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CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS

Influence of saline reclaimed water and regulated deficit irrigation on young grapefruits

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Irrigation Department
CEBAS-CSIC

Increasing demand

Quality

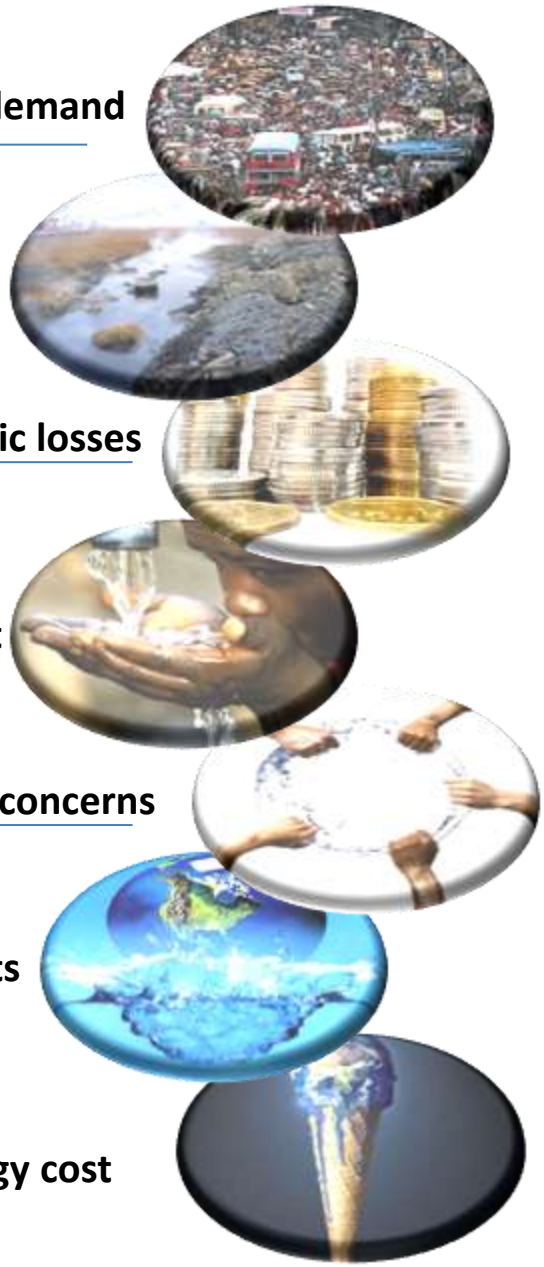
Economic losses

Development

Environmental concerns

Social conflicts

Energy cost

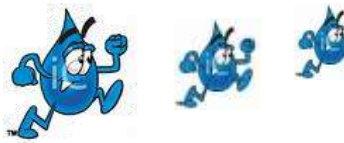


Sustainability
Environmental Ethics
Public participation

Limited resources

WATER RESOURCES MANAGEMENT
Supply or Demand?

IRRIGATION WATER **DEMAND** MANAGEMENT

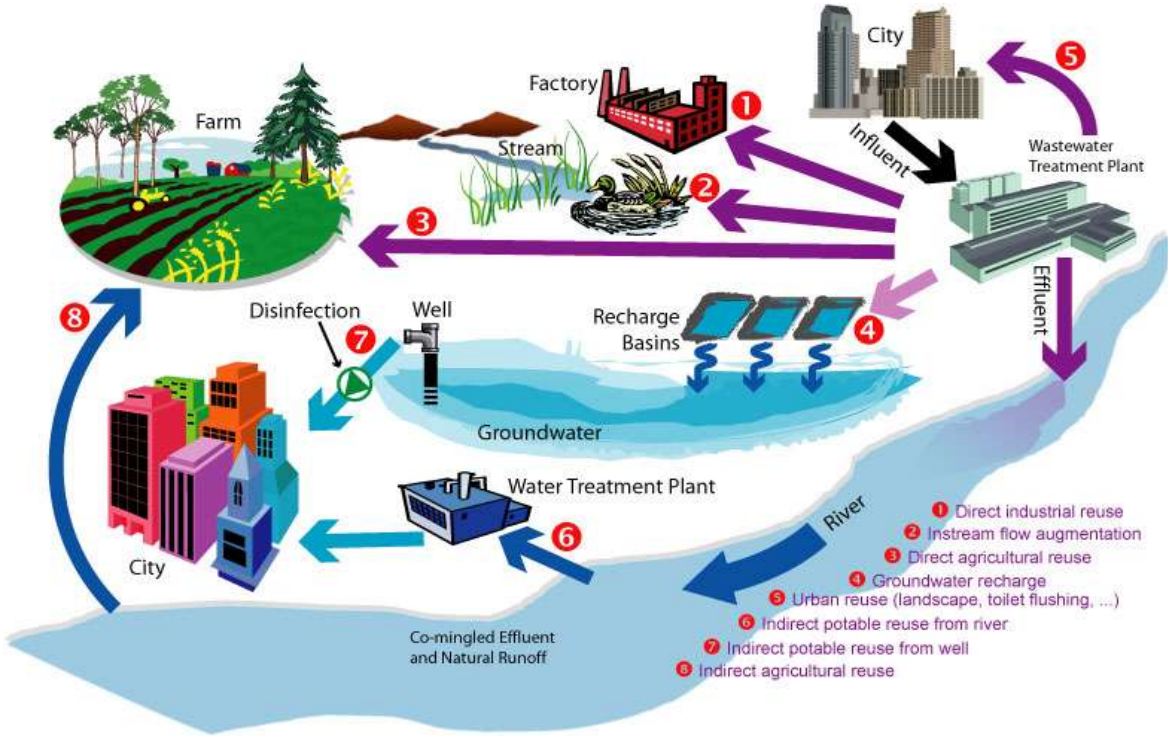


WATER SAVINGS

- ✓ Cropping pattern
- ✓ Efficient water application
- ✓ Precise irrigation scheduling (..GIS)
- ✓ Deficit irrigation strategies
  - *Sustained water deficit*
  - *Partial root zone drying*
  - *Regulated deficit irrigation*
  - *Supplemental irrigation*

NON CONVENTIONAL WATER RESOURCES

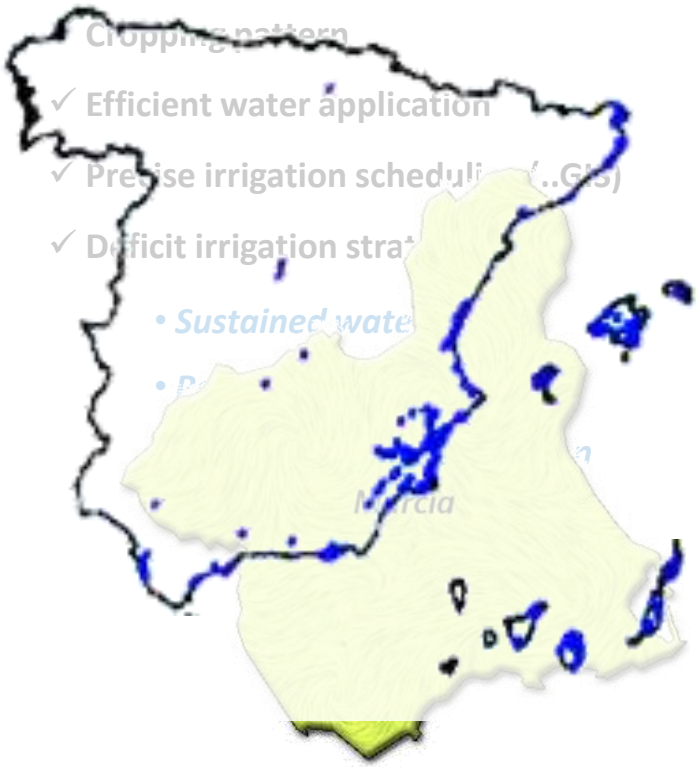
- ✓ Sea water
- ✓ Drainage water
- ✓ Harvested precipitations
- ✓ Reclaimed water



IRRIGATION WATER **DEMAND** MANAGEMENT

WATER SAVINGS

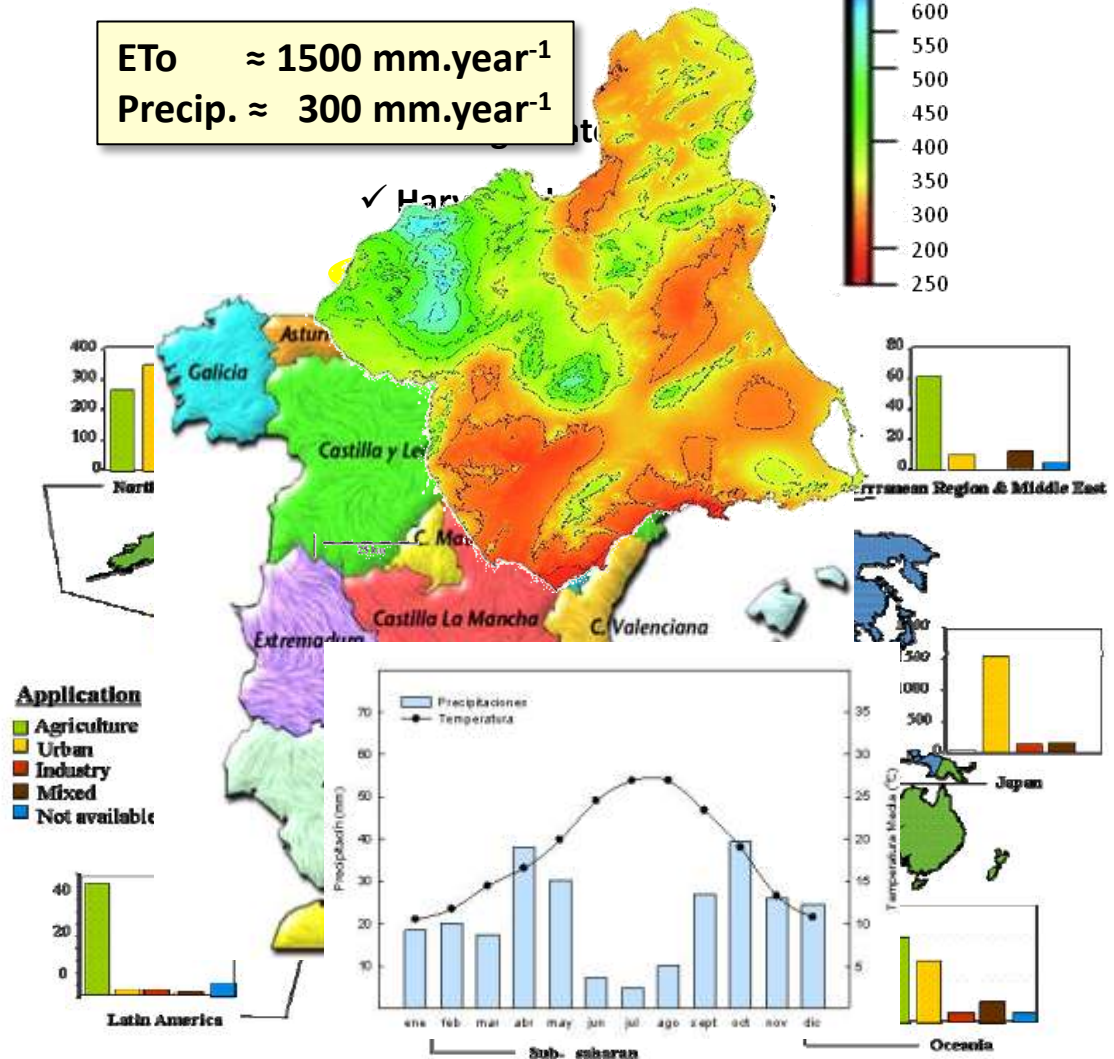
- Cropping pattern
- ✓ Efficient water application
- ✓ Precise irrigation scheduli… (..GIS)
- ✓ Deficit irrigation strat…
  - *Sustained wate…*
  - *R…*

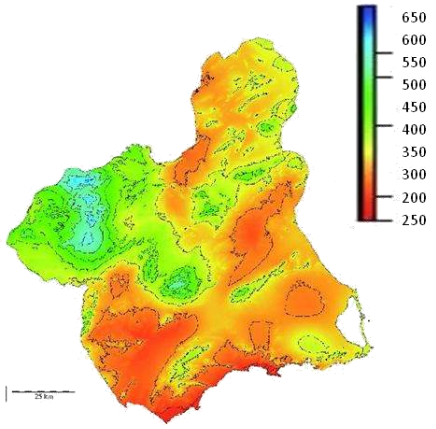


NON CONVENTIONAL WATER RESOURCES

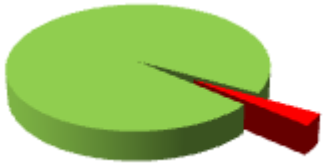
ETo ≈ 1500 mm.year^{-1}
Precip. ≈ 300 mm.year^{-1}

- ✓ Har…



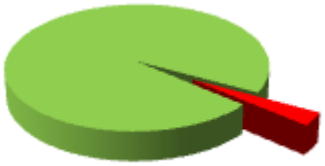


Population



3,1 %

Irrigation water



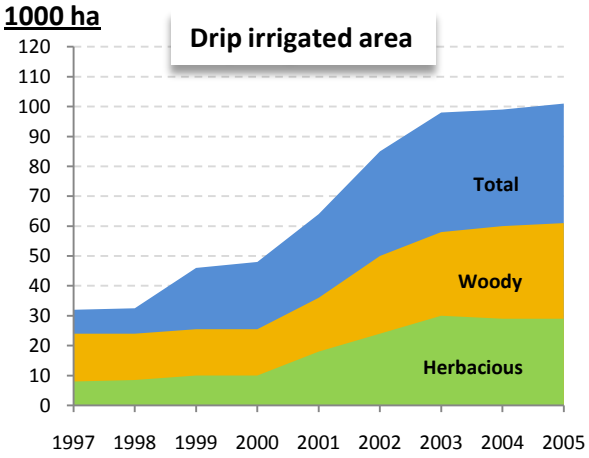
3,3 %

Fruit & Vegetables Exports

20,0 %

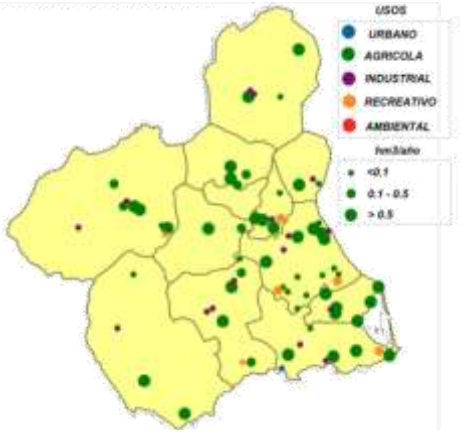
Modernization

80-90 %



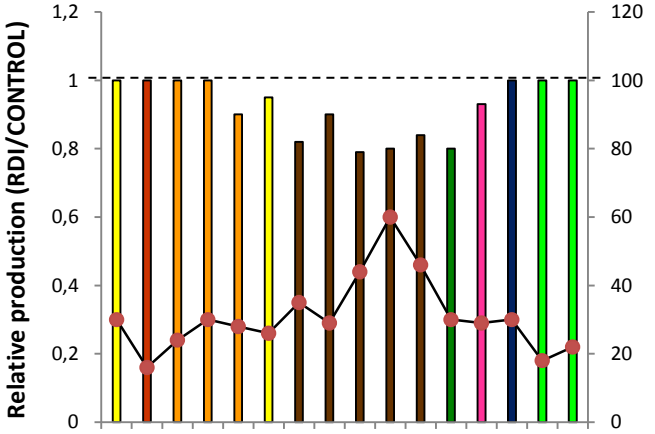
Reuse

92 WWTP- 102 Hm³/ year



Deficit management

Regulated Deficit Irrigation



INFLUENCE OF RDI AND RECLAIMED WATER ON GRAPEFRUIT TREES

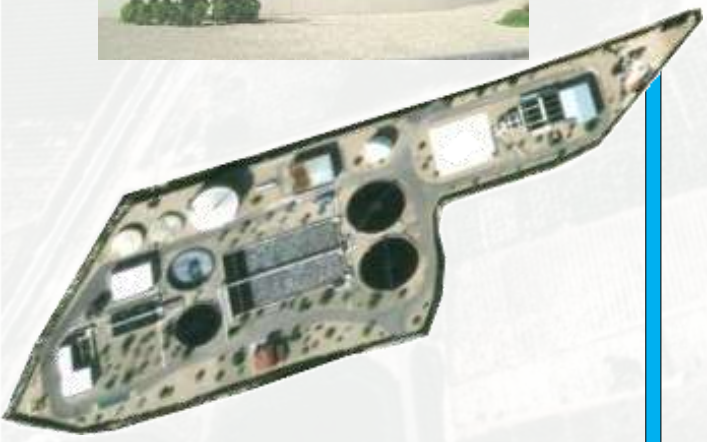
OBJECTIVE

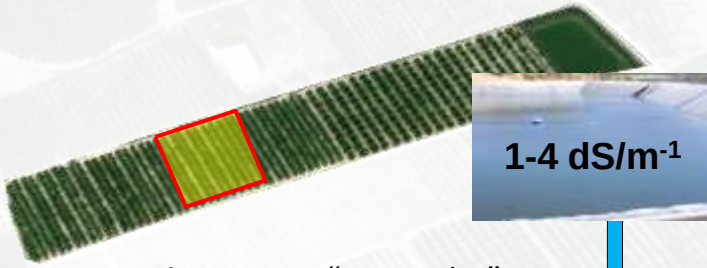
Evaluate the combined effects of irrigation water qualities and the regulated deficit irrigation strategies on mandarin tree performance, soil chemical properties, salt accumulations and on yield and fruit quality.

Orchard : Lo Montero
Province : Campotejar-Murcia

Irrigators association

WWTP





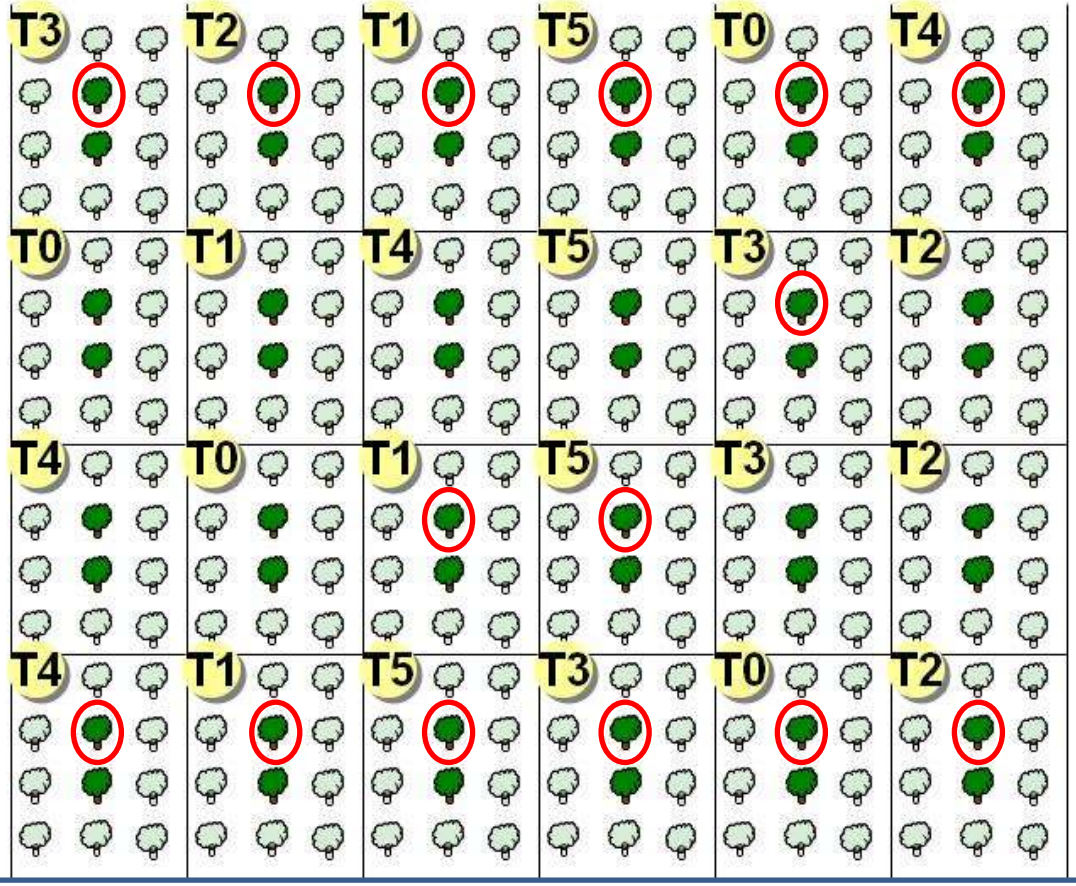
Variety : "Star Ruby"
Rootstock : Macrophylla
Age : 5 year-old
Soil : Clay-Loam
Plant Spacing : 4 x 6 m
Irrigation system: 3 emitters.t^{-1} x 4 l.h^{-1}

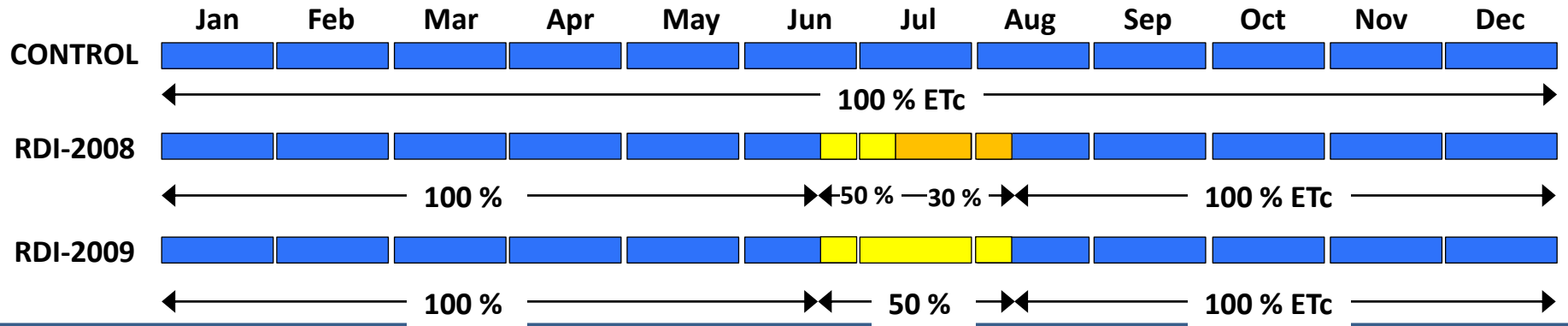
Tajo-Segura

Physico-chemical & Microbiological analysis
❑ 3 samples per source every month

Treatments

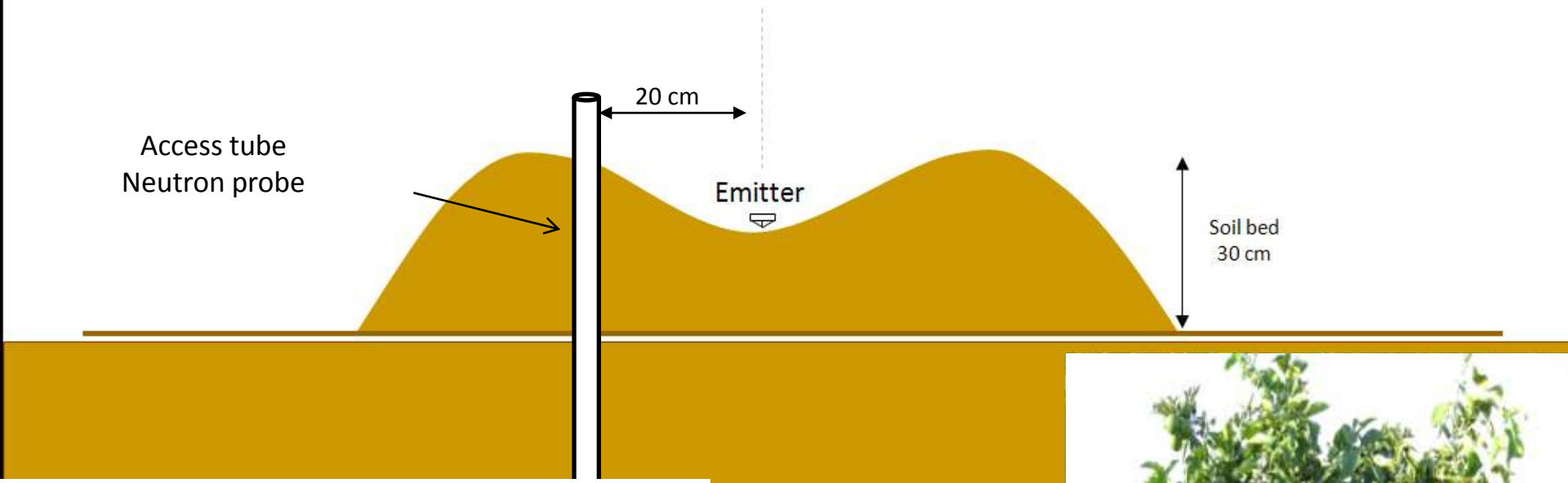
- **Transfer water**
  - T0: TW-**C**
  - T1: TW-**RDI**
- **Irrigators association**
  - T2: RW-**C**
  - T3: RW-**RDI**
- **Reclaimed water**
  - T4: IW-**C**
  - T5: IW-**RDI**





Biweekly measurements

- Volumetric soil water content

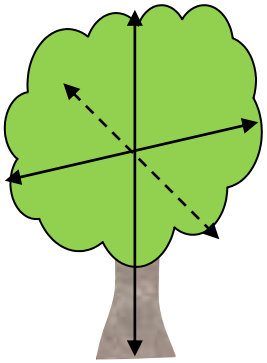


Periodic soil sampling

- At 20 cm away from the emitter and 20, 40 and 60 depths.

Periodic plant measurements

Tree
Canopy



Fruit
Diameter, fruit set

Stem water potential

Leaf gas exchange

Yield assessment

Production
(kg.tree^{-1})

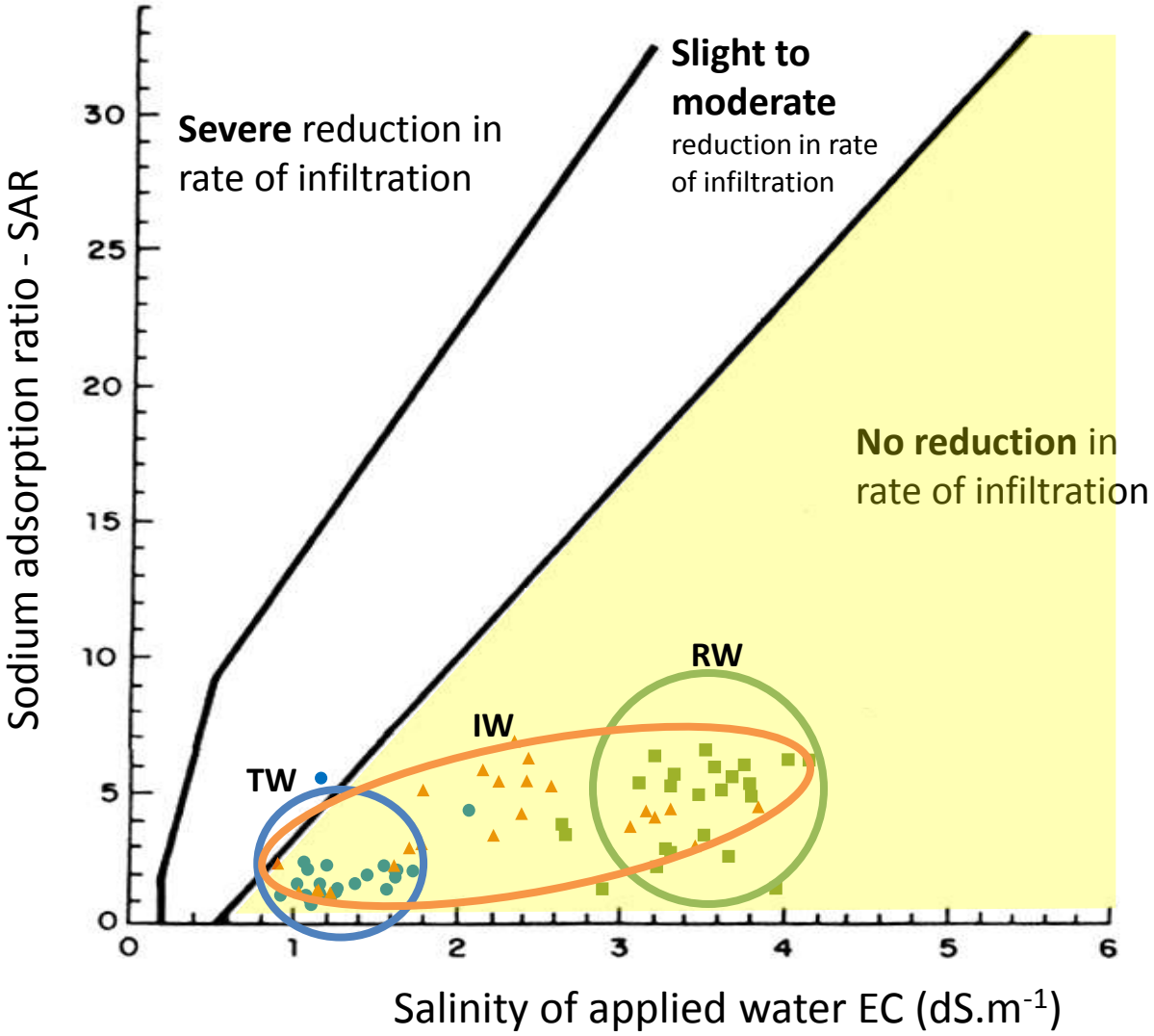
Diameter distribution

Quality indexes

- ❑ TA
- ❑ pH
- ❑ SSC
- ❑ Vitamin C

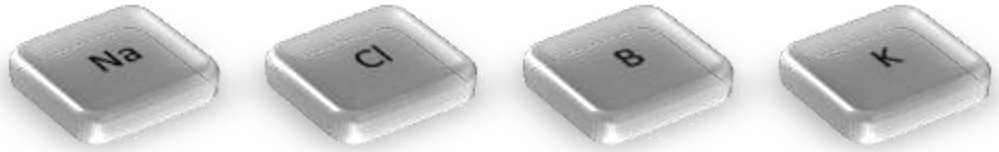
Fruit safety

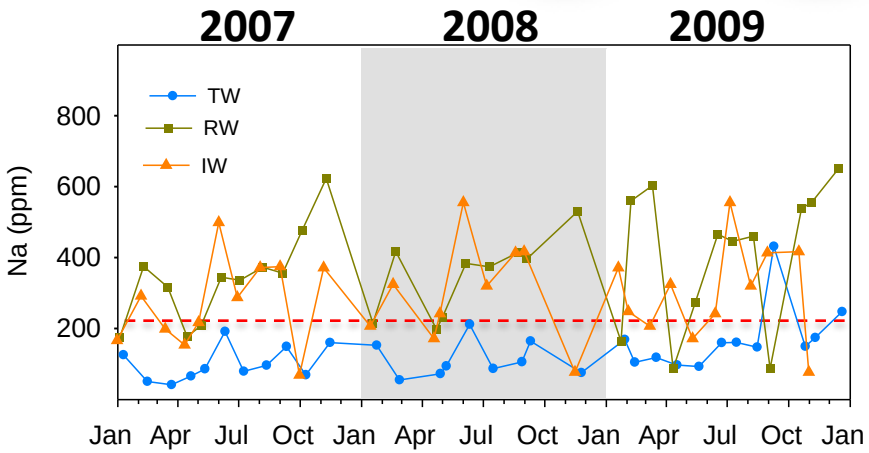
Irrigation water quality

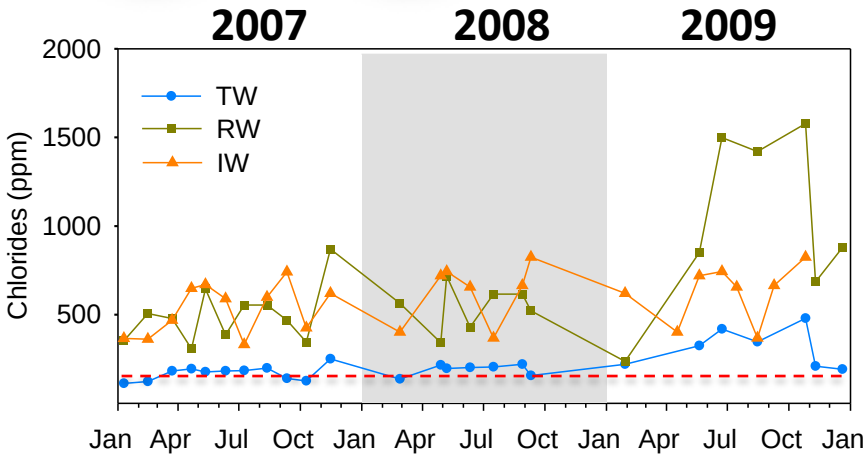


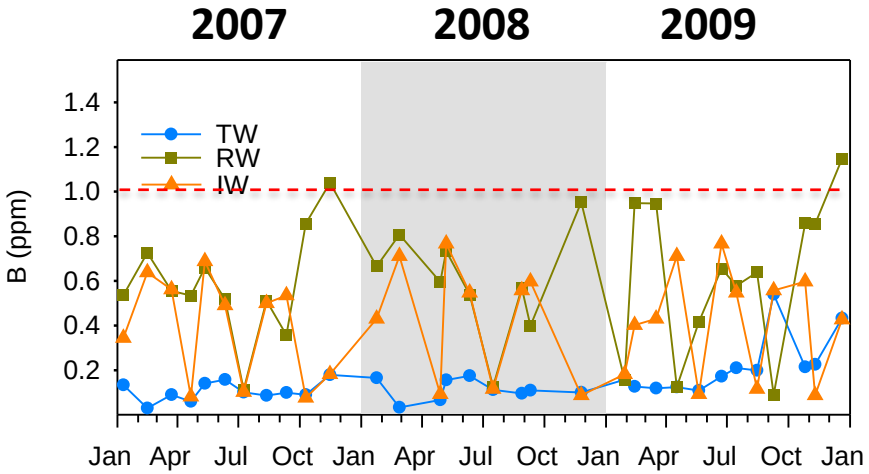
FAO, 1989

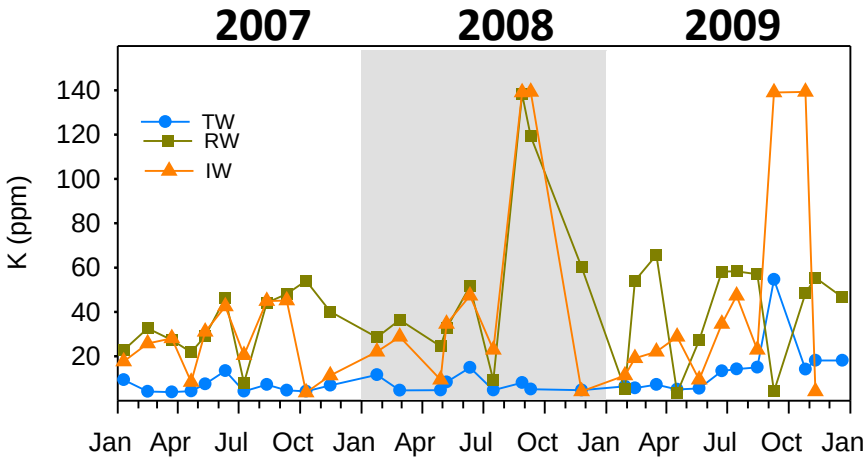
Irrigation water: mineral analysis



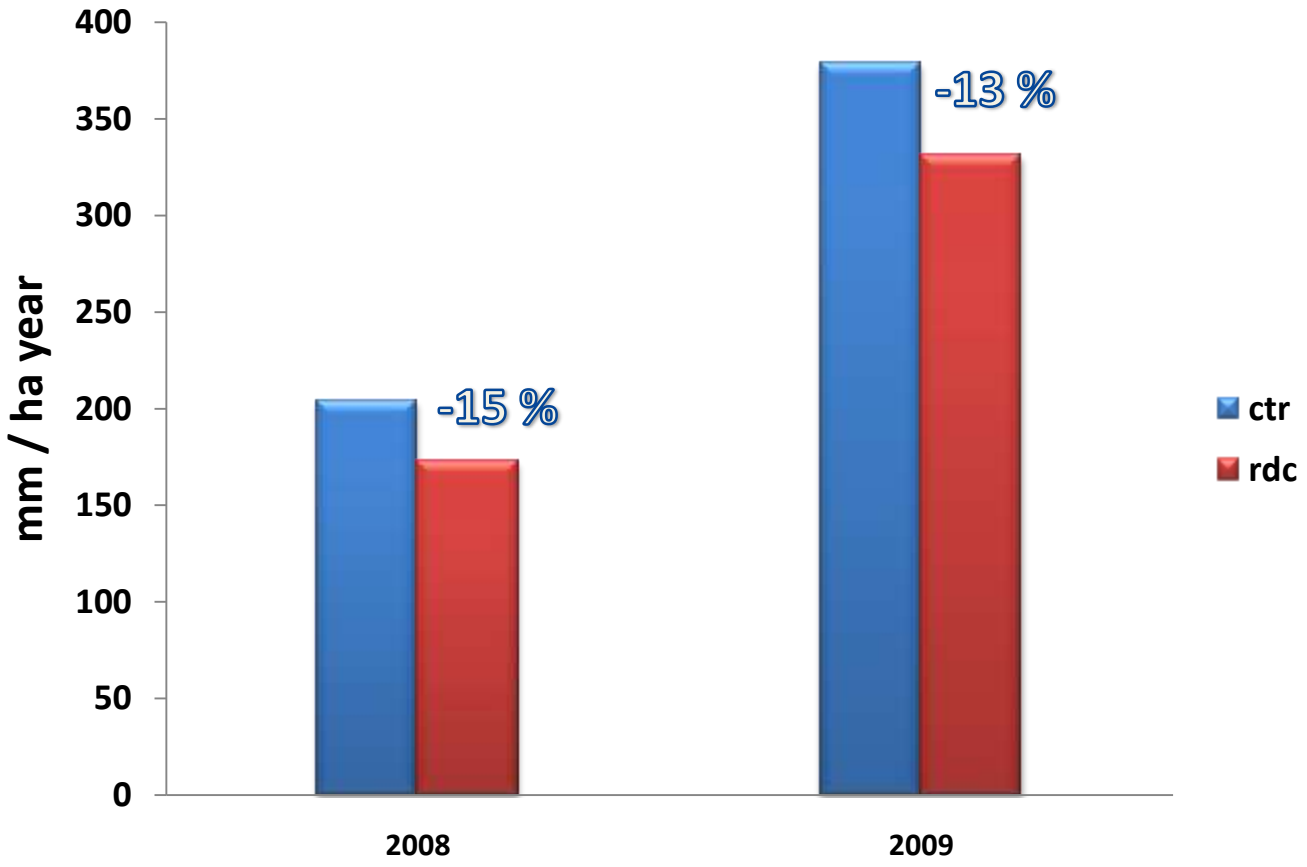




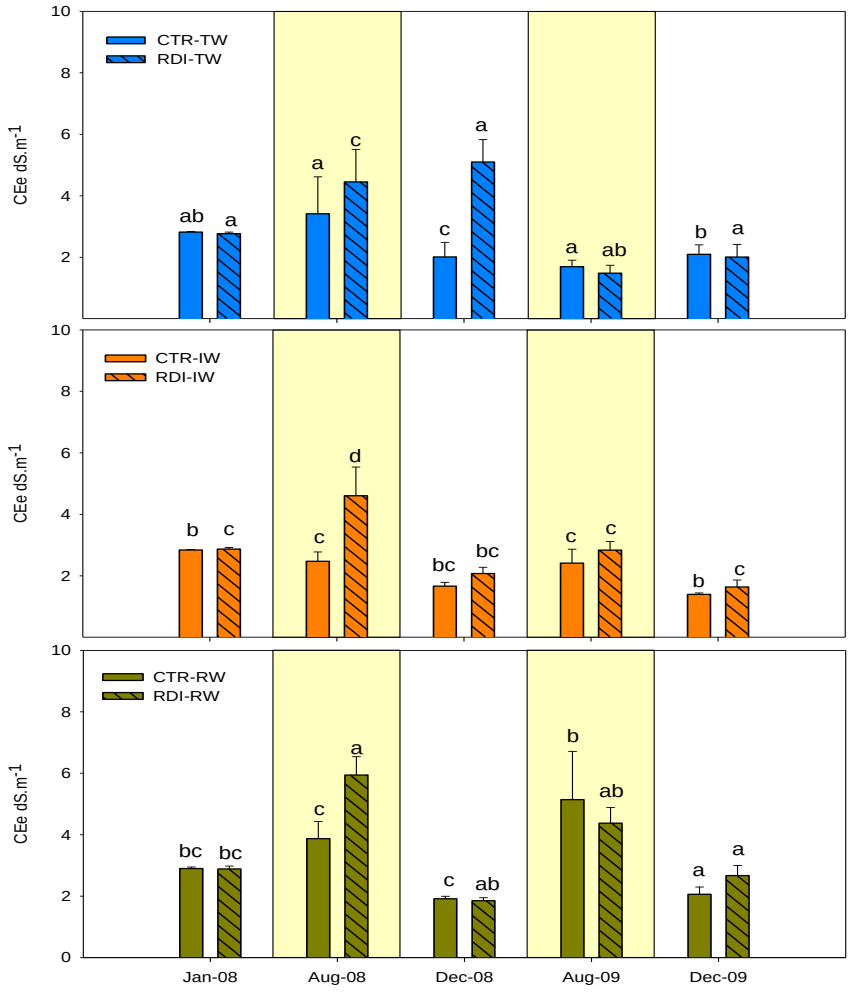


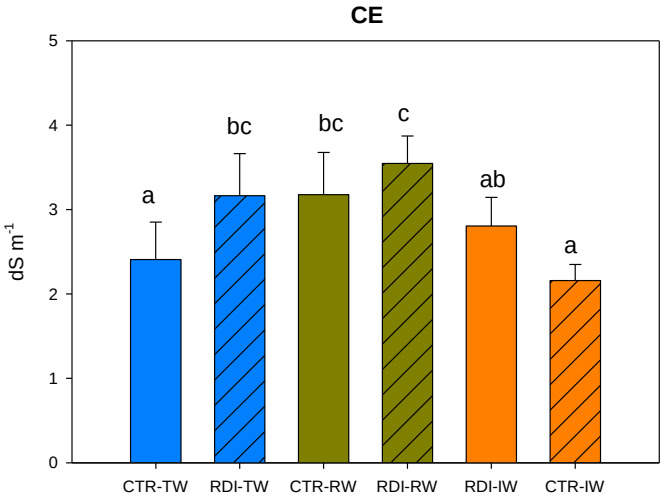


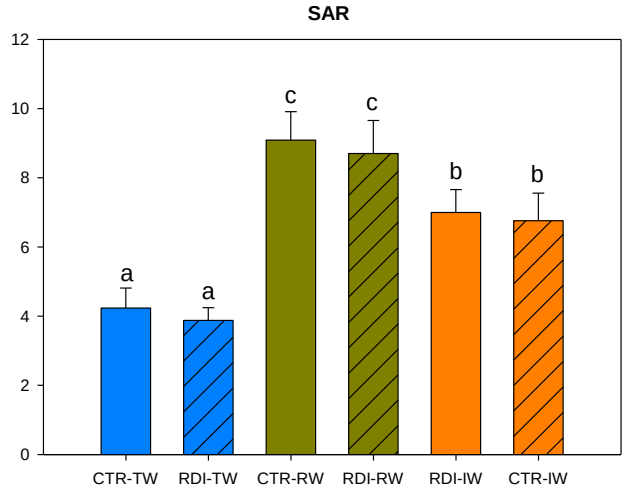
Applied irrigation-water



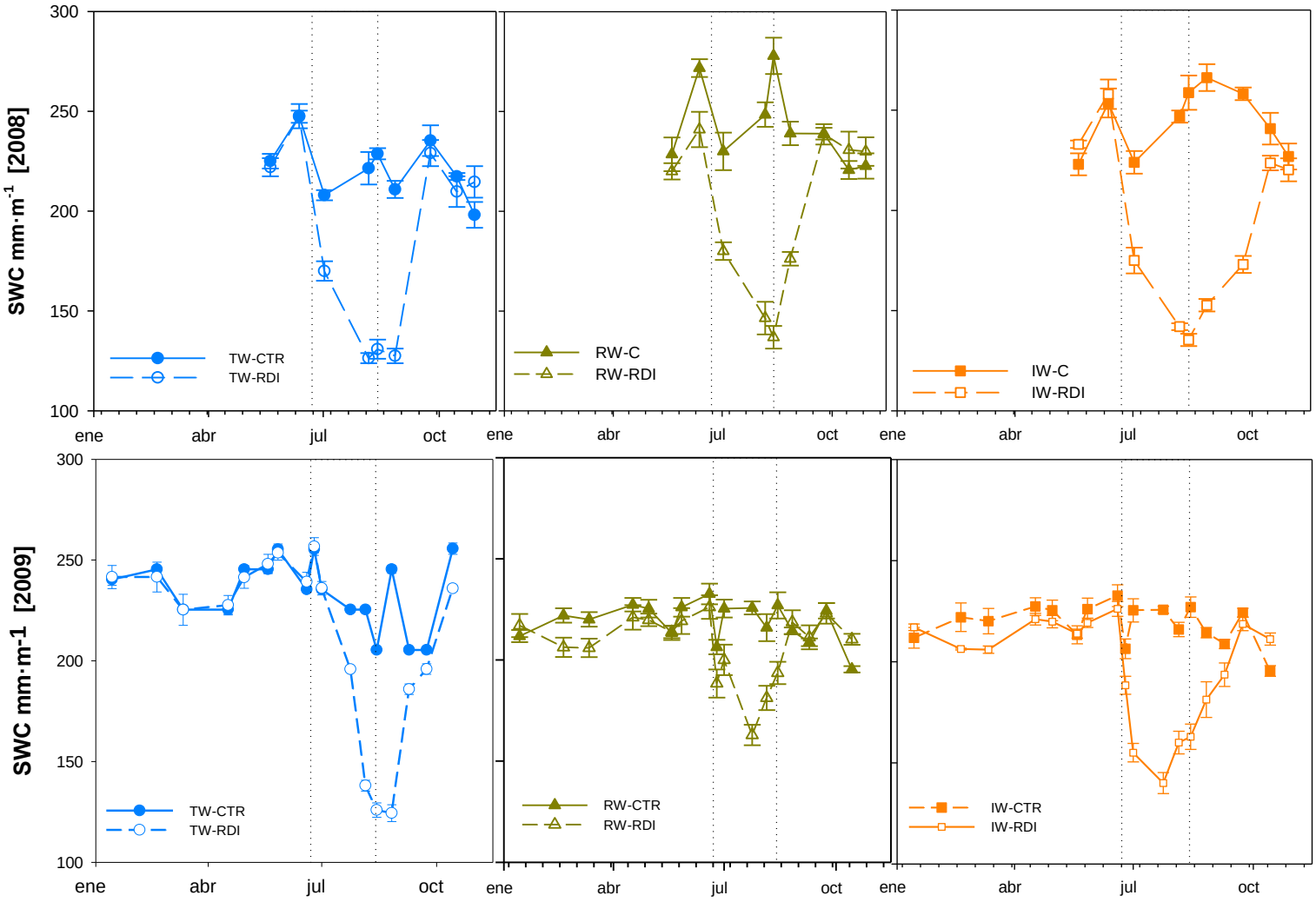
EC (dS.m^{-1}) of the soil saturated paste extract & the soil solution



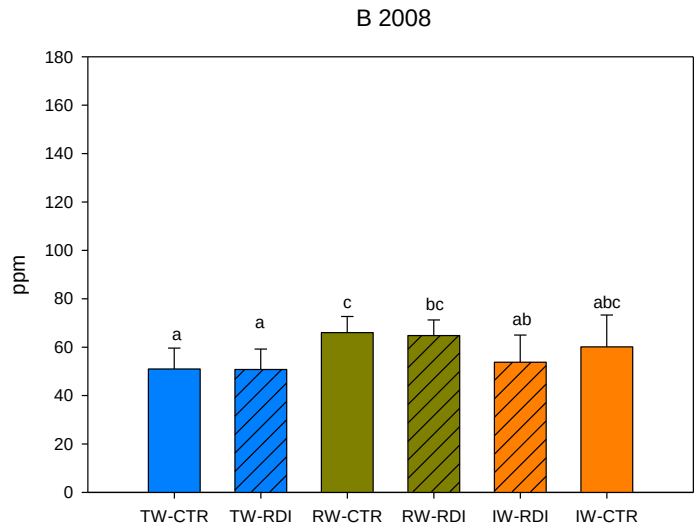


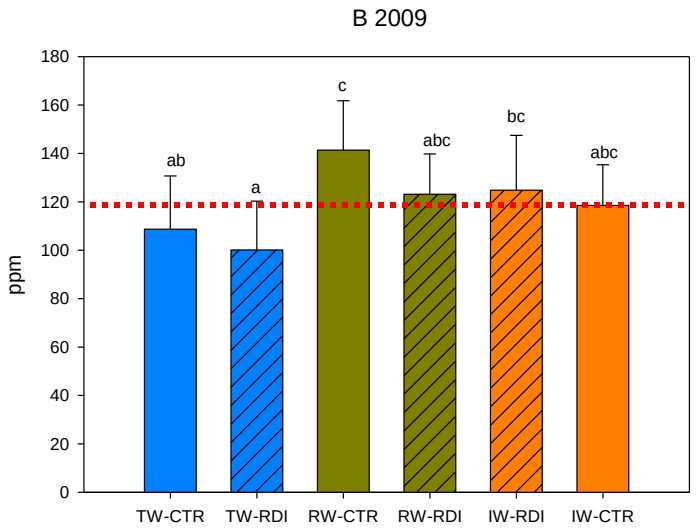


Soil Water Content (mm m^{-1})



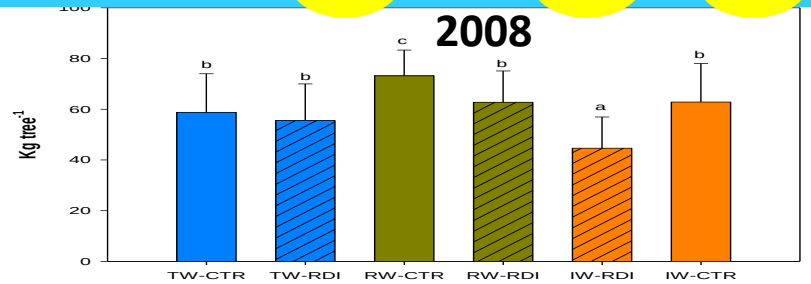
Leaf toxic elements (Na, Cl & B)



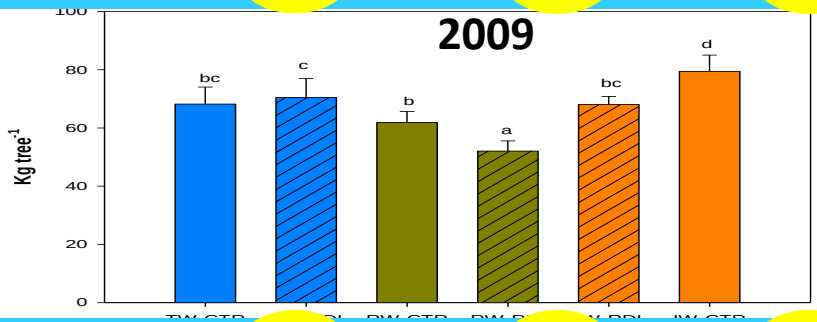


Yield (Kg.tree^{-1})

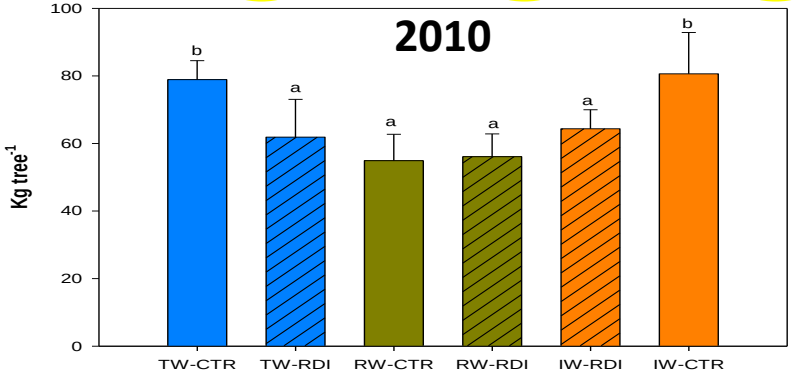
WUE (Kg.m^{-3}) 12.8 14 16 15.5 11.2 12.7



7.7 8.9 7 6.6 8.6 9



9.5 8.6 6.6 7.8 8.9 9.7



Fruit quality parameters

Treatment	Peel thickness (mm)	Juice volume (ml)	º Brix	pH	Total Acidity	Maturity Index	Vitamin C
TW-CTR	2,52 ± 0,75	53,00 ± 13,05	11.6 ±0.7	3.6 ±0.1	0,9 ±0.1	12,8 ±1.5	8,5 ±0.6
TW-RDI	2,20 ± 0,44	53,80 ± 14,81	12.0 ±0.4	3.7 ±0.0	0,9 ±0.0	13,8 ±0.6	11,0 ±0.4
IW-CTR	1,90 ± 0,38	51,40 ± 10,38	11.3 ±0.7	3.6 ±0.1	1,0 ±0.1	12,1 ±1.4	13,2 ±1.0
IW-RDI	2,10 ± 0,53	46,46 ± 9,56	11.9 ±0.9	3.6 ±0.1	1,0 ±0.1	12,4 ±1.6	15,9 ±0.2
RW-CTR	2,43 ± 0,43	61,33 ± 14,32	12.2 ±0.9	3.7 ±0.1	1,0 ±0.1	11,9 ±0.8	13,8 ±1.1
RW-RDI	2,57 ± 0,48	57,53 ± 12,71	12.7 ±1.0	3.6 ±0.1	1,1 ±0.1	11,8 ±0.6	17,7 ±0.6

Conclusions

- A tendency to reduce the number of fruits was detected under RW treatments. This reduction was more pronounced under regulated deficit irrigation (RW-RDI treatment).

- Combined effects of RDI strategies and reclaimed water increased some fruit quality parameters on mandarin trees. [**Vit.C**] RDI-RW > RDI > Control treatments.

- [Na], [B] and [Cl] exceeded the phyto-toxic levels in reclaimed irrigation-water. Although no toxic problems have been detected during the experiment, some mild toxicity symptoms started appearing during the last year and therefore long term effects could be more pronounced.

- Irrigation with reclaimed water tends to accumulate salts within the plant root zone. Therefore, careful monitoring is needed to avoid possible reduction in the soil agronomic properties.

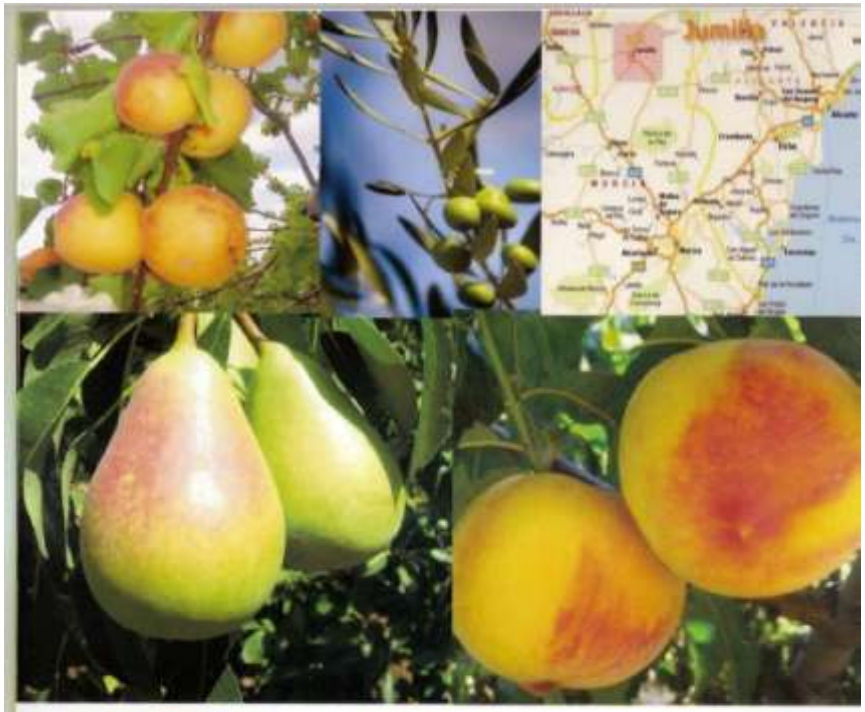
RECLAIMED WATER PROJECTS

PROJECT: **Feasibility study of using reclaimed water from the WWTP of Jumilla in the Miraflores Irrigators Community**
FINANCIATION: CAM, CAJA RURAL Y CAJAMURCIA
DURATION: 24 Noviembre 2008 – 24 Octubre 2009.

PROJECT: **Use of reclaimed water in Murcia**
FINANCIATION: AGUAS DE VALENCIA, ESAMUR
-Hydroponics crops in greenhouses
- Forestry
- Ecologic agriculture

PROJECT: **Intelligent Reclaim Irrigation System (IRIS)**
FINANCIATION: Innovatieprogramma Watertechnologie the Netherlands. Advanced Waste Water Solutions (AWWS)

PROJECT: **Effects of reclaimed water irrigation on soils, aquifers and crops in the Balears Islands (EARSAC1014)**
FINANCIATION: TRAGSA
DURATION: 2010-2014



Miraflores Irrigators Community

Feasibility study of using reclaimed water from the WWTP of Jumilla in the Miraflores Irrigators Community

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Consejo Superior de Investigaciones Científicas

Universidad Politécnica de Cartagena

Financiado por:

cajamar

CM CAJAMURCIA

Banesto

Con la colaboración de:

Región de Murcia
Consejería de Agricultura y Agua

Excmo. Ayuntamiento de Jumilla

Public acceptance and education of reclaimed water use:

-Training courses at all levels, both users and generators of such waters, to raise awareness of the importance of it.

- Economic analysis. To estimate the non-market benefits that society attaches to the use of reclaimed water for agricultural purposes


6 Mejora
a
b
c
EcoHidro


THANK YOU FOR
YOUR ATTENTION
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