.765.000
Underground water	3.851.288
WWTP Jumilla	1.500.000
<b>Total volume</b>	<b>5.351.288</b>

With this use of treated wastewater from the Jumilla WWTP, the Miraflores irrigation community will increase from 3600 m<sup>3</sup>/ha to 4900 m<sup>3</sup>/ha per year.

A landscape photograph showing a reservoir in a dry, hilly region. The water is a deep blue color, contrasting with the light-colored, eroded hills and mountains in the background. The sky is blue with some clouds.

**THANK YOU FOR YOUR  
ATTENTION**

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