48. Bundessteinobstseminar
11. - 14.12.2023

Steinobst bahnt sich einen Weg in die Zukunft!

“Bewässerung im Steinobst bei zunehmender Wasserknappheit - Ressourcenschonende Strategien aus Spanien”

Dr. Joan Girona
IRTA – *Programm zur effizienten Wassernutzung in der Landwirtschaft*
joan.girona@irta.cat

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1

48. Bundessteinobstseminar
11. - 14.12.2023

Steinobst bahnt sich einen Weg in die Zukunft!

“Irrigation in stone fruit at increasing water scarcity - Resource-saving strategies from Spain”

Dr. Joan Girona
IRTA – *Programme for the efficient use of water in agriculture*
joan.girona@irta.cat

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2

"Efficient use of water in fruit crops"

Goals:

- To produce the reasonable maximum (quantity and quality)
- Use as little water as possible to ensure viable production.

3

"Efficient use of water in fruit crops"

Indispensable:

- To know the patterns of water in the soil and the plant.
- Very precise irrigation management.

4

"Efficient use of water in fruit crops"

Indispensable:

- To know the patterns of water in the soil and the plant.
- Very precise irrigation management.
  - System
  - Strategy

5

"Efficient use of water in fruit crops"

Indispensable:

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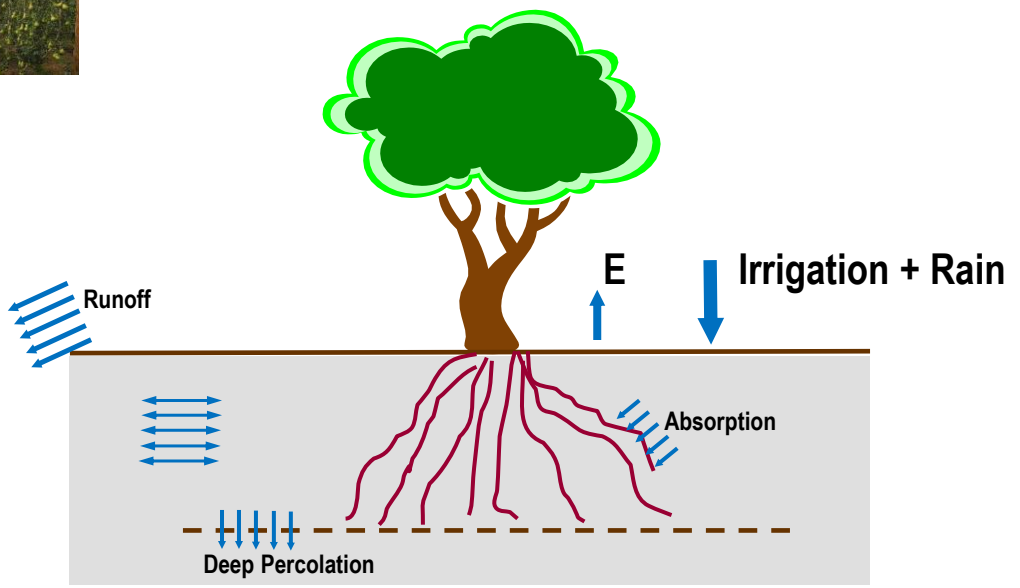
  - Strategy

6

"Efficient use of water in fruit crops"



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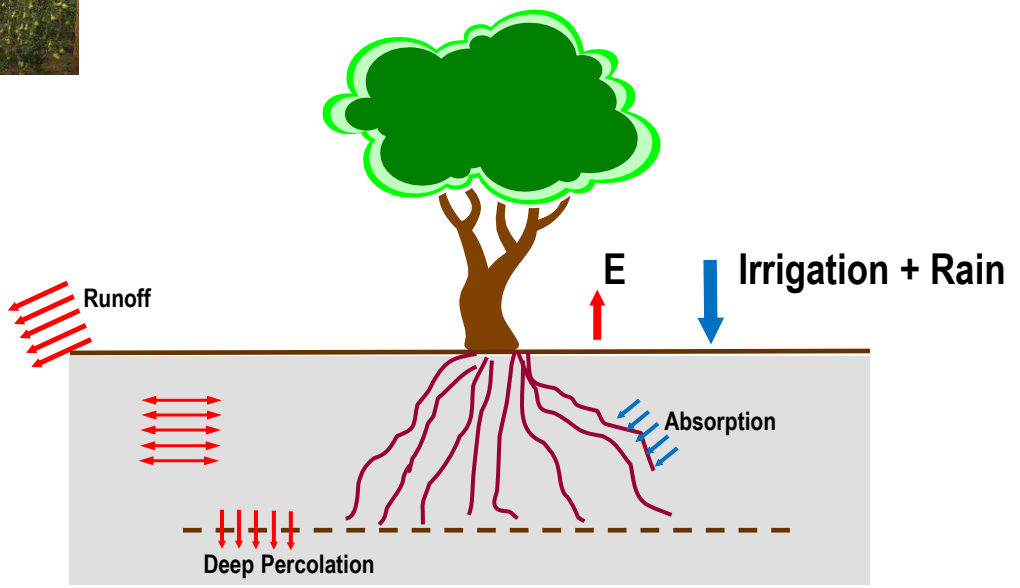
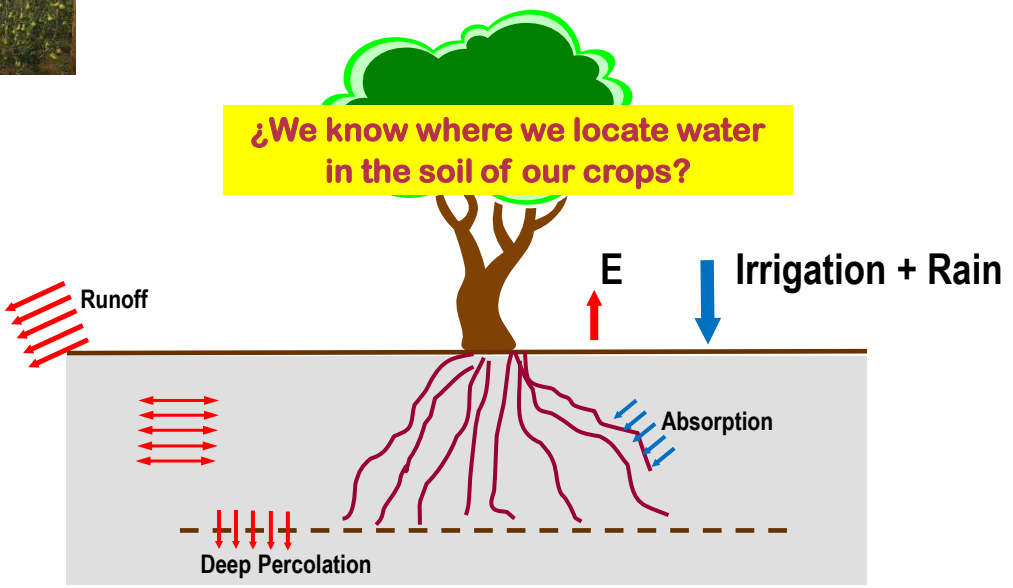
"Efficient use of water in fruit crops"



8

"Efficient use of water in fruit crops"

¿We know where we locate water in the soil of our crops?



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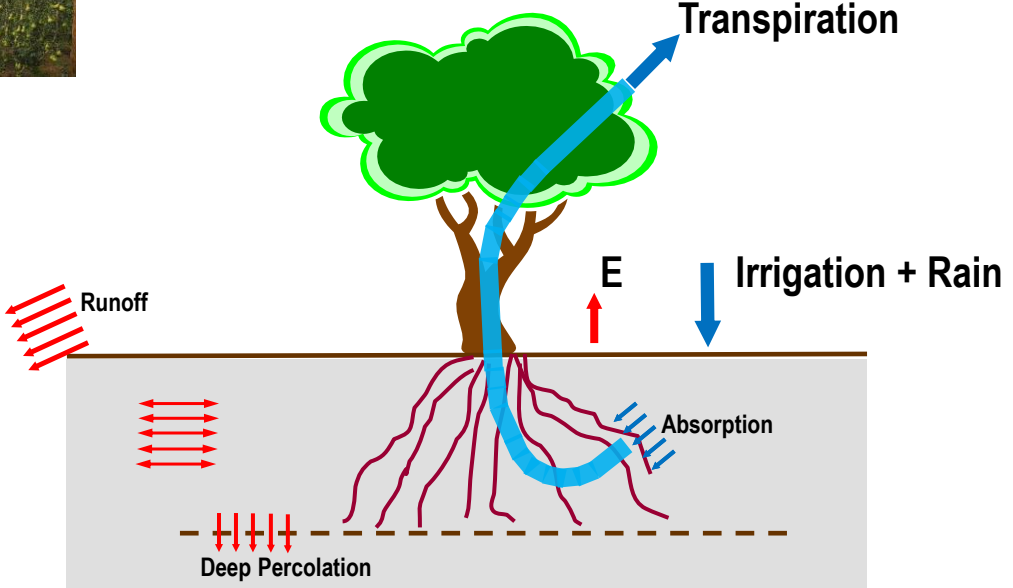
9

"Efficient use of water in fruit crops"



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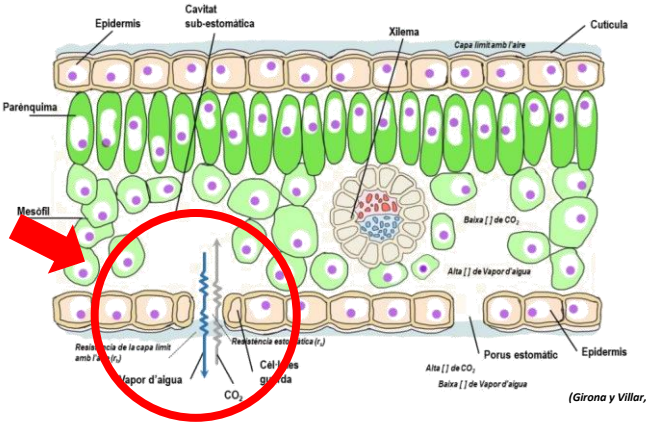
"Efficient use of water in fruit crops"

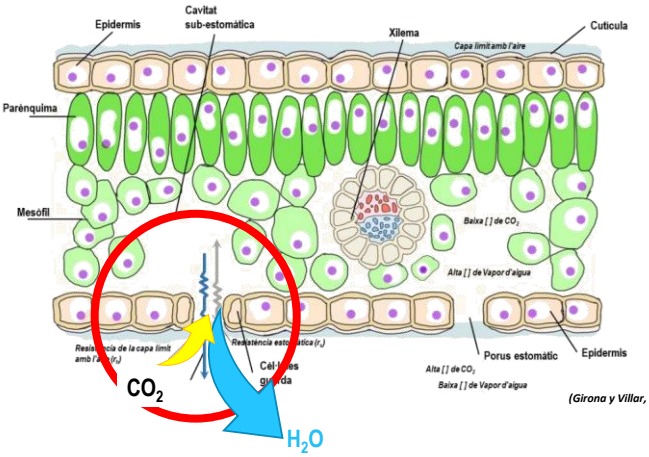


(Girona y Villar, 2021)

11

"Efficient use of water in fruit crops"

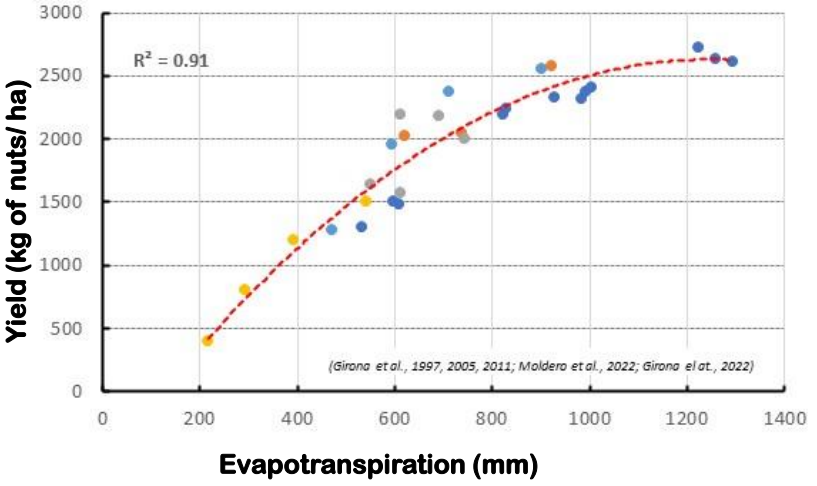
Biomass Production = *f* (Transpired Water)



(Girona y Villar, 2021)

12

"Efficient use of water in fruit crops"



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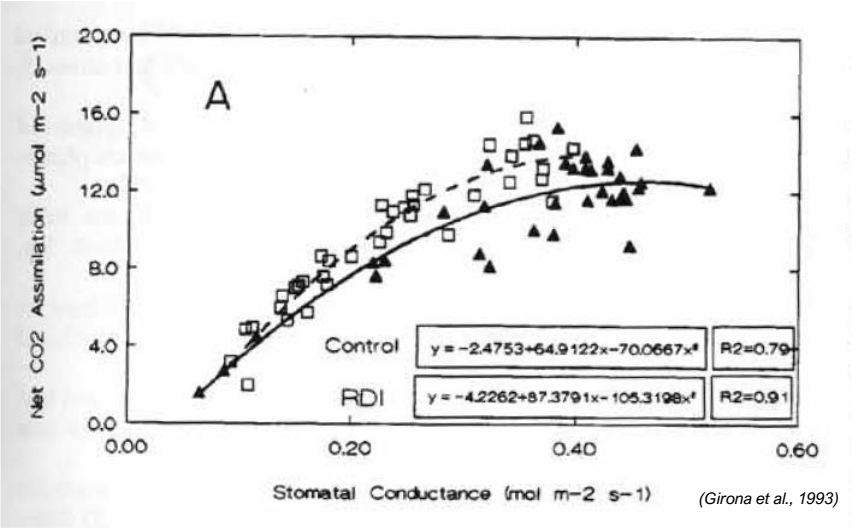
13

"Efficient use of water in fruit crops"



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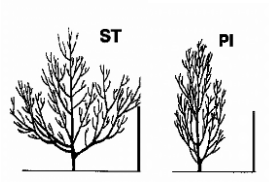
"Efficient use of water in fruit crops"



(Scorza, 2005)

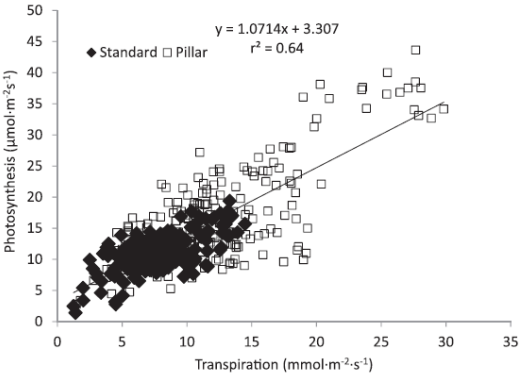
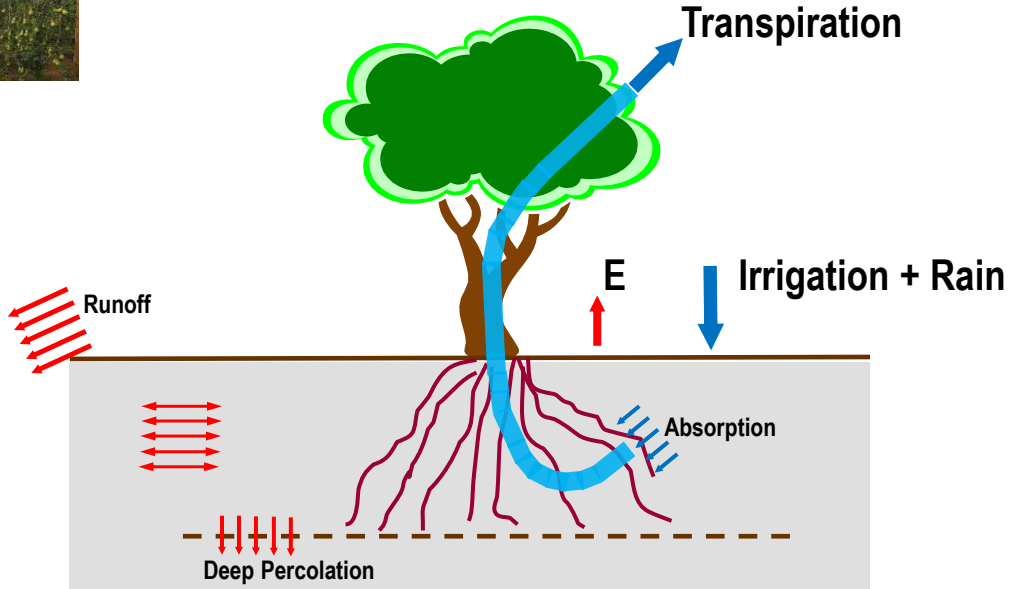


Fig. 1. Relationship between whole canopy photosynthesis and transpiration for 2 peach tree architectures in 2008–2010 at Kearneysville, WV.

(Glenn et al., 2015)

15

"Efficient use of water in fruit crops"



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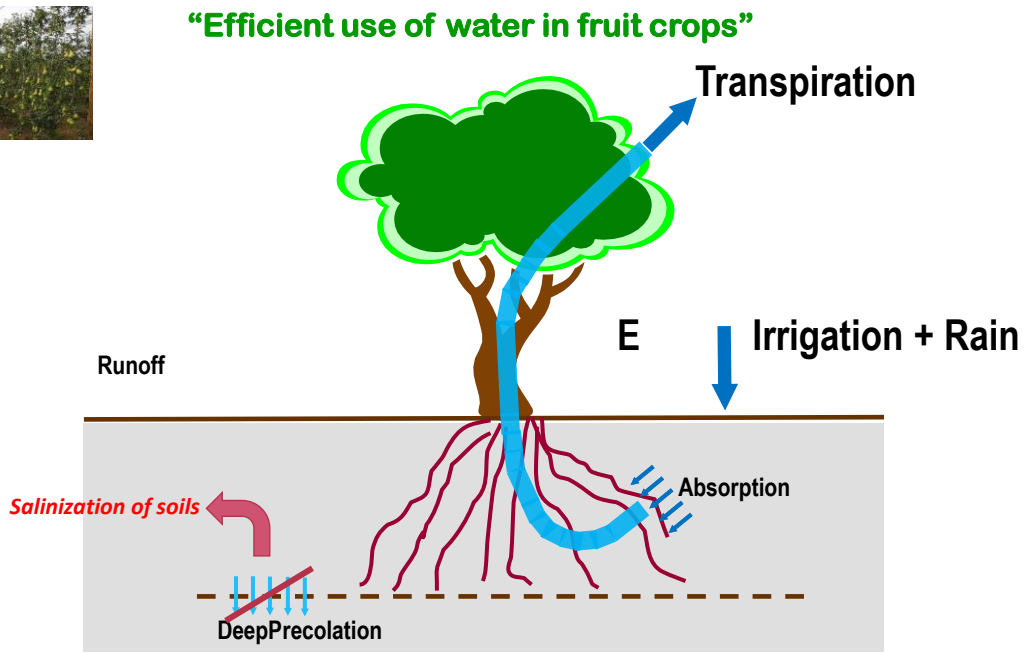
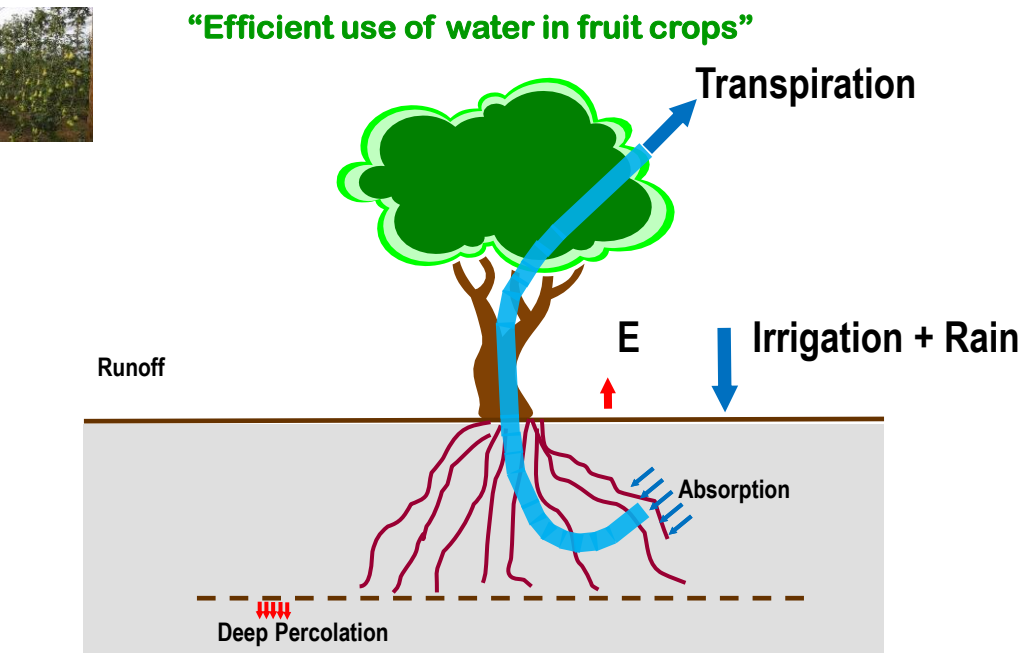

"Efficient use of water in fruit crops"
Transpiration
E
Irrigation + Rain
Runoff
Absorption
Salinization of soils
DeepPrecolation
Generalitat de Catalunya
IRTA
17
[©JGirona/IRTA(2023)]

17


"Efficient use of water in fruit crops"
Transpiration
E
Irrigation + Rain
Runoff
Absorption
Deep Percolation
Generalitat de Catalunya
IRTA
18
[©JGirona/IRTA(2023)]

18

"Efficient use of water in fruit crops"

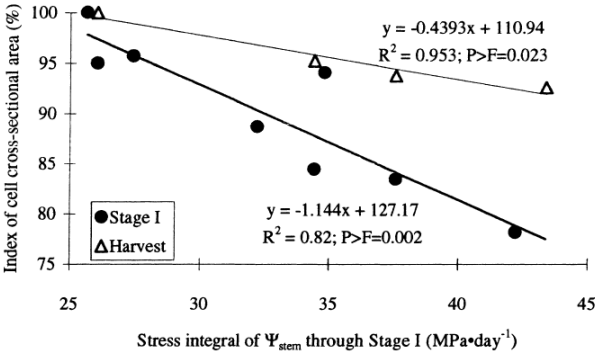
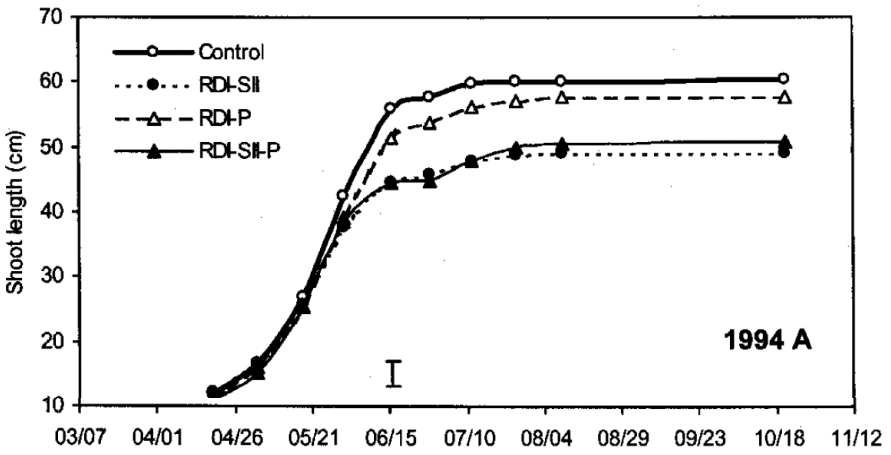


Fig. 5. Relationship between water stress integral during the deficit irrigation period $\left(S\psi = \sum_{i=0}^{i=t} \overline{\psi_{i,i+1}} * n\right)$ and index of cell cross-sectional area (100×actual value/highest value). Solid circles represent the end of Stage I, open triangles represent harvest. Each point represents the average values of both parameters for one tree.

(Marsal et al., 2000)

19

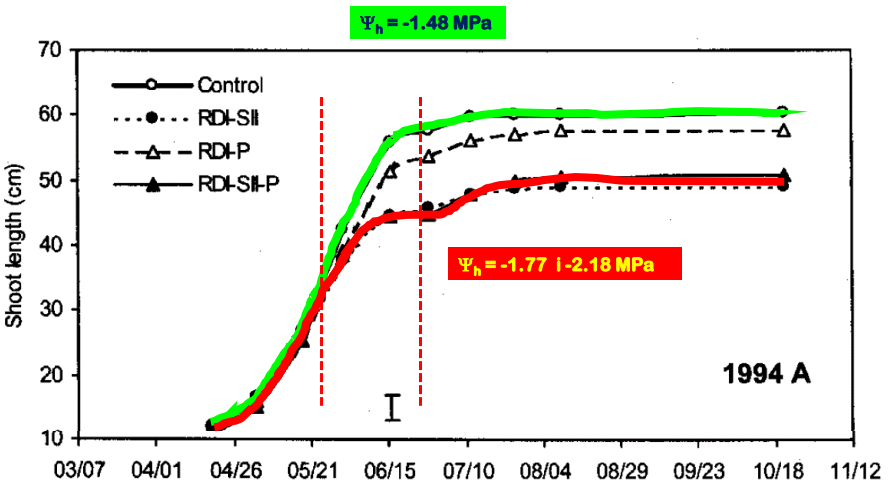
"Efficient use of water in fruit crops"



(Girona et al., 2003)

20

"Efficient use of water in fruit crops"



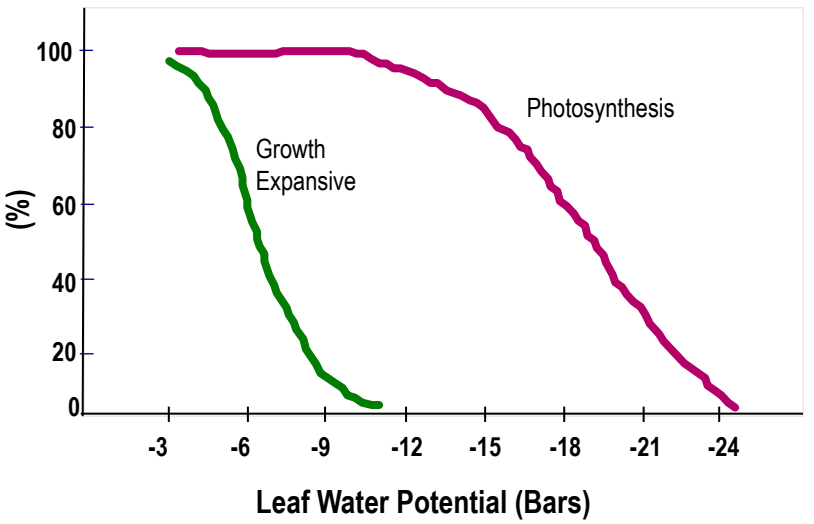
(Girona et al., 2003)

21

"Efficient use of water in fruit crops"

PLANT SENSITIVITY TO WATER DEFICIT

(Hsiao, 1981)



22

"Efficient use of water in fruit crops"

Indispensable:

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  - System
  - Strategy

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  - System
  - Strategy

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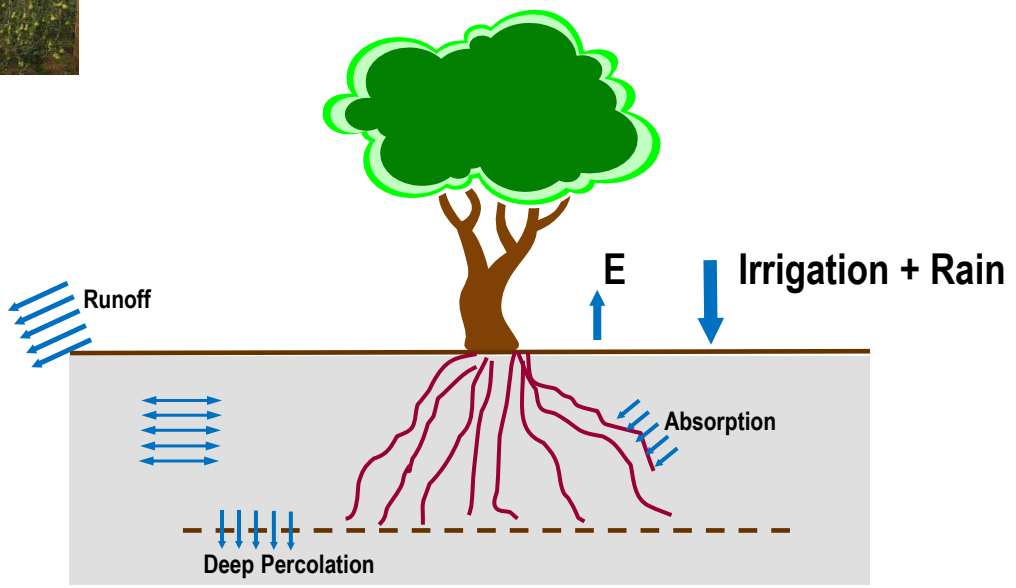
"Efficient use of water in fruit crops"



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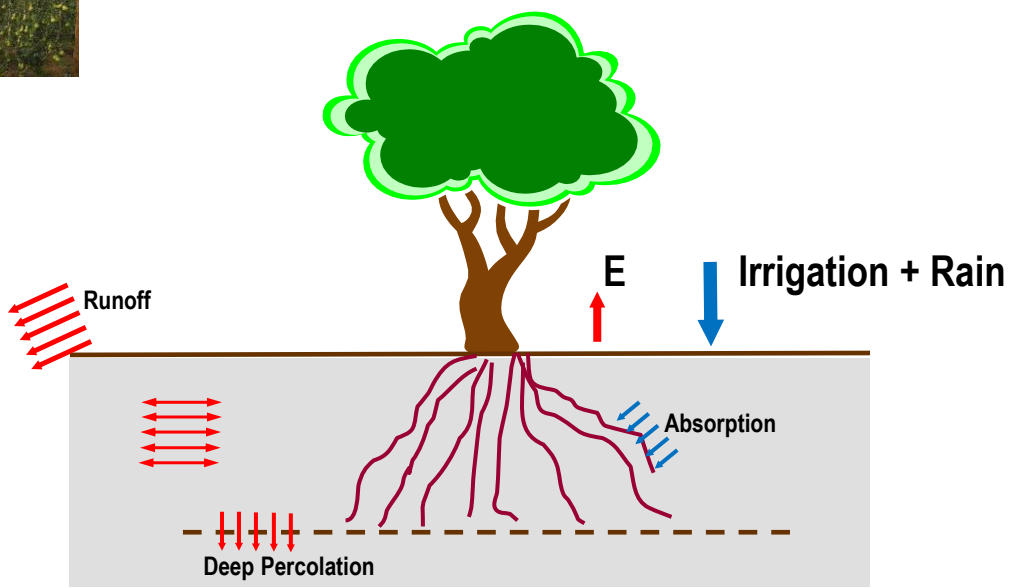
"Efficient use of water in fruit crops"



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26

"Efficient use of water in fruit crops"

Indispensable:

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- **Very precise irrigation management.**
  - System
  - Strategy

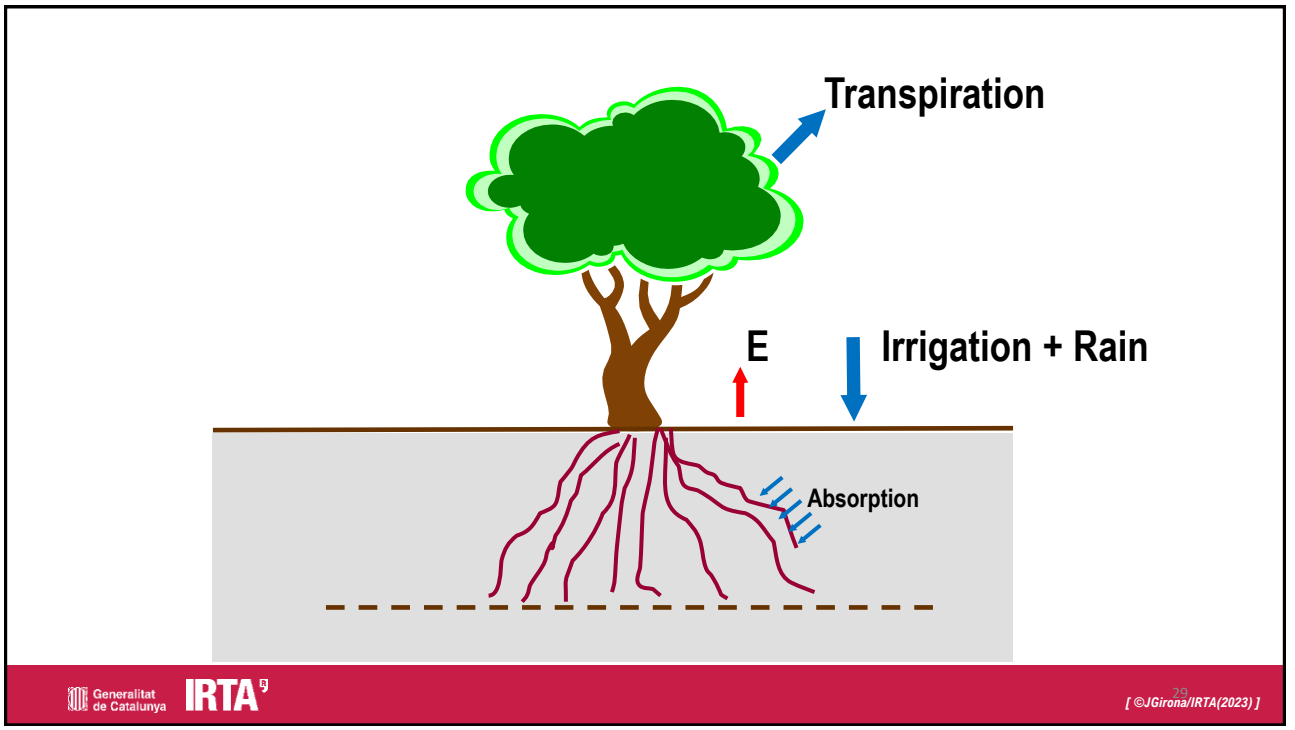
27

"Efficient use of water in fruit crops"

Indispensable:

- To know the patterns of water in the soil and the plant.
- **Very precise irrigation management.**
  - System
  - Strategy
    - **Full Irrigation**
    - Deficit Irrigation

28


Transpiration
E
Irrigation + Rain
Absorption
Generalitat de Catalunya
IRTA
29
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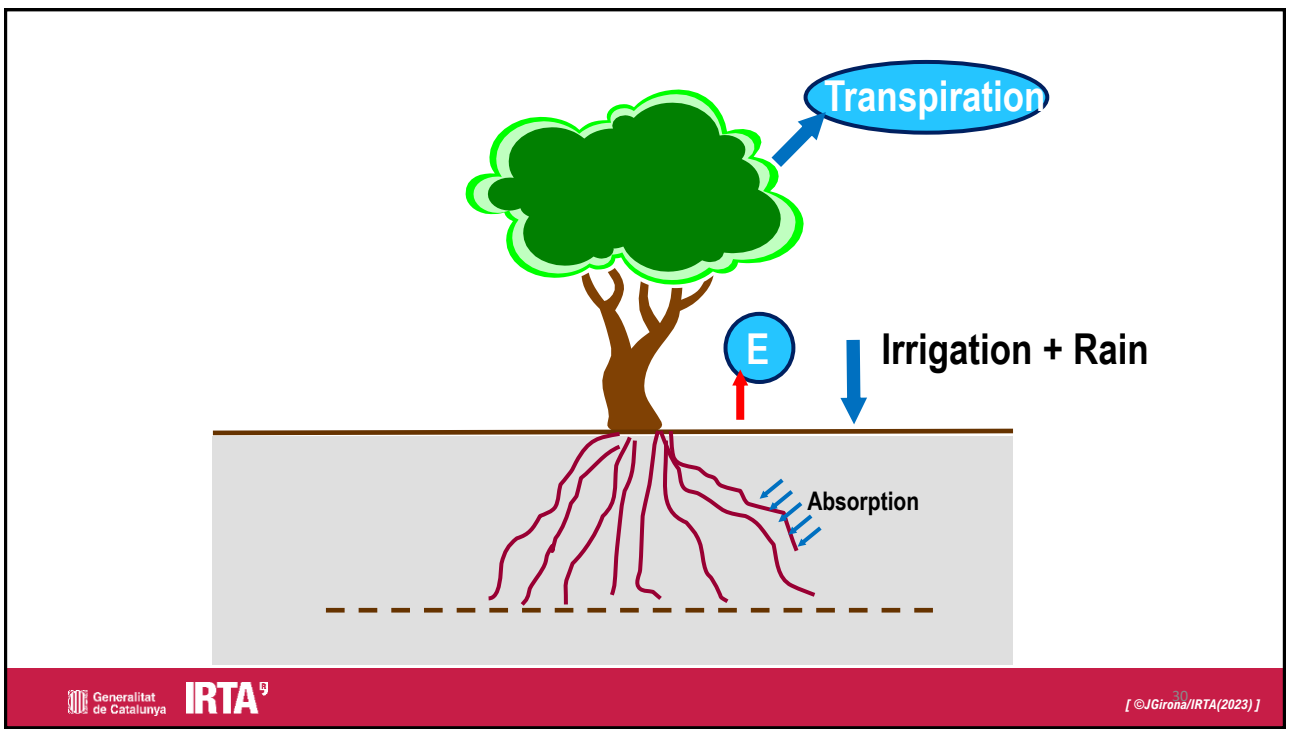
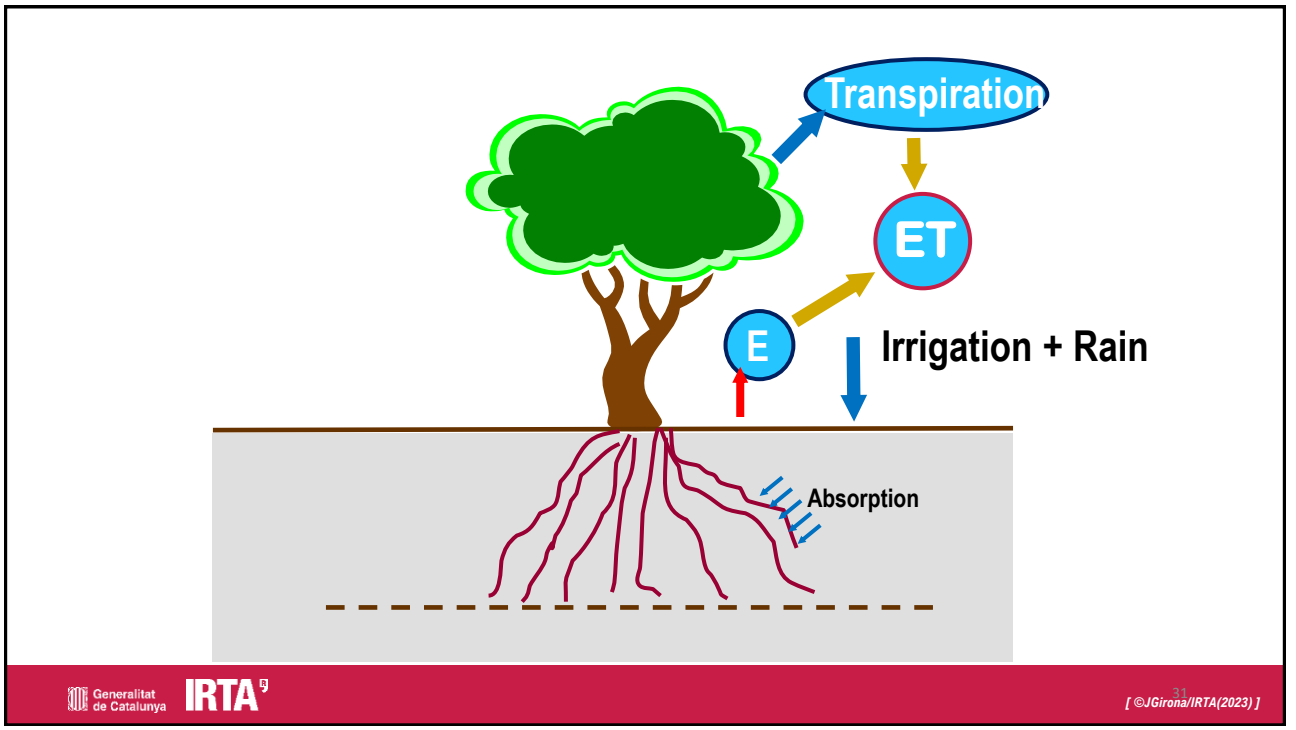
29


Transpiration
E
Irrigation + Rain
Absorption
Generalitat de Catalunya
IRTA
30
[©JGirona/IRTA(2023)]

30


Transpiration
ET
E
Irrigation + Rain
Absorption
Generalitat de Catalunya
IRTA
31
[©JGirona/IRTA(2023)]

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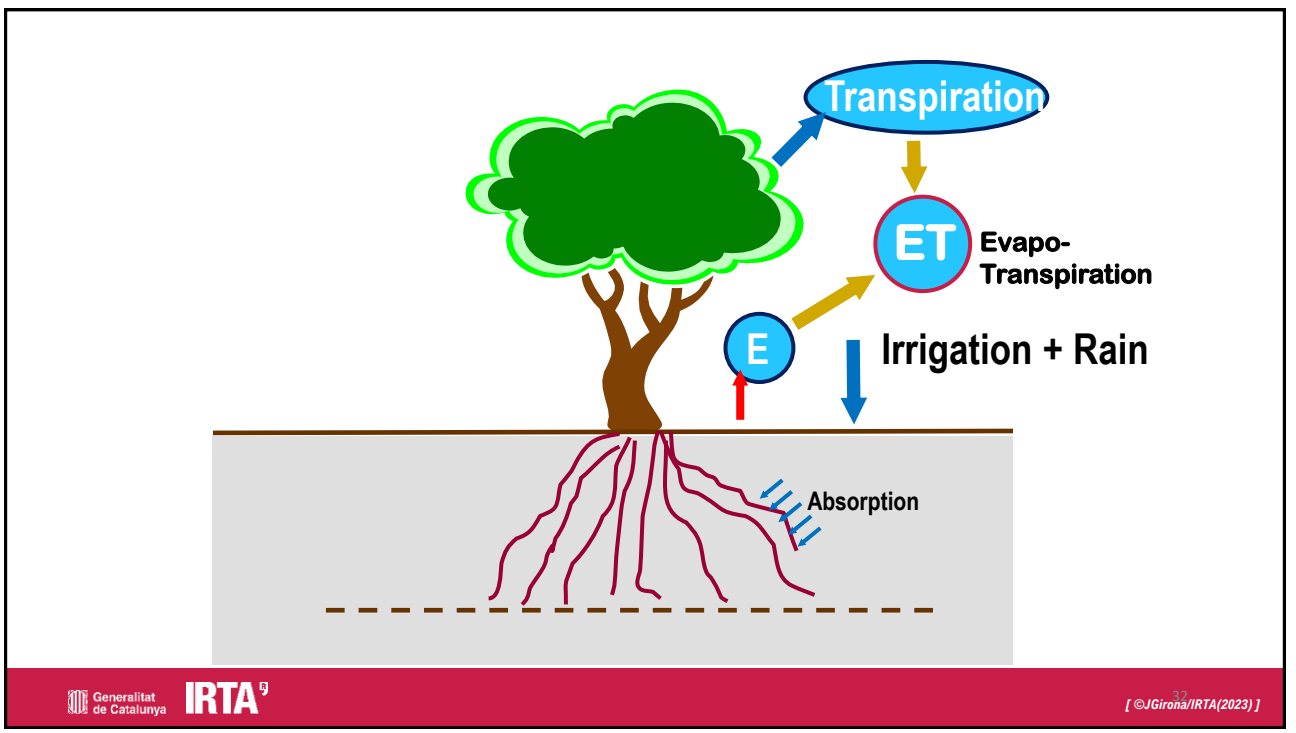
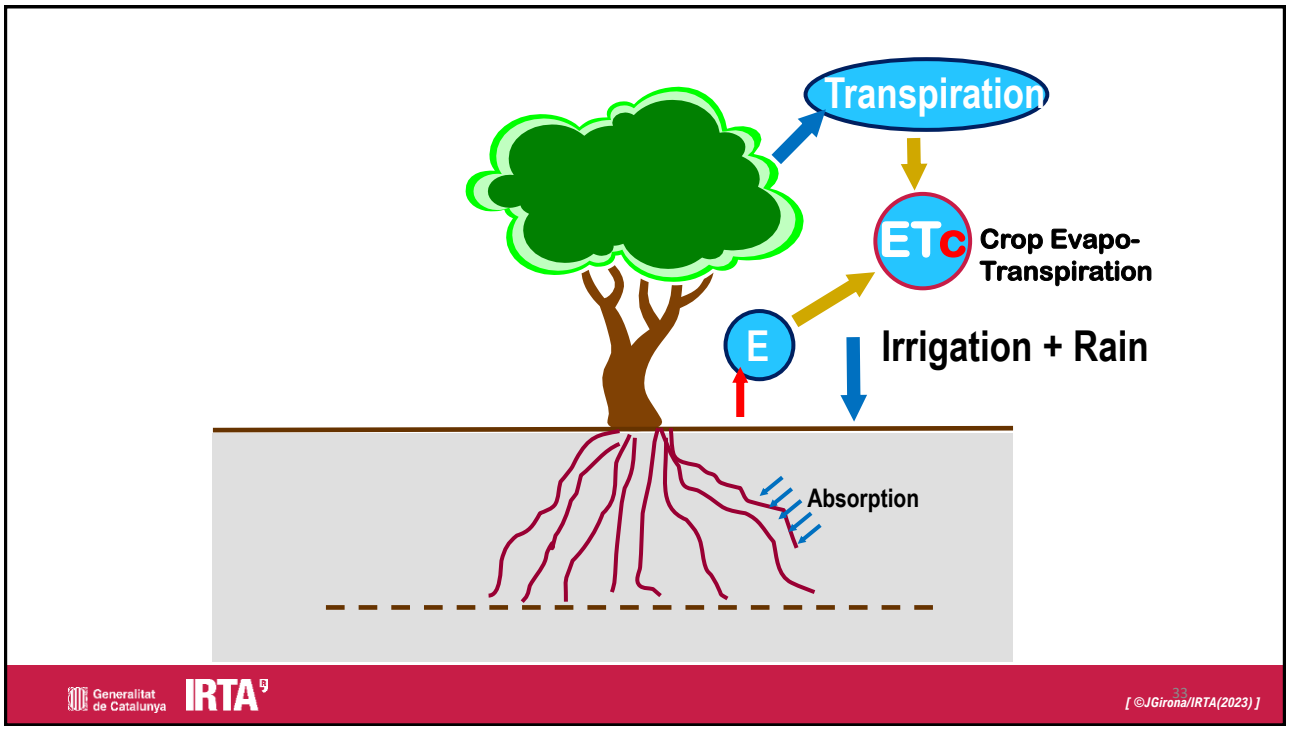
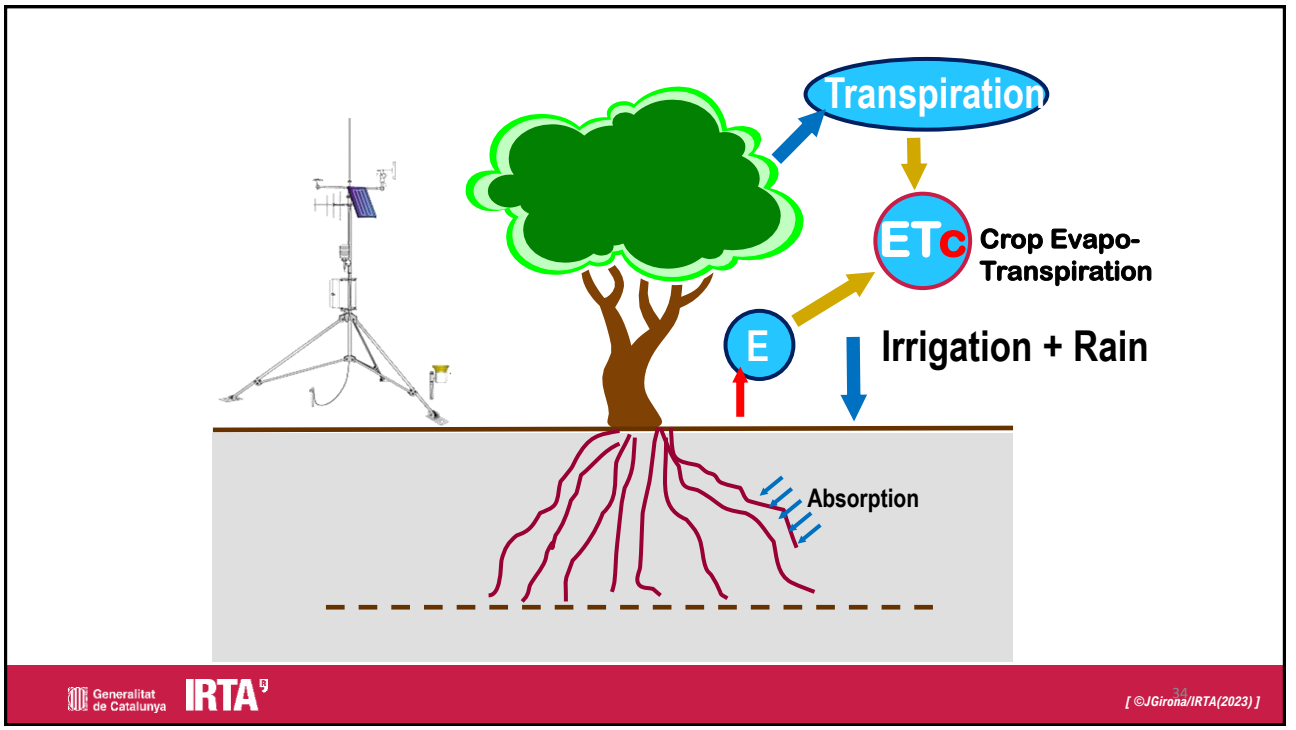

Transpiration
ET
Evapo-
Transpiration
E
Irrigation + Rain
Absorption
Generalitat de Catalunya
IRTA
32
[©JGirona/IRTA(2023)]

32


Transpiration
ETc
Crop Evapo-
Transpiration
E
Irrigation + Rain
Absorption
Generalitat de Catalunya
IRTA
33
[©JGirona/IRTA(2023)]

33


Transpiration
ETc
Crop Evapo-
Transpiration
E
Irrigation + Rain
Absorption
Generalitat de Catalunya
IRTA
34
[©JGirona/IRTA(2023)]

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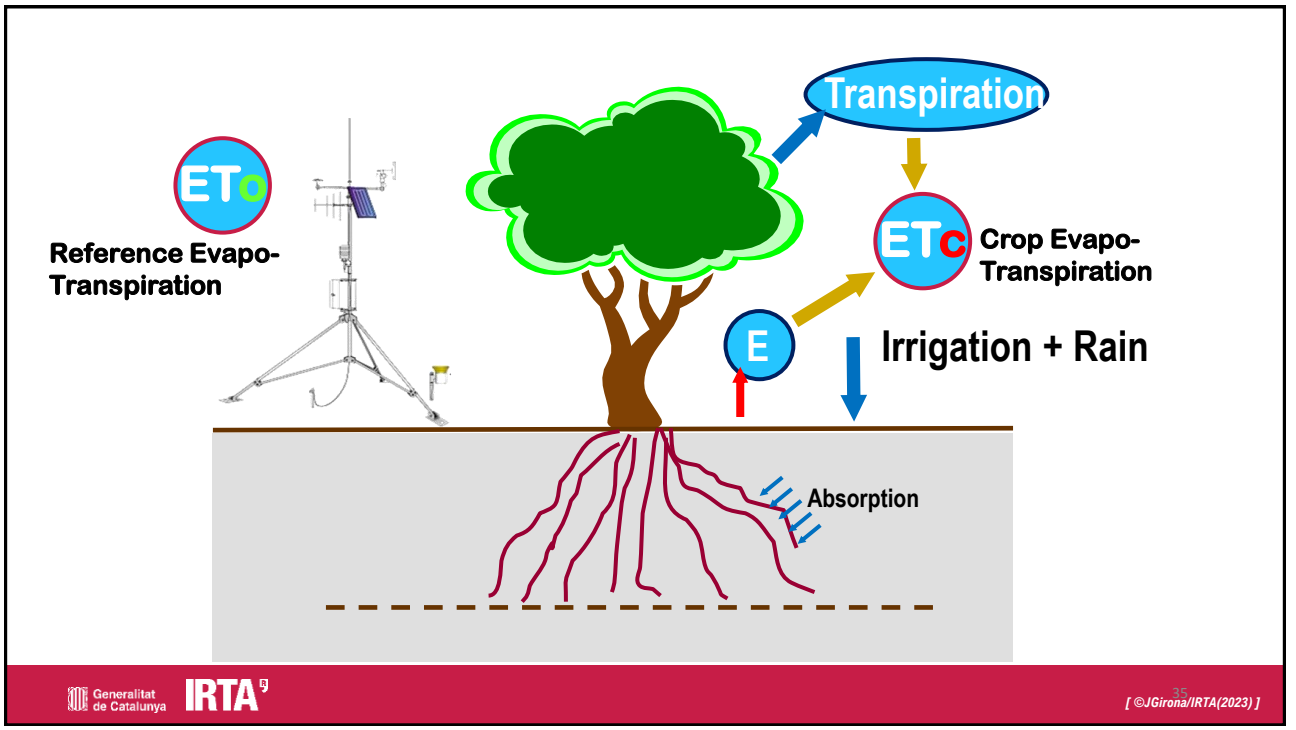
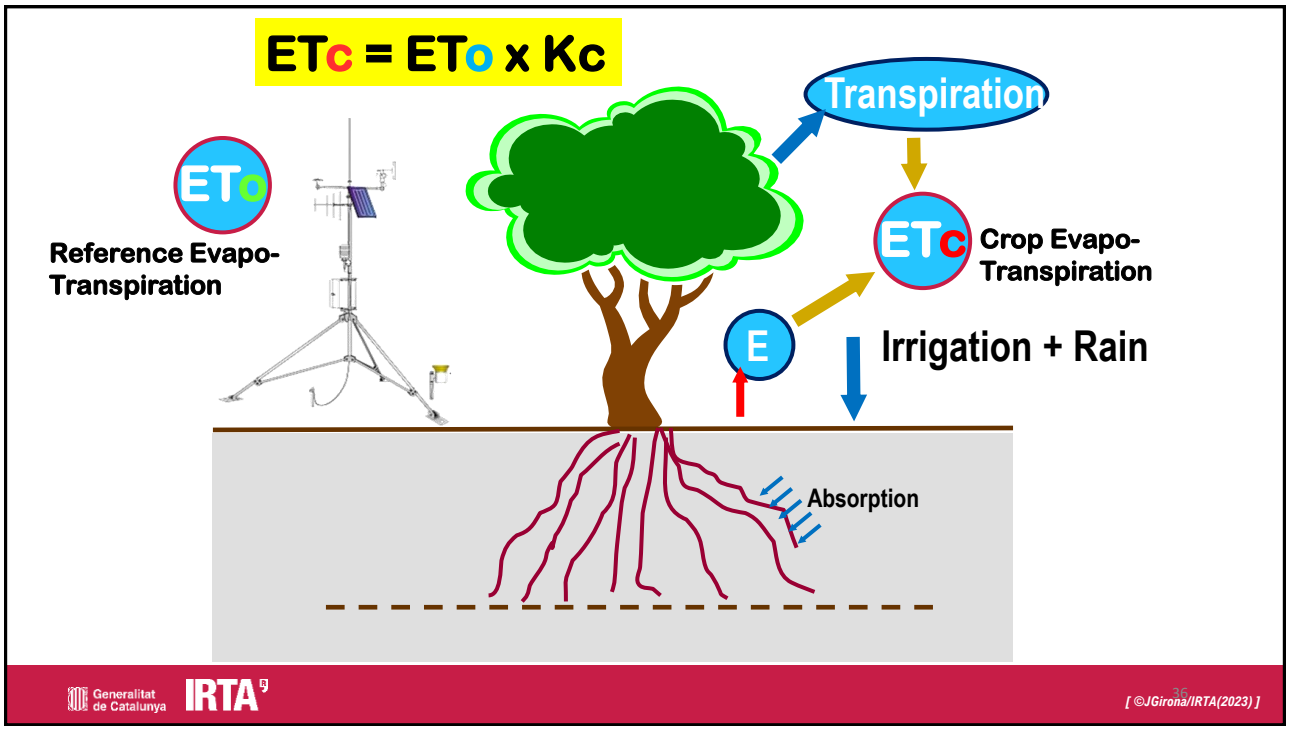
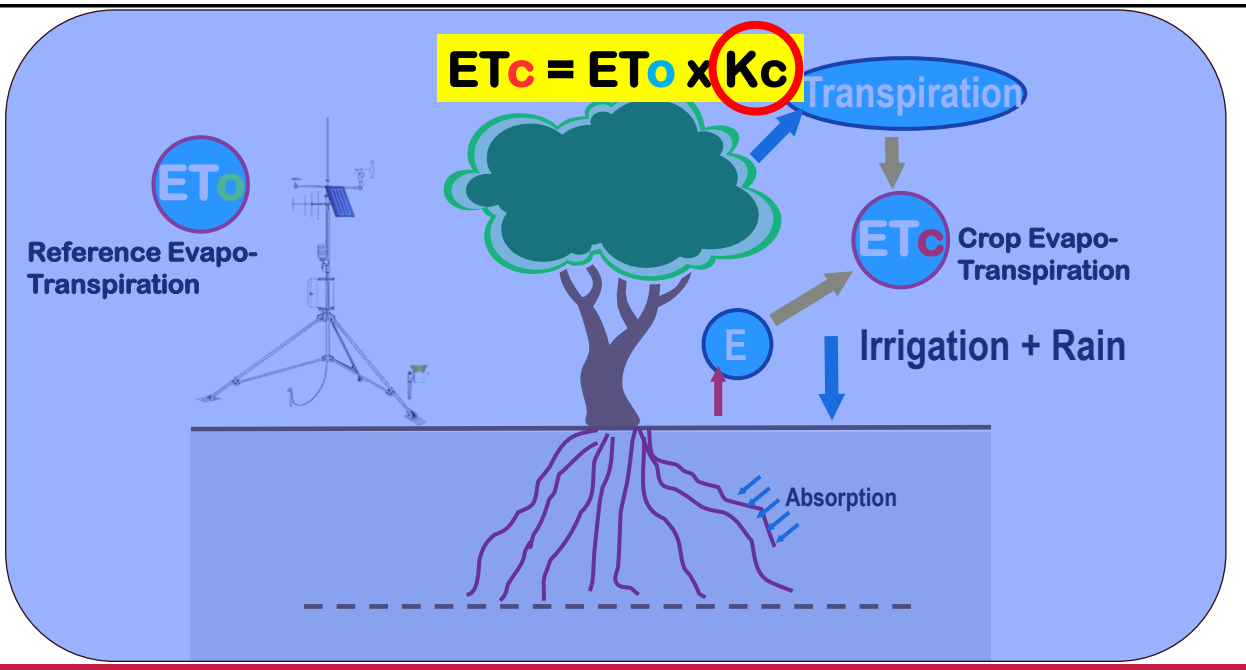

Transpiration
ETo
Reference Evapo-Transpiration
ETc
Crop Evapo-Transpiration
E
Irrigation + Rain
Absorption
Generalitat de Catalunya
IRTA
35
[©JGirona/IRTA(2023)]

35


ETc = ETo x Kc
Transpiration
ETo
Reference Evapo-Transpiration
ETc
Crop Evapo-Transpiration
E
Irrigation + Rain
Absorption
Generalitat de Catalunya
IRTA
36
[©JGirona/IRTA(2023)]

36



37

ETc = ETo x Kc

TABLE 2 Apple orchard water requirements, based on an orchard planted at 4 x 1.6 m, trained with a central leader and with a ground cover about 45-50 percent and tree heights > 3.5 m. Located in Mollerussa (Lleida, Spain). ET_o values used are the average daily data from the last 8 years (2002-2009).

			FULL IRRIGATION		MODERATE RDI		SEVERE RDI	
		ET_o	K_c	ET_c	K_c	ET_c	K_c	ET_c
		(mm/day)		(mm/day)		(mm/day)		(mm/day)
March	1-15	2.19	0.30	0.66	0.30	0.66	0.30	0.66
March	16-31	2.61	0.30	0.78	0.30	0.78	0.30	0.78
April	1-15	2.70	0.40	1.08	0.40	1.08	0.30	0.81
April	16-30	3.75	0.45	1.69	0.45	1.69	0.30	1.13
May	1-15	3.95	0.60	2.37	0.60	2.37	0.40	1.58
May	16-31	4.64	0.75	3.48	0.75	3.48	0.40	1.86
June	1-15	5.08	0.82	4.17	0.82	4.17	0.50	2.54
June	16-30	5.45	0.87	4.74	0.87	4.74	0.50	2.73
July	1-15	5.40	0.92	4.97	0.90	4.86	0.50	2.70
July	16-31	5.47	0.93	5.09	0.70	2.74	0.45	2.46
August	1-15	4.90	0.93	4.56	0.50	2.45	0.45	2.21
August	16-31	4.45	0.94	4.18	0.50	2.22	0.45	2.00
September	1-15	3.57	0.95	3.39	0.50	1.78	0.45	1.61
September	16-30	3.01	0.75	2.26	0.50	1.51	0.45	1.35
October	1-15	2.44	0.60	1.46	0.50	1.22	0.45	1.10
October	16-31	1.60	0.55	0.88	0.55	0.88	0.55	0.88

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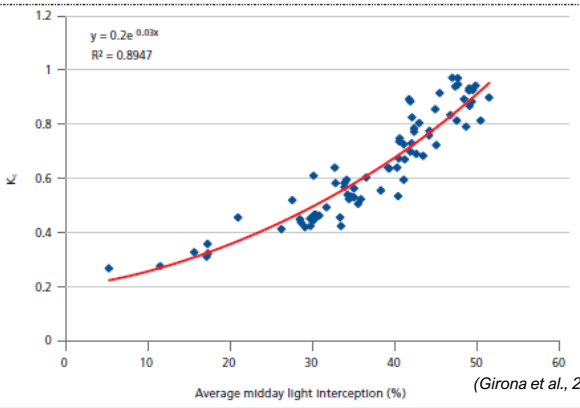
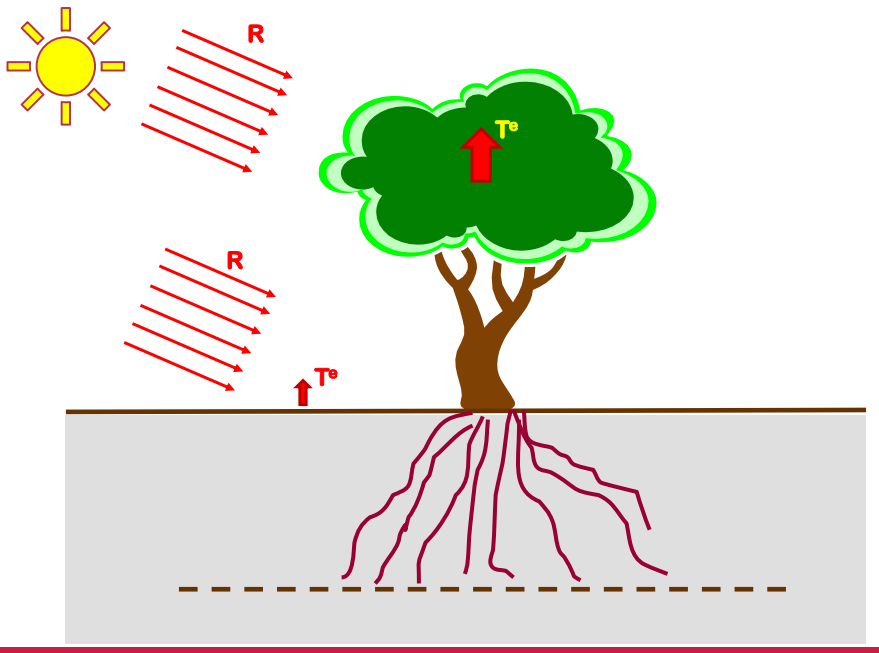
ETc = ETo x Kc

FIGURE 7 Effect of midday light interception of apples on their K_c values - data from a weighing lysimeter study of commercial size trees within an orchard in Mollerussa (Lleida, Spain) (Girona *et al.*, 2011).



(Girona et al., 2011)

39



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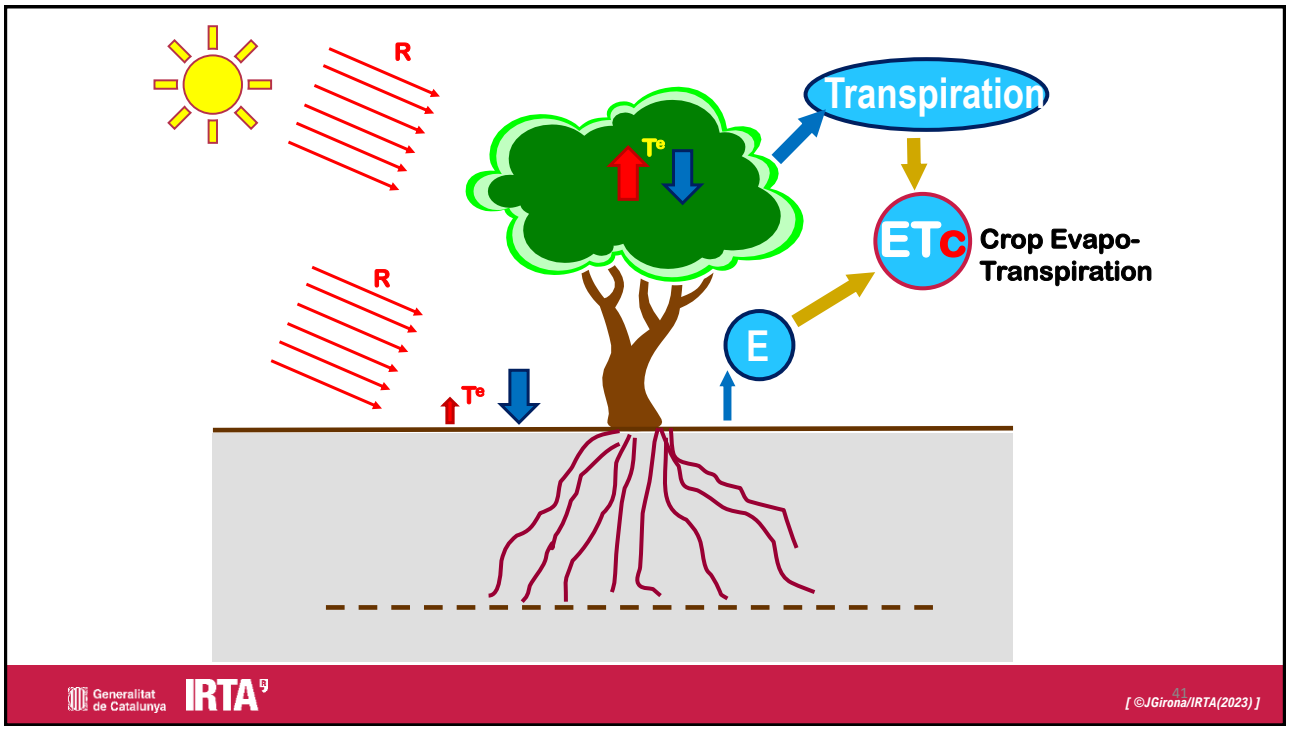
R
R
Te
Te
Transpiration
ETc
Crop Evapo-
Transpiration
E
Generalitat de Catalunya
IRTA
41
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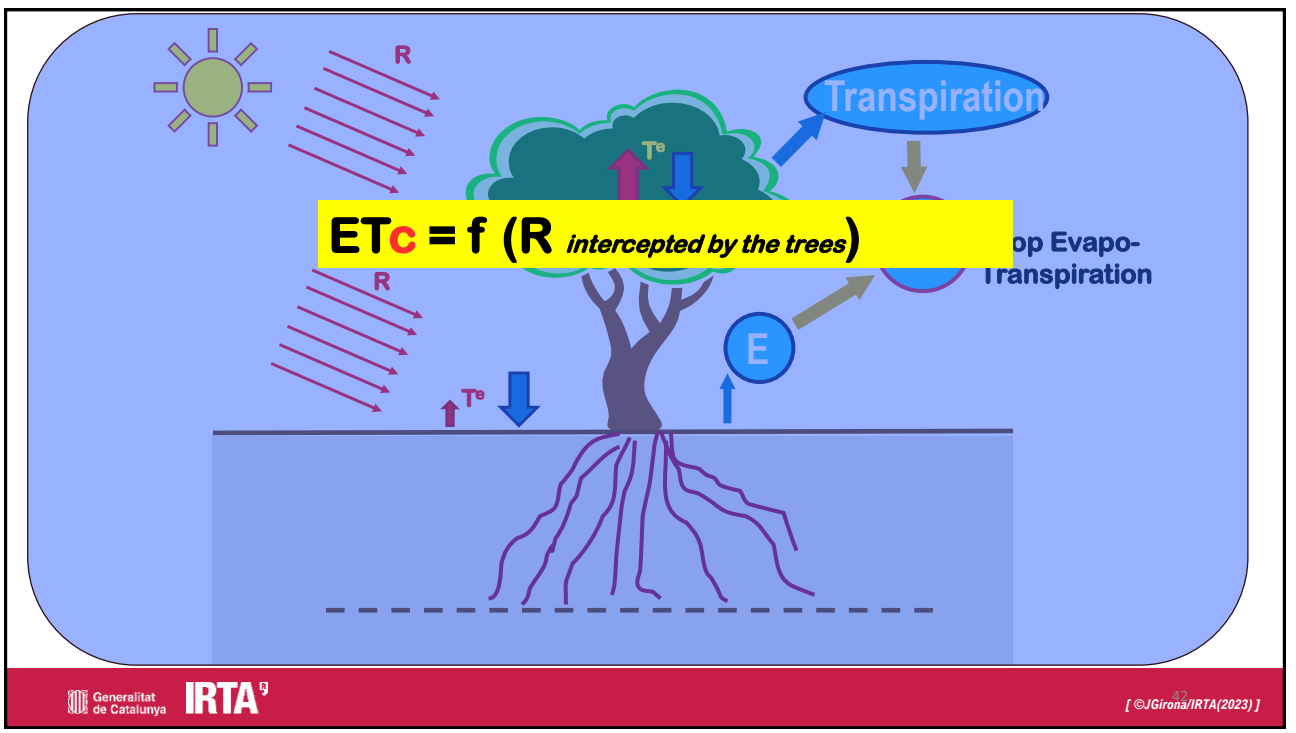
41


R
R
Te
Te
Transpiration
ETc = f (R intercepted by the trees)
op Evapo-
Transpiration
E
Generalitat de Catalunya
IRTA
42
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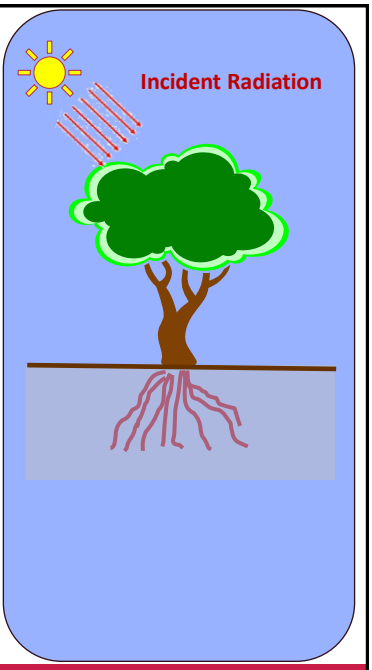
42



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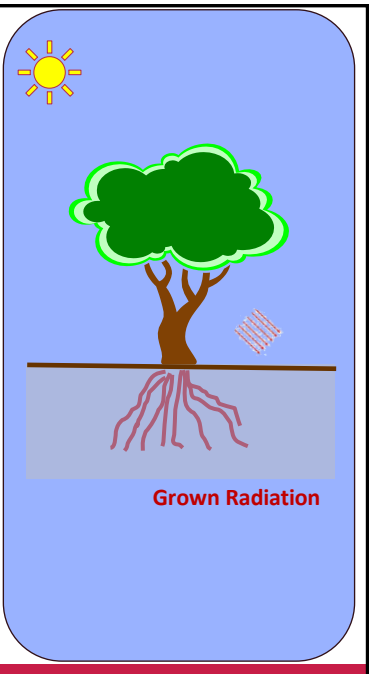

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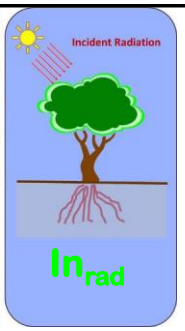
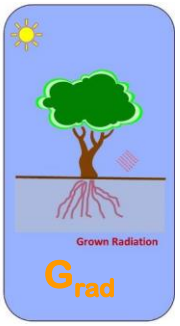
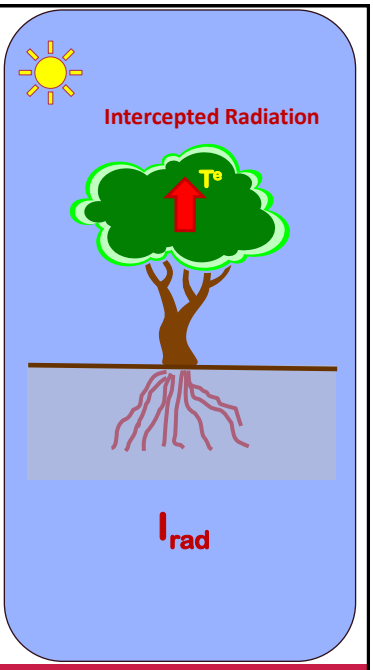
44





$I_{rad} = In_{rad} - G_{rad}$

$\%I_{rad} = \frac{I_{rad}}{In_{rad}}$



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45

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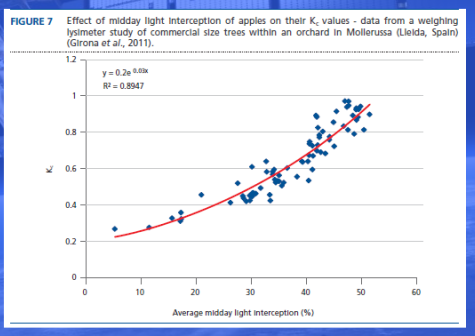
46

Kc



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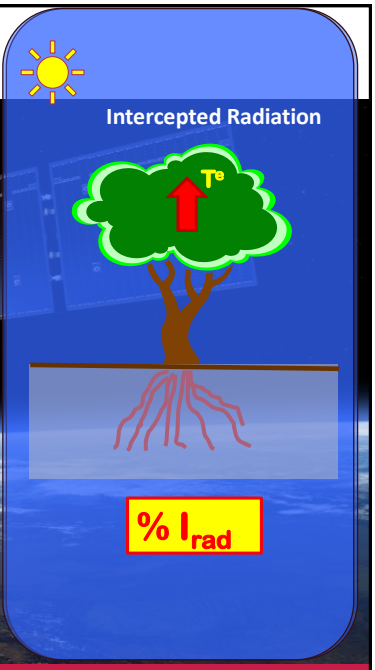
ETc = ETo x Kc



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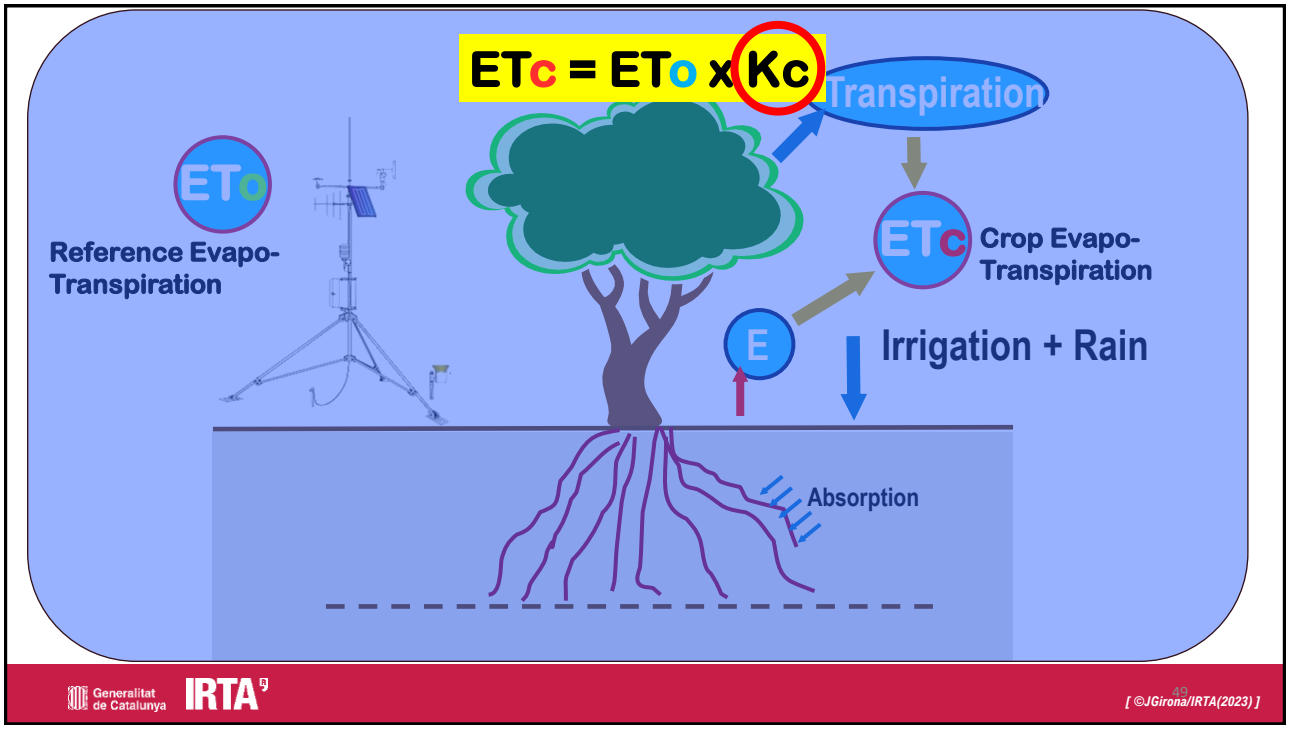
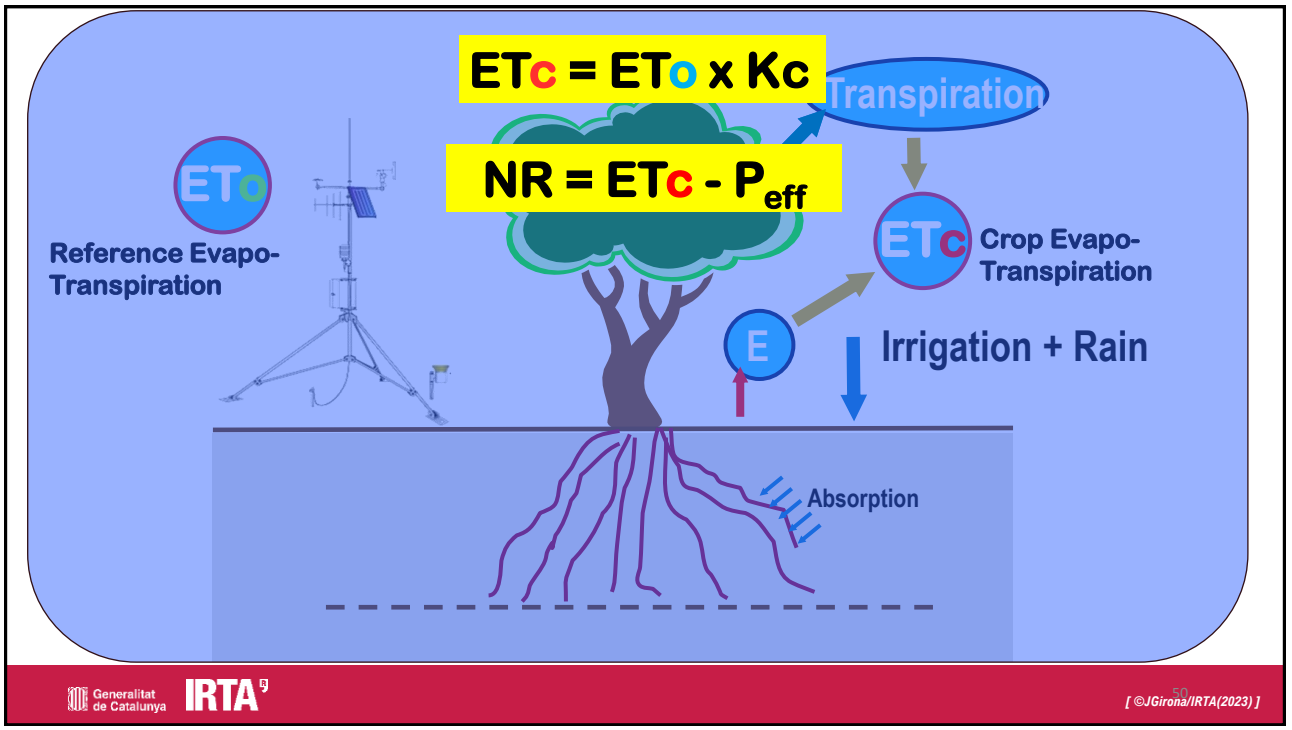
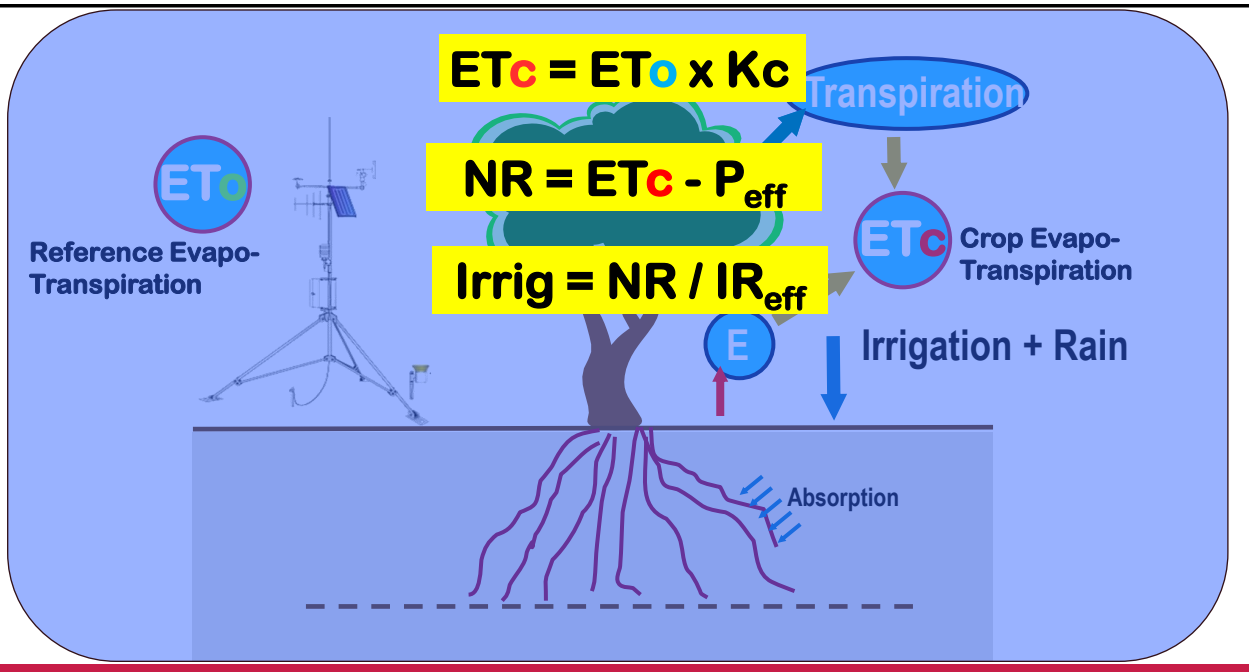

ETc = ETo x Kc
Transpiration
ETo
Reference Evapo-Transpiration
ETc
Crop Evapo-Transpiration
E
Irrigation + Rain
Absorption
Generalitat de Catalunya
IRTA
49
[©JGirona/IRTA(2023)]

49


ETc = ETo x Kc
NR = ETc - Peff
Transpiration
ETo
Reference Evapo-Transpiration
ETc
Crop Evapo-Transpiration
E
Irrigation + Rain
Absorption
Generalitat de Catalunya
IRTA
50
[©JGirona/IRTA(2023)]

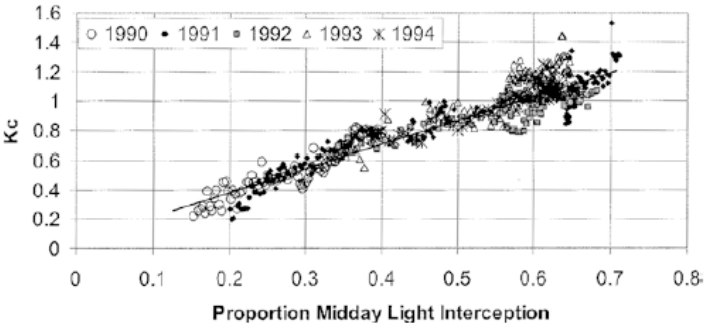
50



51

ETc = ETo x Kc

Fig. 5 Mature peach tree crop coefficients (K_c) as a function of the proportion of available light intercepted by the canopy at mid-day. Equation of the regression line is $y = 1.59x + 0.082$, $R^2 = 0.86$

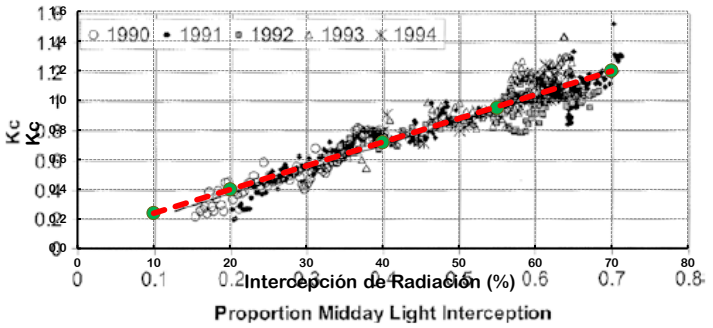


(Ayars et al., 2003)

52

ETc = ETo x Kc

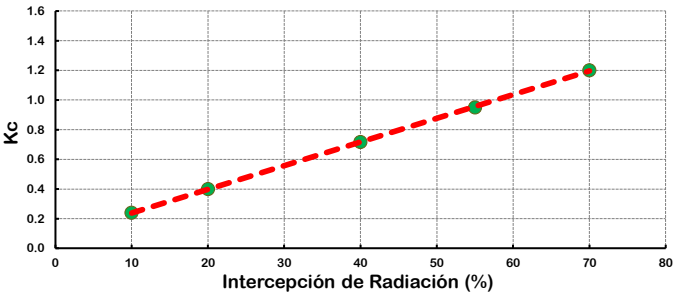
Fig. 5 Mature peach tree crop coefficients (K_c) as a function of the proportion of available light intercepted by the canopy at mid-day. Equation of the regression line is $y = 1.59x + 0.082$, $R^2 = 0.86$



(Ayars et al., 2003)

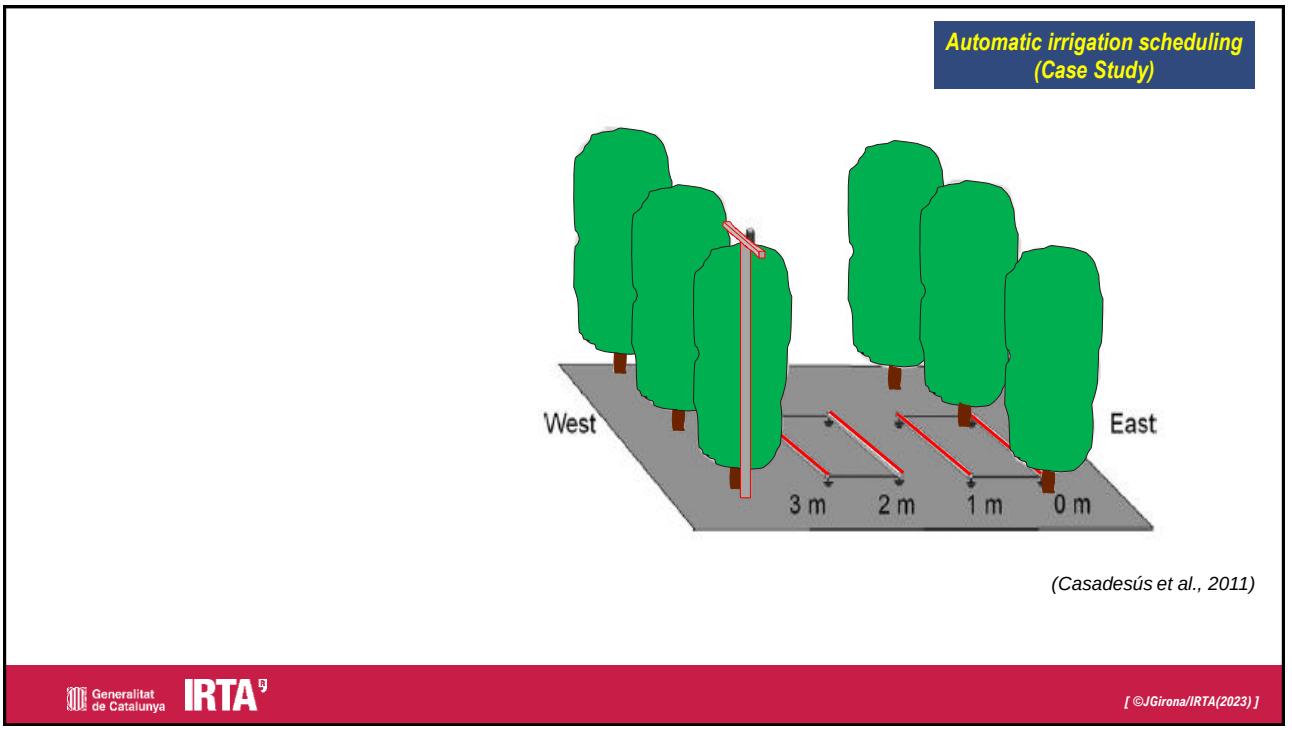
ETc = ETo x Kc

Fig. 5 Mature peach tree crop coefficients (K_c) as a function of the proportion of available light intercepted by the canopy at mid-day. Equation of the regression line is $y = 1.59x + 0.082$, $R^2 = 0.86$



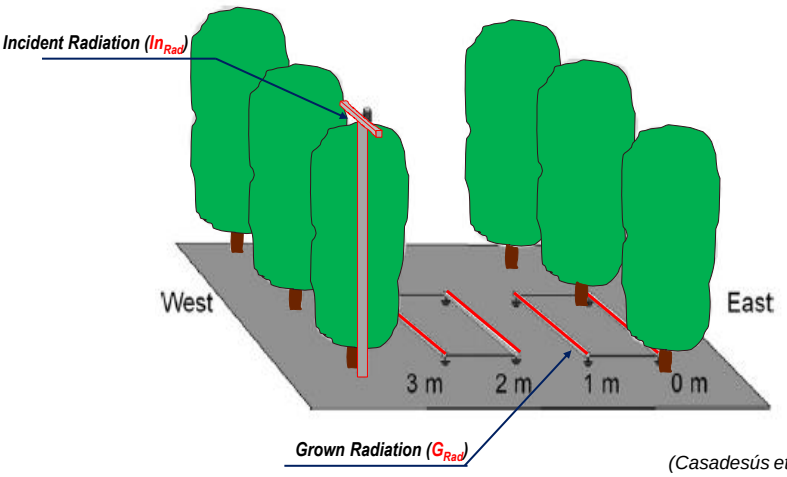
(Ayars et al., 2003)

55



56

Automatic irrigation scheduling (Case Study)

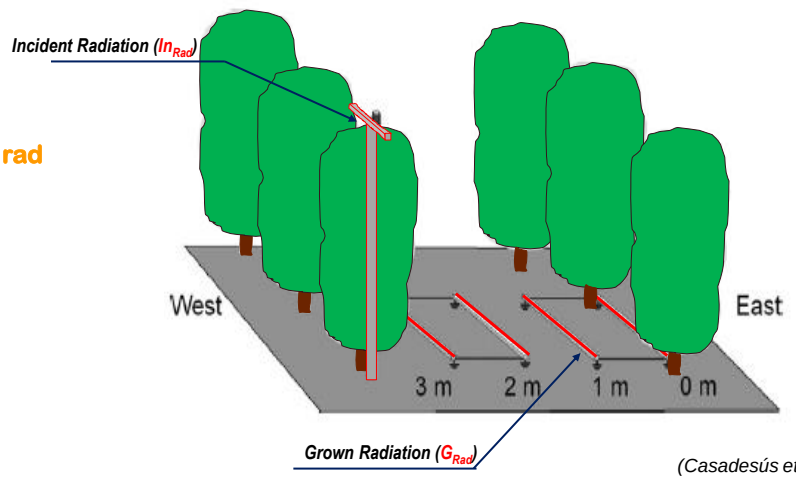


(Casadesús et al., 2011)

57

Automatic irrigation scheduling (Case Study)

$I_{rad} = In_{rad} - G_{rad}$



(Casadesús et al., 2011)

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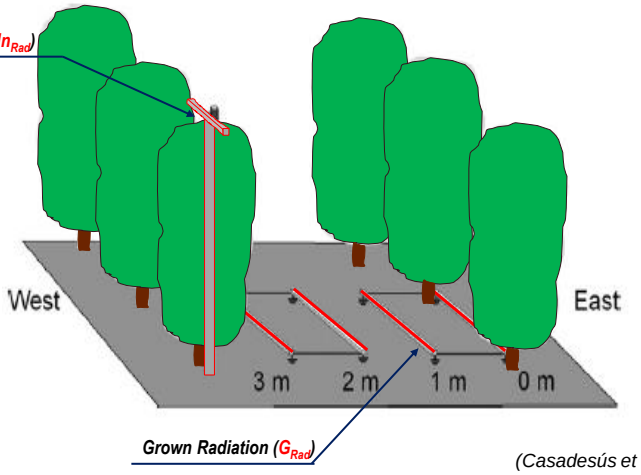
Automatic irrigation scheduling (Case Study)

$$I_{rad} = In_{rad} - G_{rad}$$

$$W = K_{RI} * I_{rad}$$

(Auzmendi et al., 2011)



(Casadesús et al., 2011)

W = Irrigation water to be applied (*mm/día*)
K_{Ir} = Coefficient (*l / MJ*$^{-1}$)
I_{rad}= Intercepted Radiation (*MJ*)

Automatic irrigation scheduling (Case Study)

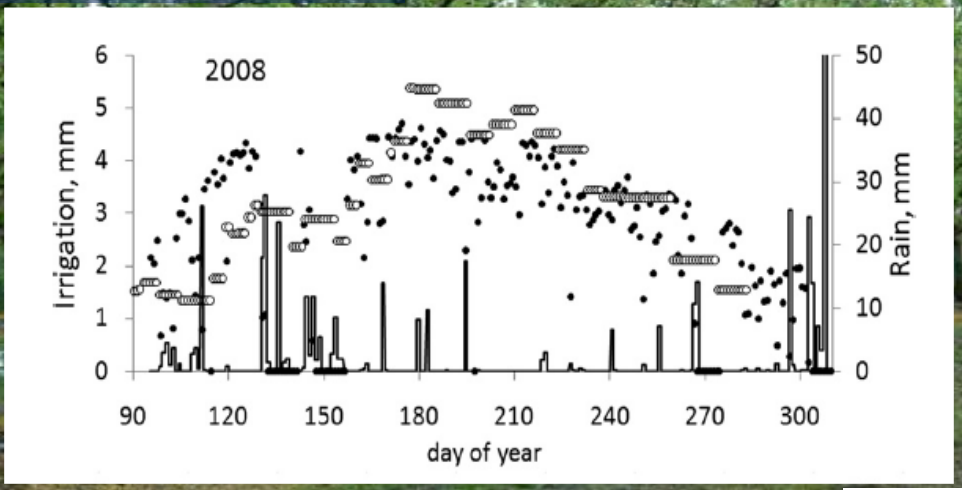
Irrigation Treatments

$$Irad_{based} = f(ETo, I_{rad})$$

$$WB = f(ETc \text{ y } \Psi_{md})$$

(Casadesús et al., 2011)

Automatic irrigation scheduling (Case Study)



(Casadesús et al., 2011)

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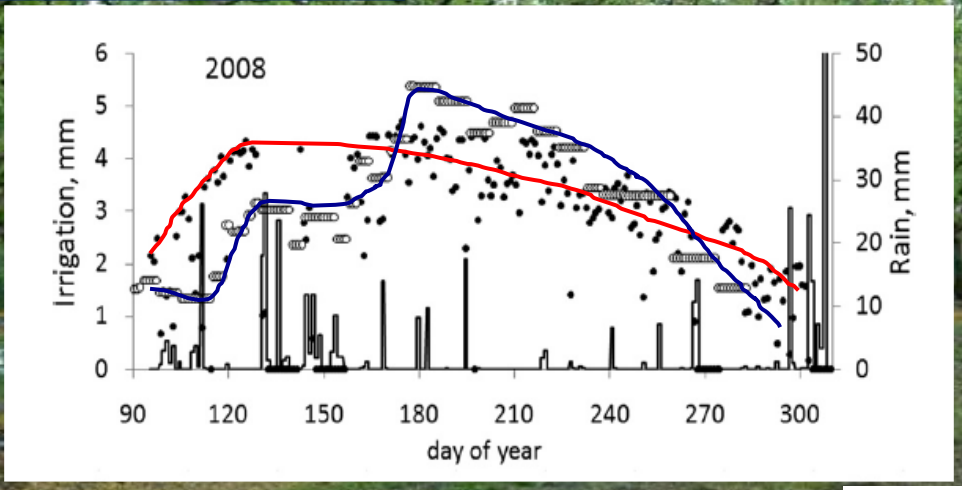
Automatic irrigation scheduling (Case Study)



(Casadesús et al., 2011)

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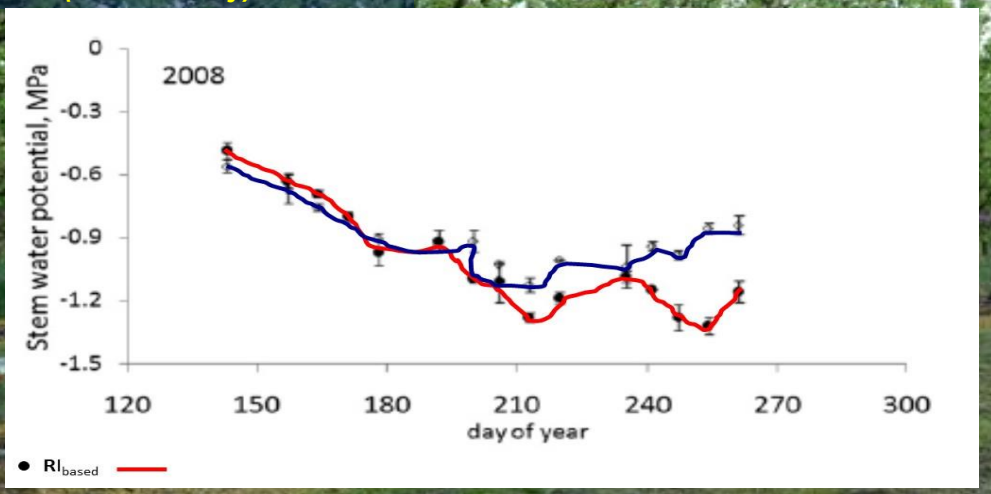
Automatic irrigation scheduling (Case Study)



(Casadesús et al., 2011)

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Automatic irrigation scheduling (Case Study)

Year	Irrigation Treatment	Irrigation Applied Water *(mm)*	Yield *(t/ha)*	Fruit Weight *(g)*	Fruit Load *(fruits/tree)*
2008	Irad based	606			
	WB based	615			
2009	Irad based	703	45	220	131
	WB based	748	43	234	119

(Casadesús et al., 2011)

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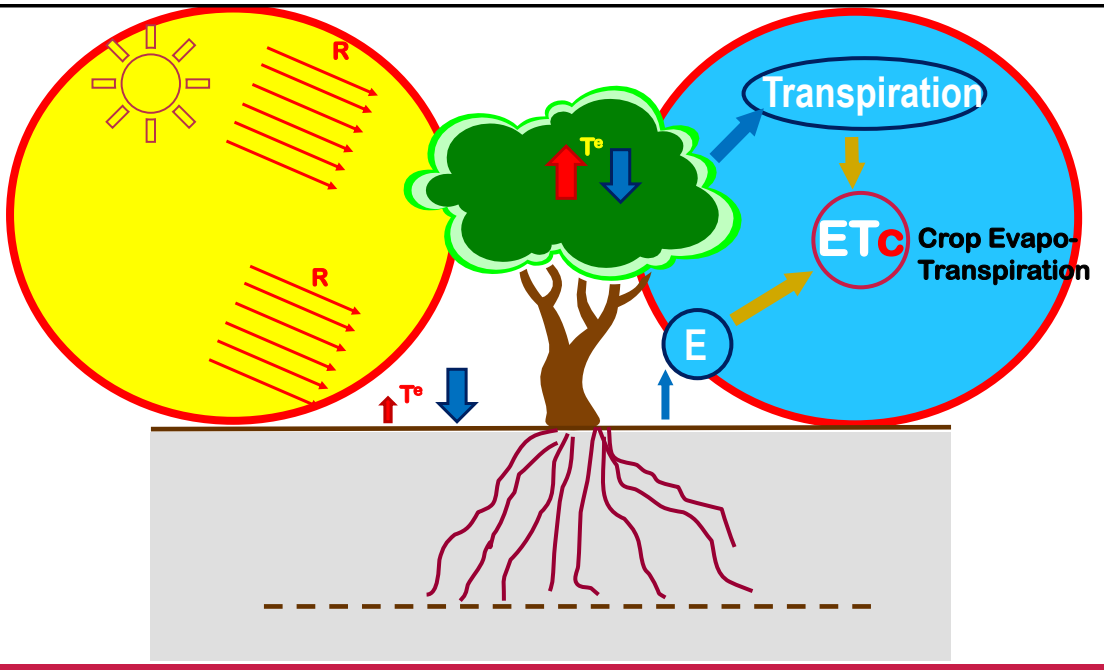
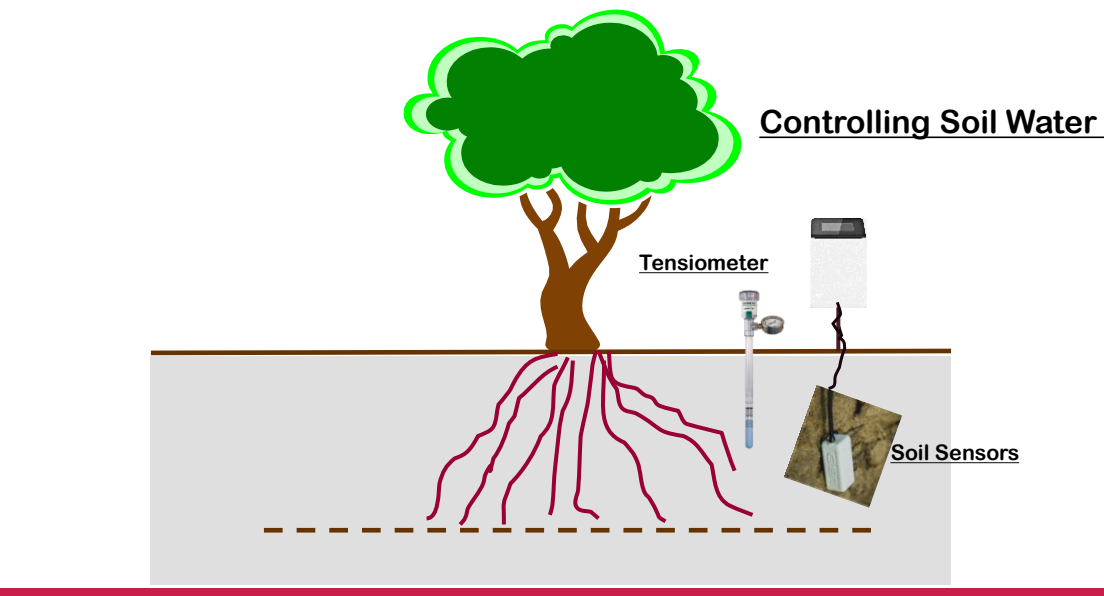


65



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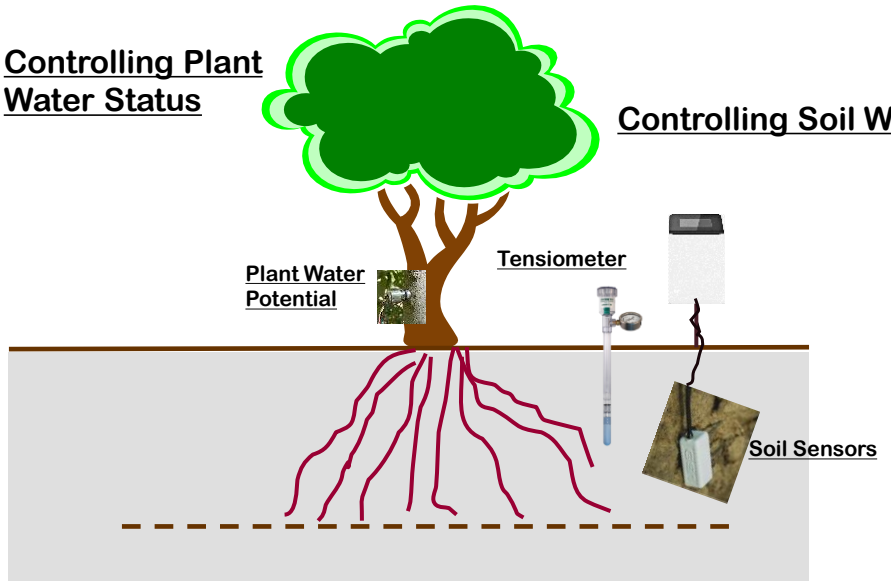
Controlling Plant Water Status

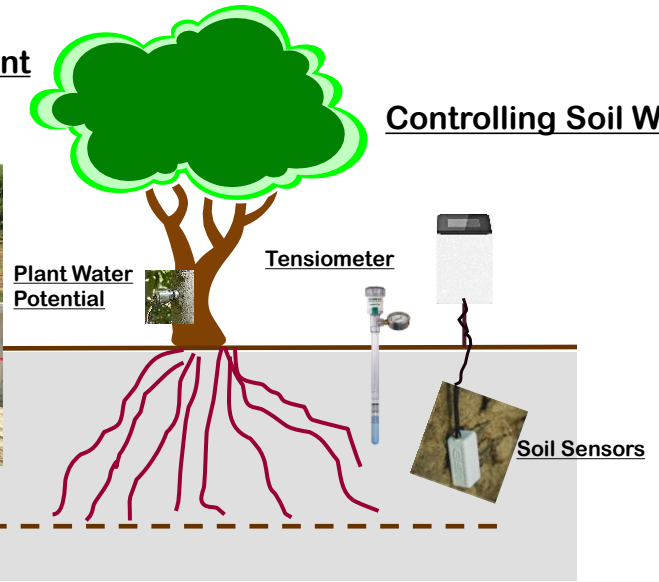
Controlling Soil Water Status



67

Controlling Plant Water Status

Controlling Soil Water Status



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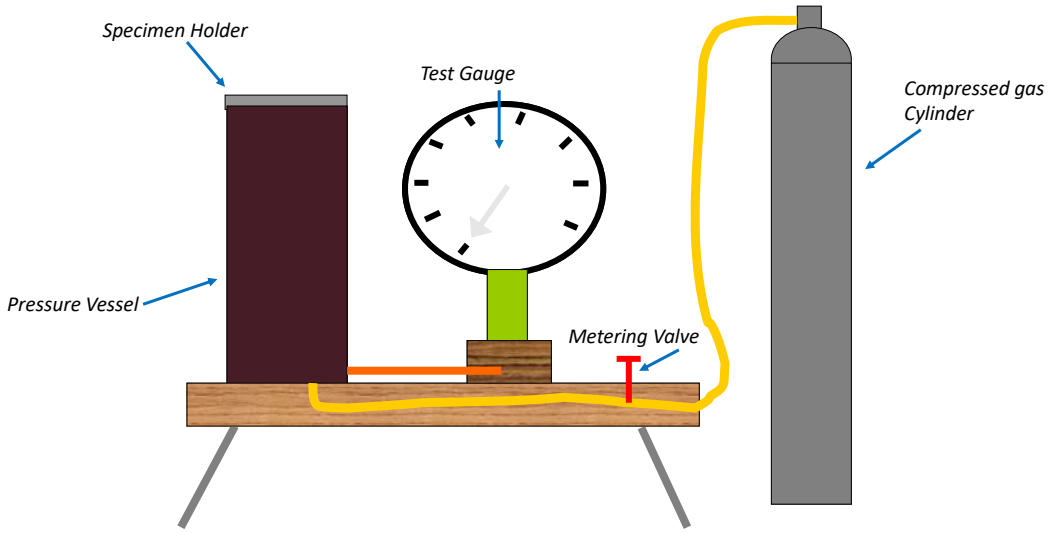
Determination of Leaf Water Potential (Ψ_h)



69

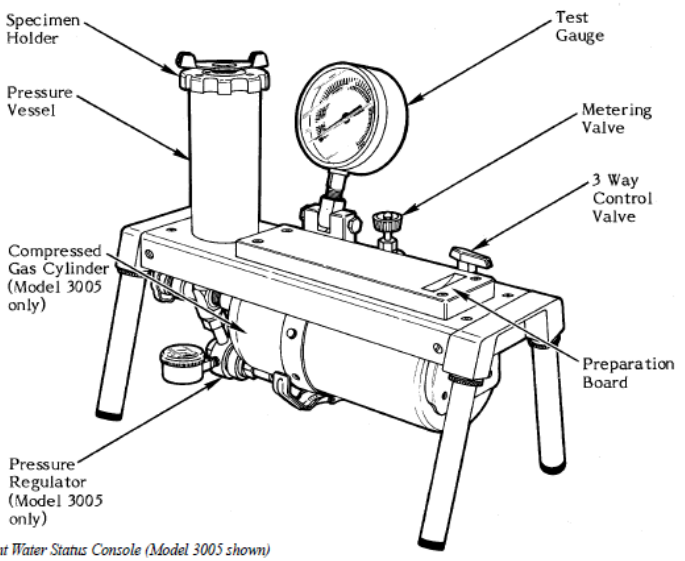


Fig. 2 - Plant Water Status Console (Model 3005 shown)

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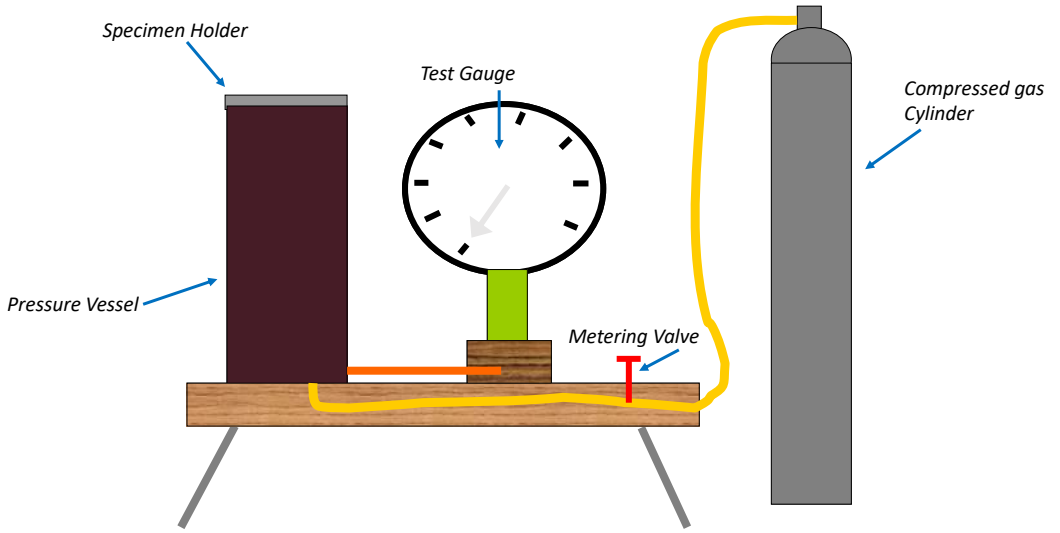
Determination of Leaf Water Potential (Ψ_h)



71

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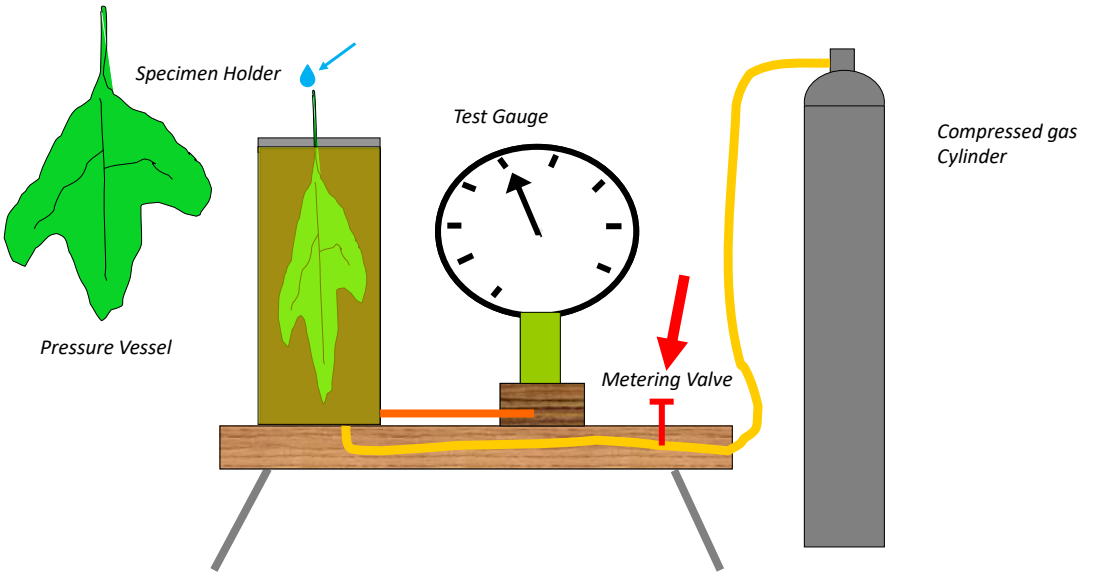
Determination of Leaf Water Potential (Ψ_h)



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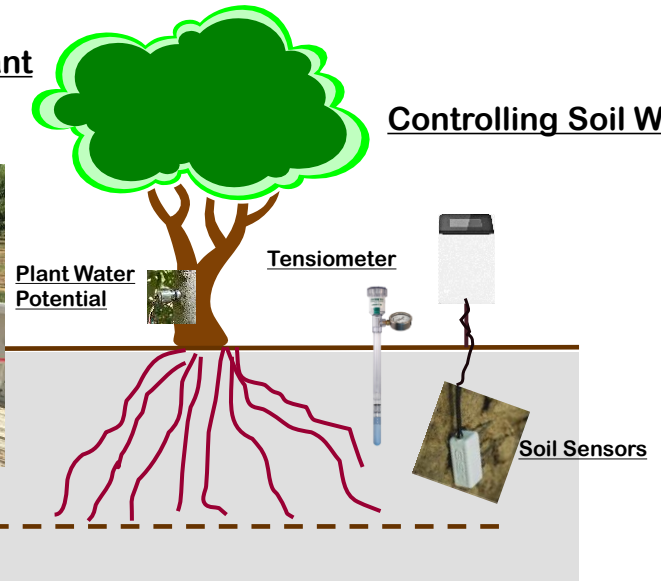
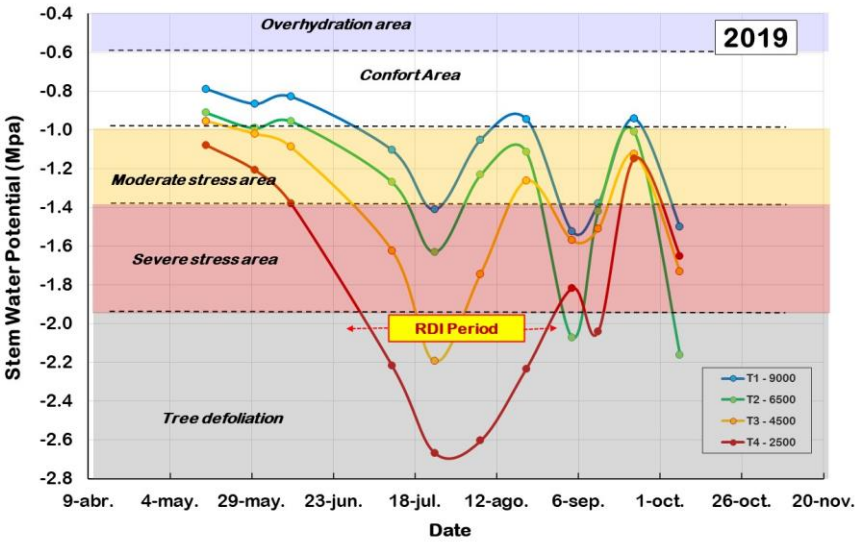
Controlling Plant Water Status

Controlling Soil Water Status



73

Almond tree physiological response to different climatic scenarios, water availability and productive load.



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"Efficient use of water in fruit crops"

Indispensable:

- To know the patterns of water in the soil and the plant.
- **Very precise irrigation management.**
  - System
  - **Strategy**
    - Full Irrigation
    - **Deficit Irrigation**

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"Efficient use of water in fruit crops"

- **Deficit Irrigation:** Applying less irrigation water than the crop needs

- **Regulated Deficit Irrigation (RDI):**

  Applying less irrigation water than the crop needs, but at the moments in the annual cycle when the crop is less sensitive to water stress

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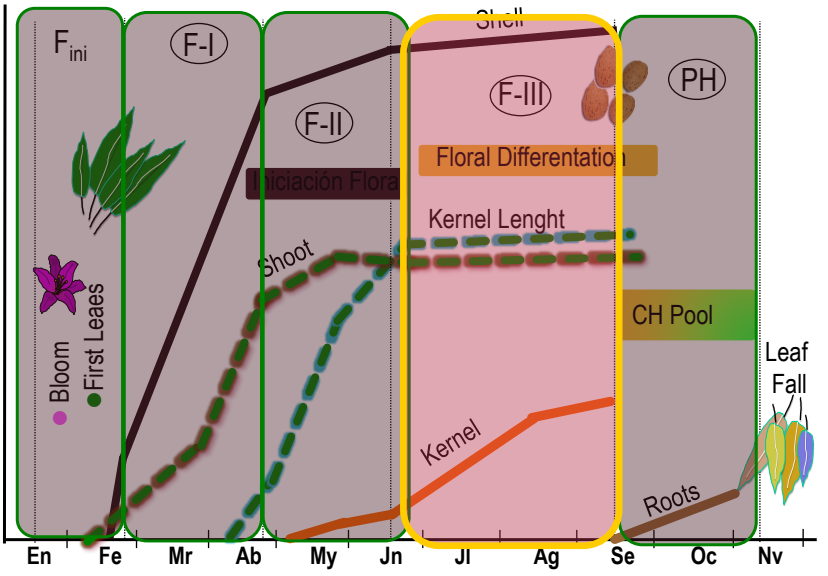
- **Regulated Deficit Irrigation (RDI):**



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"Efficient use of water in fruit crops"

Indispensable:

- To know the patterns of water in the soil and the plant.
- **Very precise irrigation management.**
  - System
  - **Strategy**
    - Full Irrigation
    - **Deficit Irrigation & RDI.**

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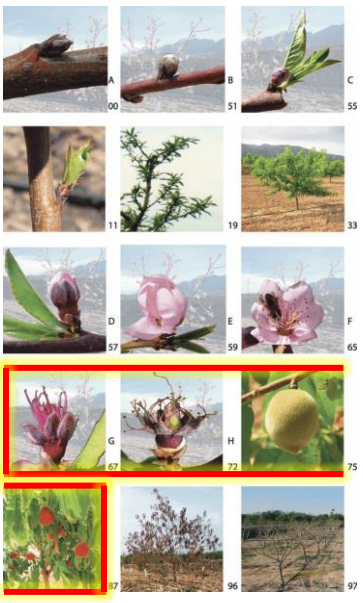
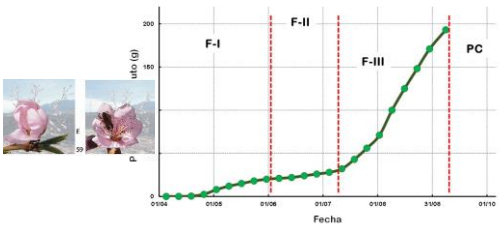
"Efficient use of water in fruit crops"

REGULATED DEFICIT IRRIGATION

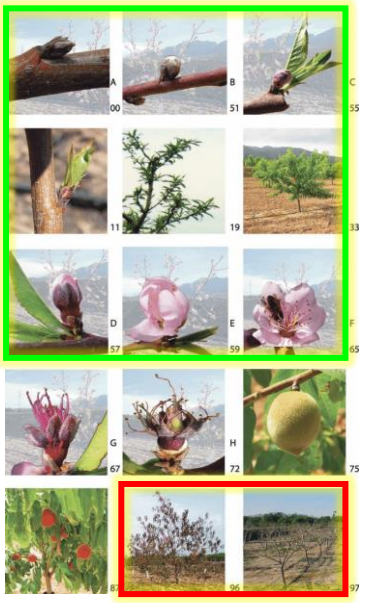
PEACH TREE



Peach Annual Cycle



(Mounzer et al., 2008)



Peach Annual Cycle

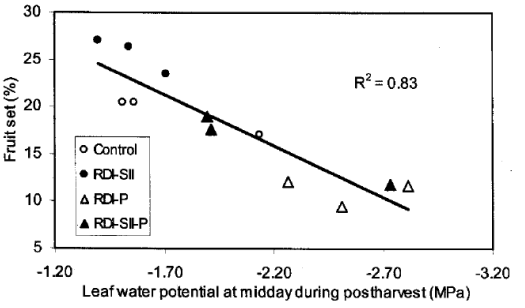
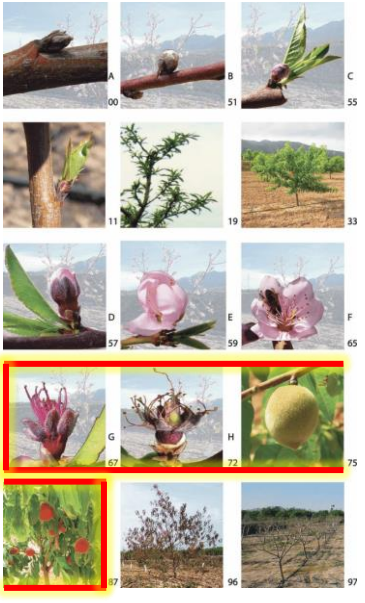


Fig. 5. Relationship between fruit set 2 months after full bloom in 1996 and seasonal average midday leaf water potential during a previous year at postharvest. Each observation corresponds to a treatment average. Open circles control, closed circles RDI-SII, open triangles RDI-P, and closed triangles RDI-SII-P.

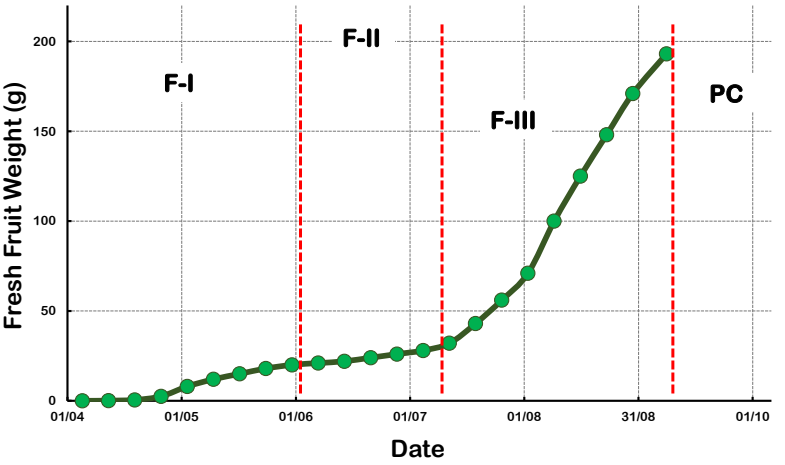
(Girona et al., 2003)

(Mounzer et al., 2008)



Peach Annual Cycle

(Mounzer et al., 2008)


F-I
F-II
F-III
PC
Fresh Fruit Weight (g)
0
50
100
150
200
01/04
01/05
01/06
01/07
01/08
31/08
01/10
Date

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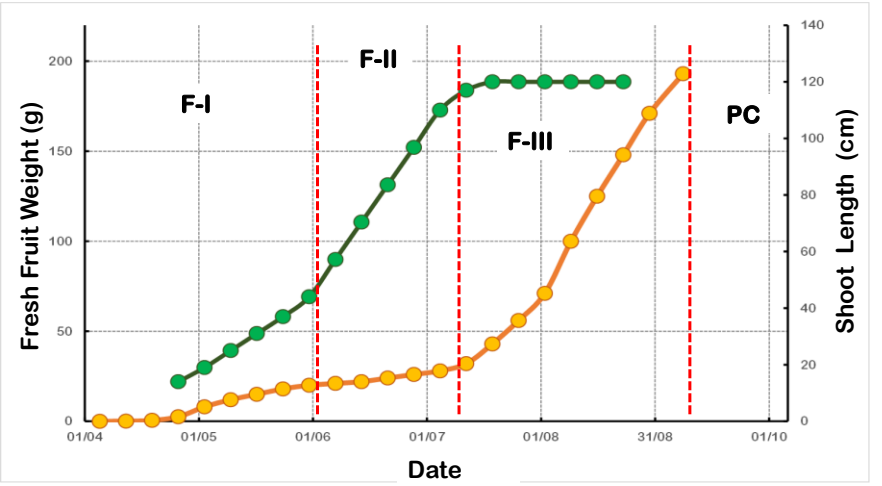
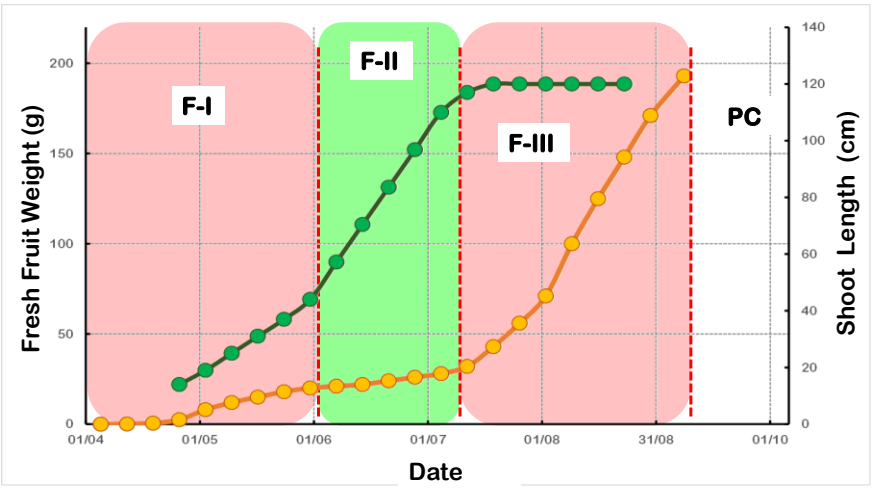
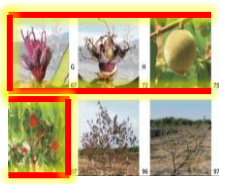
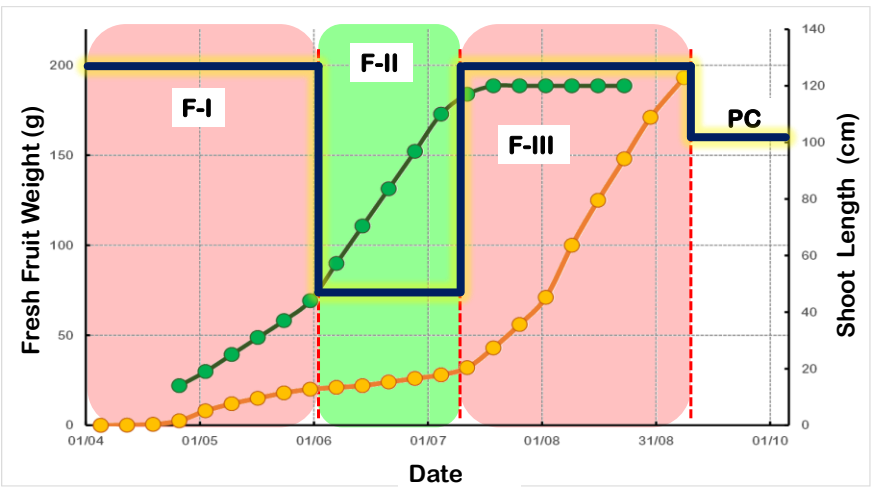

F-I
F-II
F-III
PC
Fresh Fruit Weight (g)
Shoot Length (cm)
0
50
100
150
200
0
20
40
60
80
100
120
140
01/04
01/05
01/06
01/07
01/08
31/08
01/10
Date

84

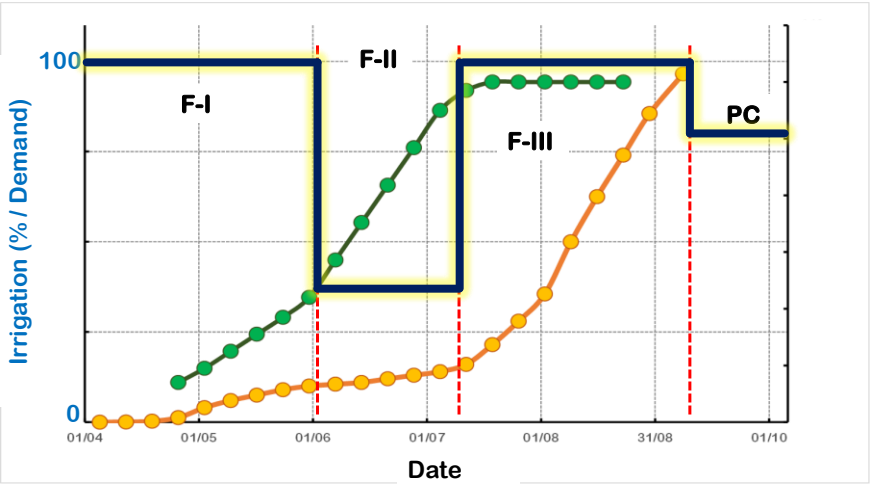

F-I
F-II
F-III
PC
Fresh Fruit Weight (g)
Shoot Length (cm)
Date
01/04
01/05
01/06
01/07
01/08
31/08
01/10
0
50
100
150
200
0
20
40
60
80
100
120
140

85




F-I
F-II
F-III
PC
Fresh Fruit Weight (g)
Shoot Length (cm)
Date
01/04
01/05
01/06
01/07
01/08
31/08
01/10
0
50
100
150
200
0
20
40
60
80
100
120
140

86



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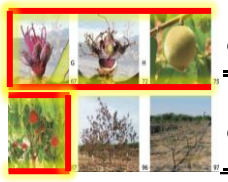

Cultivar	Specifications		Peach Seasonal Stages									
			S-I		S-II		S-III		Post Harvest (PH) Initial		Post Harvest (PH) Late	
	Soils	Fruit Load	Ψ_{stem} (Mpa)	ETc (%)	Ψ_{stem} (Mpa)	ETc (%)	Ψ_{stem} (Mpa)	ETc (%)	Ψ_{stem} (Mpa)	ETc (%)	Ψ_{stem} (Mpa)	ETc (%)
Early Cultivars	Deep Soils	High Fruit Load	-0.5	100 - 80			-0.7	100	-2.0	30 - 50	-1.5	50 - 70
		Low Fruit Load	-0.8	100 - 50			-1.0	100	-2.2	30 - 50	-1.5	50 - 70
	Shallow Soils	High Fruit Load	-0.5	100			-0.7	110 - 100	-2.0	50 - 70	-1.5	70 - 80
		Low Fruit Load	-0.7	100 - 80			-0.8	100	-2.2	50 - 70	-1.5	70 - 80
Mid Season Cultivars	Deep Soils	High Fruit Load	-0.5	100 - 80	-1.8	0 - 50	-0.9	130 : 100	-2.0	0 - 30	-1.5	50 - 70
		Low Fruit Load	-0.8	100 - 50	-2.0	0- 50	-1.2	130 : 100	-2.2	0 - 30	-1.5	50 - 70
	Shallow Soils	High Fruit Load	-0.5	100	-1.6	40 - 70	-0.9	110 : 100	-2.0	20 - 50	-1.5	70 - 80
		Low Fruit Load	-0.7	100 - 80	-1.8	40 - 50	-1.1	110 : 100	-2.2	20 - 50	-1.5	70 - 80
Late Cultivars	Deep Soils	High Fruit Load	-0.5	100 - 80	-1.8	0 - 50	-1.0	130 : 100	-1.5	0 - 50		
		Low Fruit Load	-0.8	100 - 50	-2.0	0- 50	-1.2	130 : 100	-1.5	0 - 50		
	Shallow Soils	High Fruit Load	-0.5	100	-1.6	40 - 70	-1.0	110 : 100	-1.5	50 - 70		
		Low Fruit Load	-0.7	100 - 80	-1.8	40 - 50	-1.1	110 : 100	-1.5	50 - 70		

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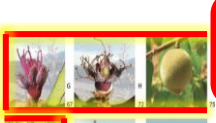

Cultivar	Specifications		Peach Seasonal Stages									
			S-I		S-II		S-III		Post Harvest (PH)			
									Initial		Late	
	Soils	Fruit Load	Ψ_{stem} (Mpa)	ETc (%)	Ψ_{stem} (Mpa)	ETc (%)	Ψ_{stem} (Mpa)	ETc (%)	Ψ_{stem} (Mpa)	ETc (%)	Ψ_{stem} (Mpa)	ETc (%)
Early Cultivars	Deep Soils	High Fruit Load	-0.5	100 - 80			-0.7	100	-2.0	30 - 50	-1.5	50 - 70
		Low Fruit Load	-0.8	100 - 50			-1.0	100	-2.2	30 - 50	-1.5	50 - 70
	Shallow Soils	High Fruit Load	-0.5	100			-0.7	110 - 100	-2.0	50 - 70	-1.5	70 - 80
		Low Fruit Load	-0.7	100 - 80			-0.8	100	-2.2	50 - 70	-1.5	70 - 80
Mid Season Cultivars	Deep Soils	High Fruit Load	-0.5	100 - 80	-1.8	0 - 50	-0.9	130 : 100	-2.0	0 - 30	-1.5	50 - 70
		Low Fruit Load	-0.8	100 - 50	-2.0	0- 50	-1.2	130 : 100	-2.2	0 - 30	-1.5	50 - 70
	Shallow Soils	High Fruit Load	-0.5	100	-1.6	40 - 70	-0.9	110 : 100	-2.0	20 - 50	-1.5	70 - 80
		Low Fruit Load	-0.7	100 - 80	-1.8	40 - 50	-1.1	110 : 100	-2.2	20 - 50	-1.5	70 - 80
Late Cultivars	Deep Soils	High Fruit Load	-0.5	100 - 80	-1.8	0 - 50	-1.0	130 : 100	-1.5	0 - 50		
		Low Fruit Load	-0.8	100 - 50	-2.0	0- 50	-1.2	130 : 100	-1.5	0 - 50		
	Shallow Soils	High Fruit Load	-0.5	100	-1.6	40 - 70	-1.0	110 : 100	-1.5	50 - 70		
		Low Fruit Load	-0.7	100 - 80	-1.8	40 - 50	-1.1	110 : 100	-1.5	50 - 70		

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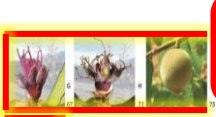

Cultivar	Specifications		Peach Seasonal Stages									
			S-I		S-II		S-III		Post Harvest (PH)			
									Initial		Late	
	Soils	Fruit Load	Ψ_{stem} (Mpa)	ETc (%)	Ψ_{stem} (Mpa)	ETc (%)	Ψ_{stem} (Mpa)	ETc (%)	Ψ_{stem} (Mpa)	ETc (%)	Ψ_{stem} (Mpa)	ETc (%)
Early Cultivars	Deep Soils	High Fruit Load	-0.5	100 - 80			-0.7	100	-2.0	30 - 50	-1.5	50 - 70
		Low Fruit Load	-0.8	100 - 50			-1.0	100	-2.2	30 - 50	-1.5	50 - 70
	Shallow Soils	High Fruit Load	-0.5	100			-0.7	110 - 100	-2.0	50 - 70	-1.5	70 - 80
		Low Fruit Load	-0.7	100 - 80			-0.8	100	-2.2	50 - 70	-1.5	70 - 80
Mid Season Cultivars	Deep Soils	High Fruit Load	-0.5	100 - 80	-1.8	0 - 50	-0.9	130 : 100	-2.0	0 - 30	-1.5	50 - 70
		Low Fruit Load	-0.8	100 - 50	-2.0	0- 50	-1.2	130 : 100	-2.2	0 - 30	-1.5	50 - 70
	Shallow Soils	High Fruit Load	-0.5	100	-1.6	40 - 70	-0.9	110 : 100	-2.0	20 - 50	-1.5	70 - 80
		Low Fruit Load	-0.7	100 - 80	-1.8	40 - 50	-1.1	110 : 100	-2.2	20 - 50	-1.5	70 - 80
Late Cultivars	Deep Soils	High Fruit Load	-0.5	100 - 80	-1.8	0 - 50	-1.0	130 : 100	-1.5	0 - 50		
		Low Fruit Load	-0.8	100 - 50	-2.0	0- 50	-1.2	130 : 100	-1.5	0 - 50		
	Shallow Soils	High Fruit Load	-0.5	100	-1.6	40 - 70	-1.0	110 : 100	-1.5	50 - 70		
		Low Fruit Load	-0.7	100 - 80	-1.8	40 - 50	-1.1	110 : 100	-1.5	50 - 70		

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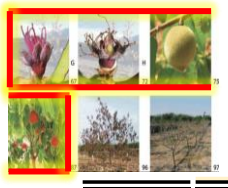

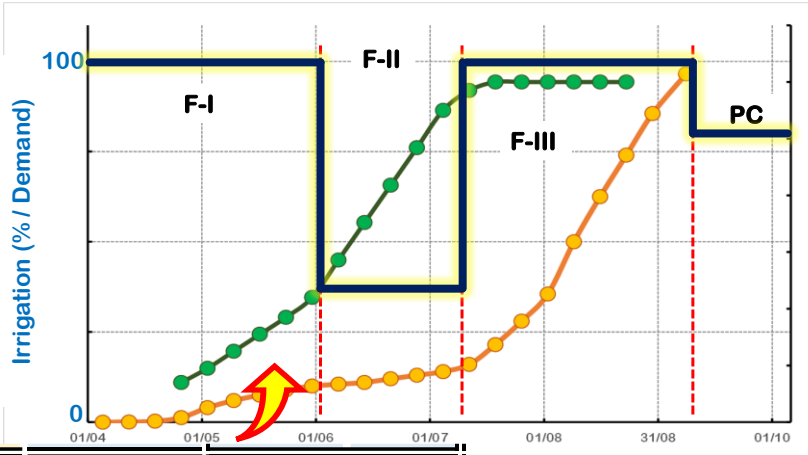

Mid Season Cultivars	**Deep** Soils	**High** Fruit Load	-0.5	100 - 80
		Low Fruit Load	-0.8	100 - 50
	Shallow Soils	**High** Fruit Load	-0.5	100
		Low Fruit Load	-0.7	100 - 80

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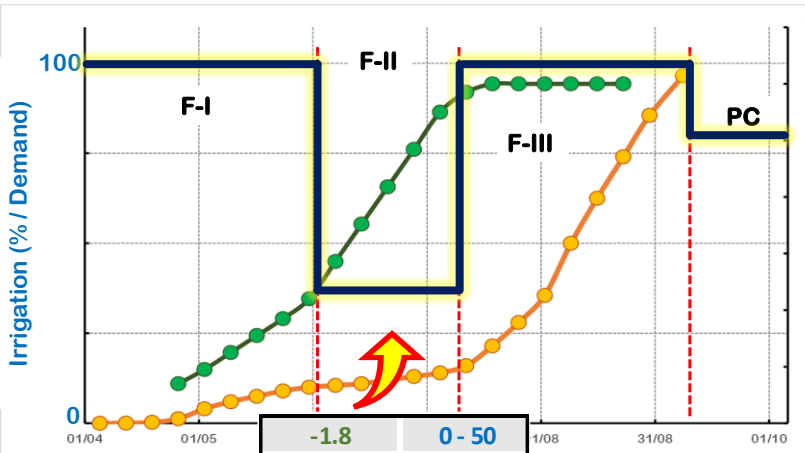

-1.8	0 - 50
-2.0	0- 50
-1.6	40 - 70
-1.8	40 - 50

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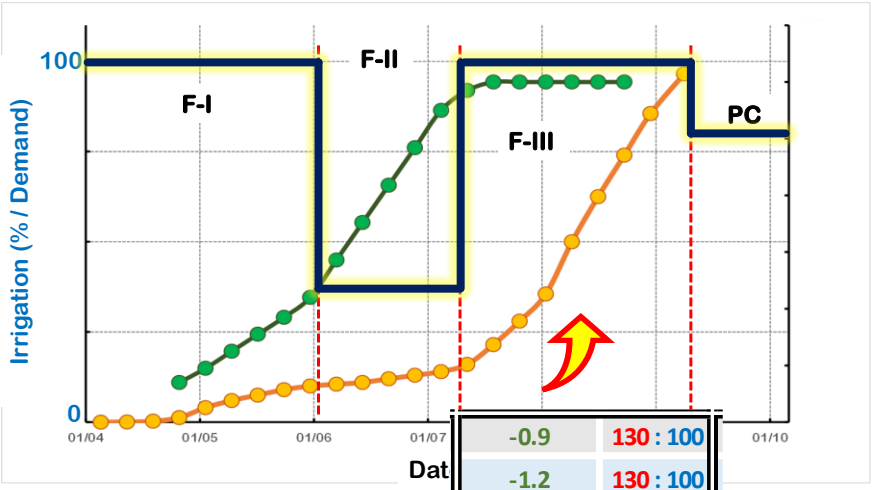

-0.9	130 : 100
-1.2	130 : 100
-0.9	110 : 100
-1.1	110 : 100

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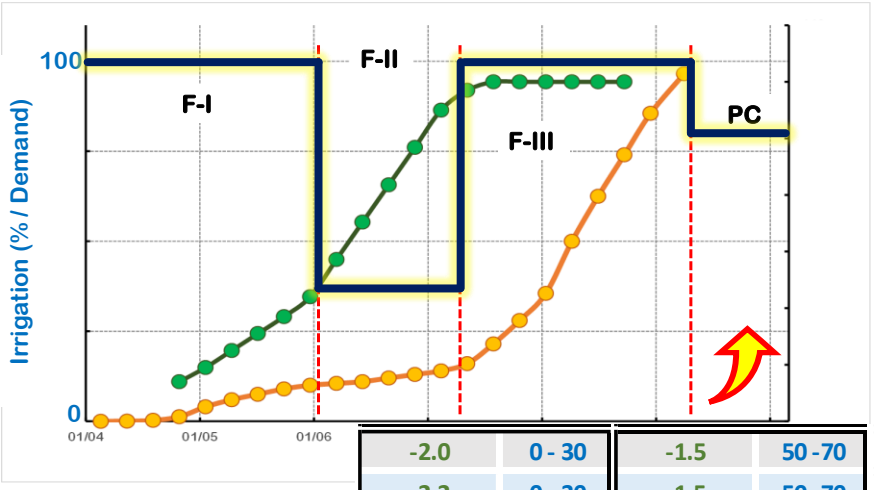

-2.0	0 - 30	-1.5	50 - 70
-2.2	0 - 30	-1.5	50 - 70
-2.0	20 - 50	-1.5	70 - 80
-2.2	20 - 50	-1.5	70 - 80

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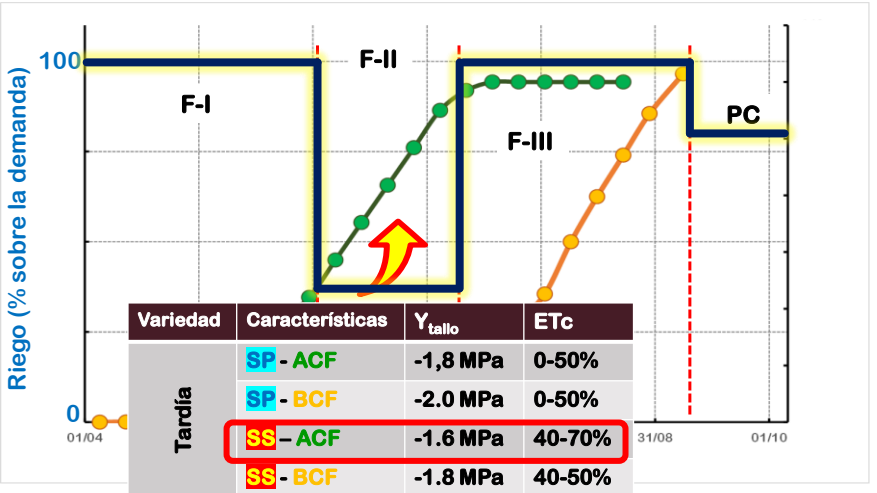
Fruits de Hueso
V Congreso Nacional

"Uso eficiente del agua en cultivos frutales"

Murcia, 24 de Noviembre de 2023 ·



Variedad	Características	Y_{tallo}	ETc
Tardía	SP - ACF	-1,8 MPa	0-50%
	SP - BCF	-2.0 MPa	0-50%
	SS – ACF	-1.6 MPa	40-70%
	SS - BCF	-1.8 MPa	40-50%

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"Efficient use of water in fruit crops"

REGULATED DEFICIT IRRIGATION

APPLE TREE

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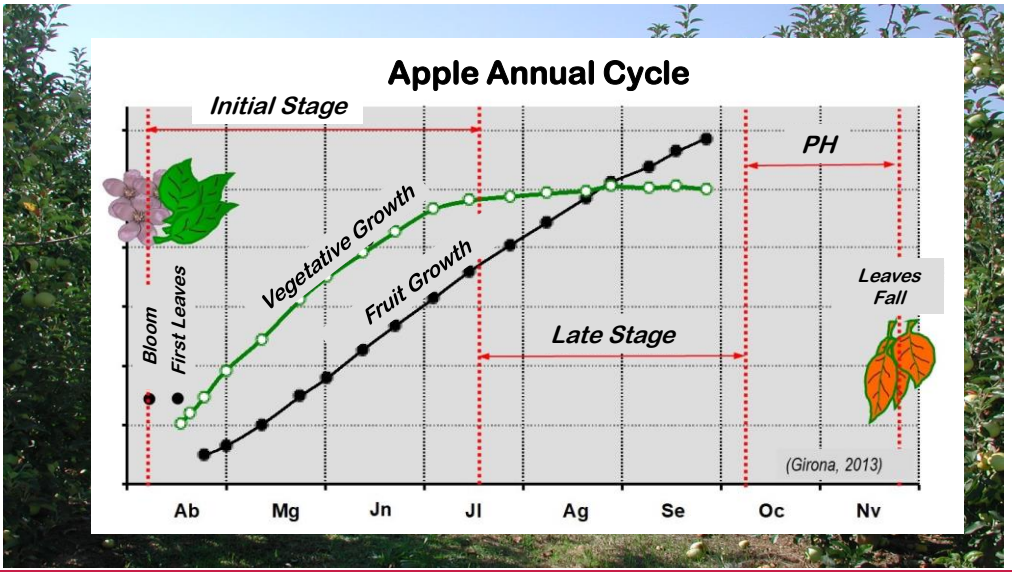

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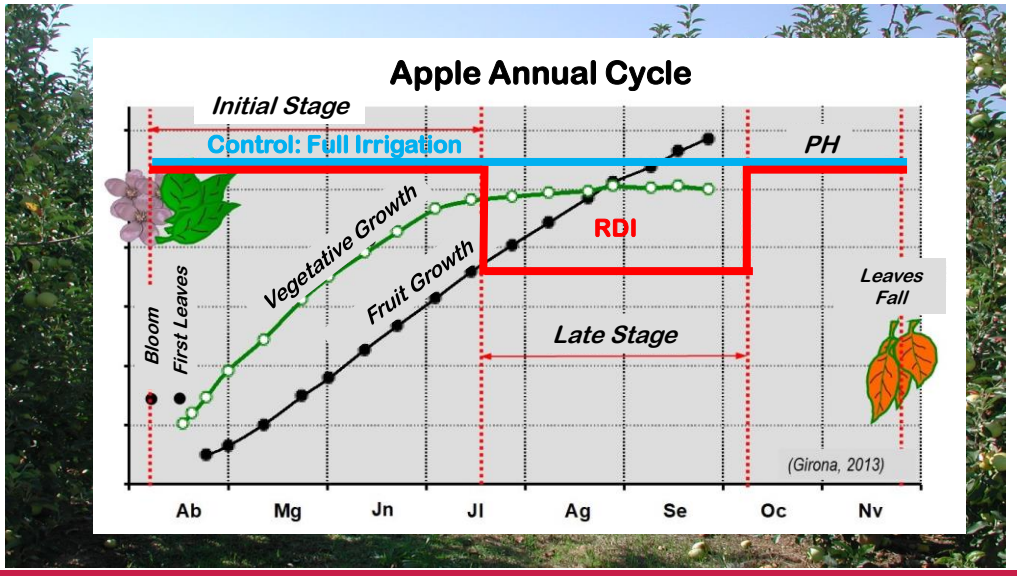

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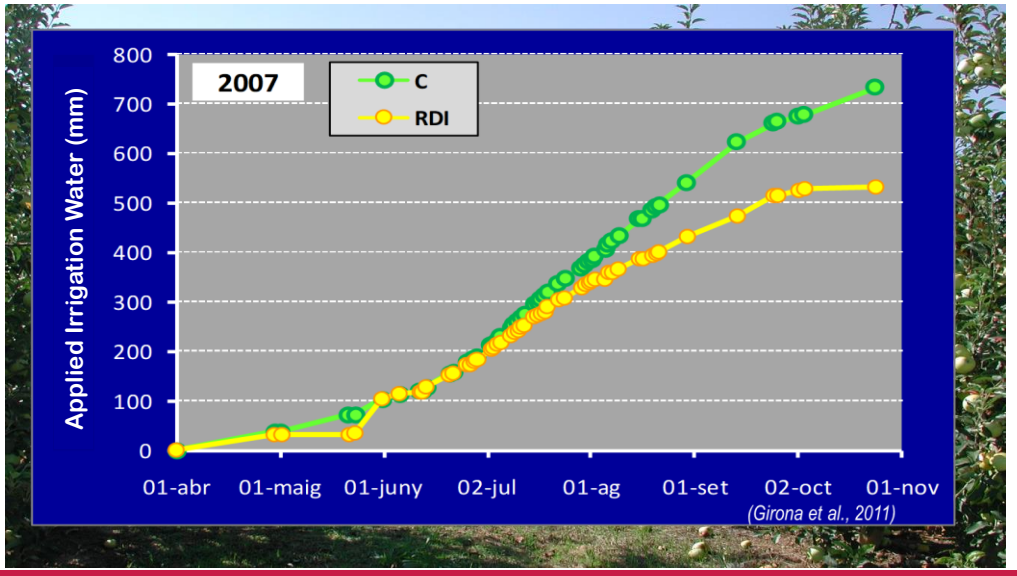

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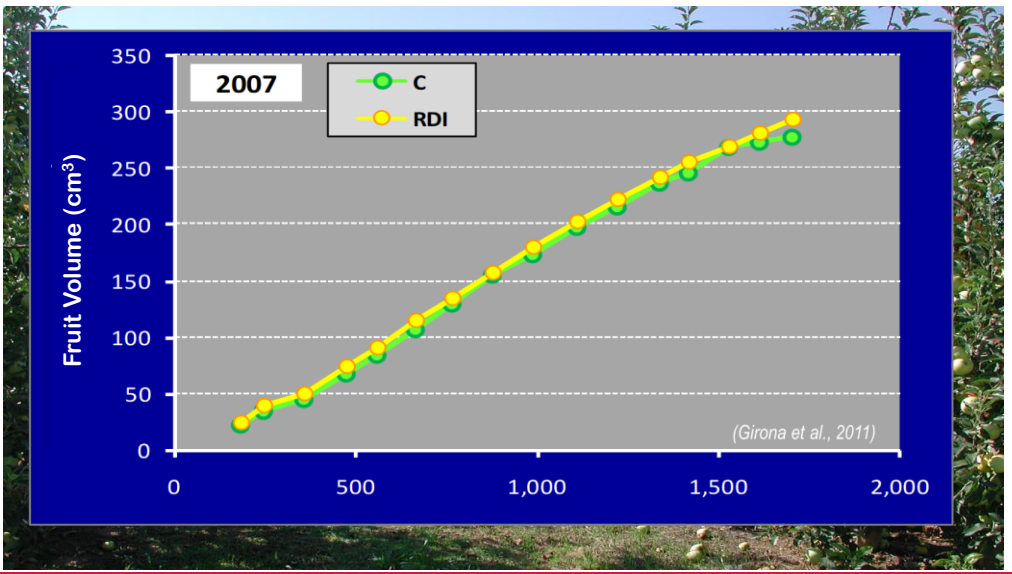

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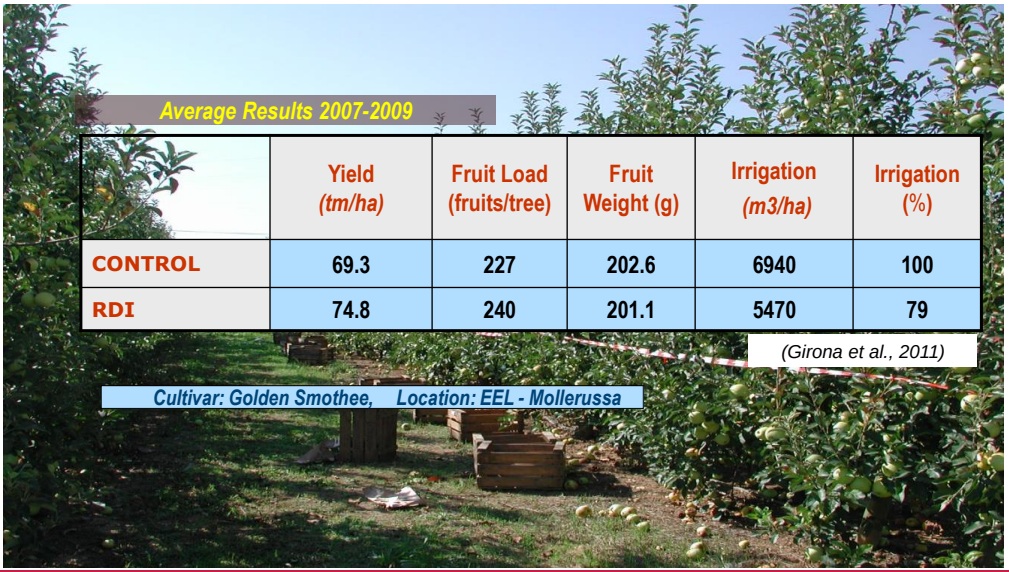
Average Results 2007-2009
Yield (tm/ha)
Fruit Load (fruits/tree)
Fruit Weight (g)
Irrigation (m3/ha)
Irrigation (%)
CONTROL 69.3 227 202.6 6940 100
RDI 74.8 240 201.1 5470 79
(Girona et al., 2011)
Cultivar: Golden Smothee, Location: EEL - Mollerussa
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[©JGirona/IRTA(2023)]

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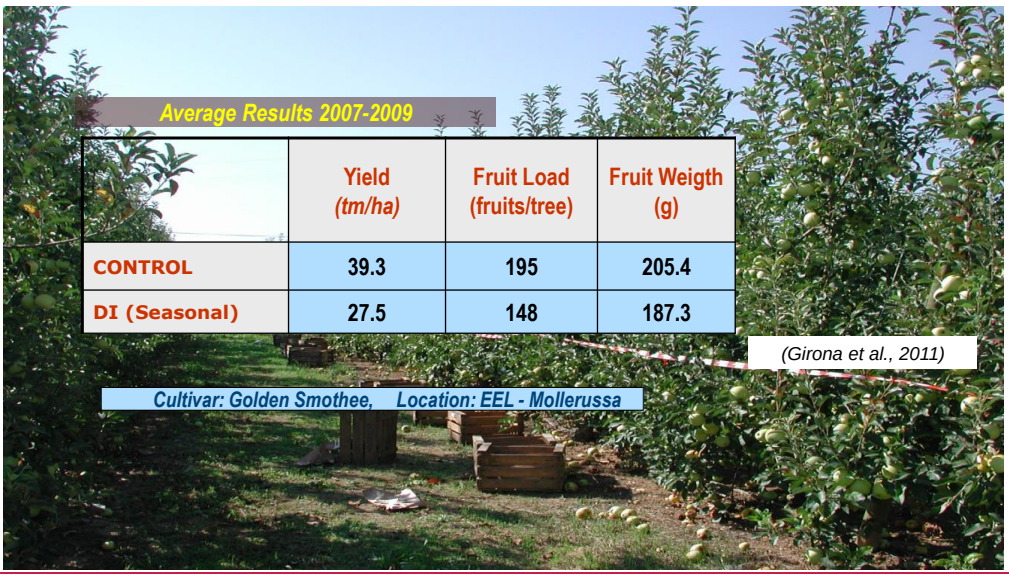
Average Results 2007-2009
Yield (tm/ha)
Fruit Load (fruits/tree)
Fruit Weigth (g)
CONTROL 39.3 195 205.4
DI (Seasonal) 27.5 148 187.3
(Girona et al., 2011)
Cultivar: Golden Smothee, Location: EEL - Mollerussa
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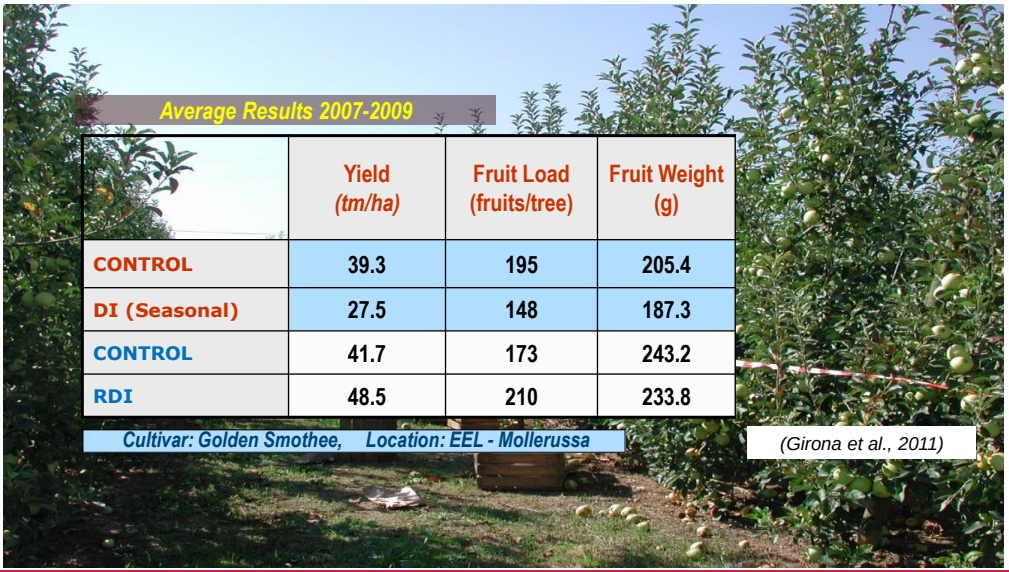

Average Results 2007-2009

	Yield (tm/ha)	Fruit Load (fruits/tree)	Fruit Weight (g)
CONTROL	39.3	195	205.4
DI (Seasonal)	27.5	148	187.3
CONTROL	41.7	173	243.2
RDI	48.5	210	233.8

Cultivar: Golden Smothee, Location: EEL - Mollerussa

(Girona et al., 2011)

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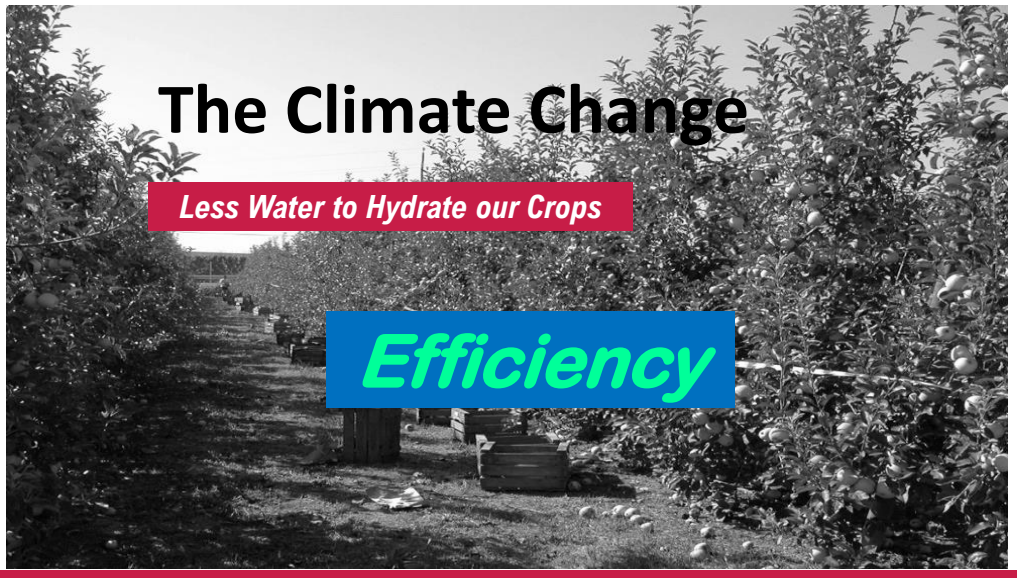

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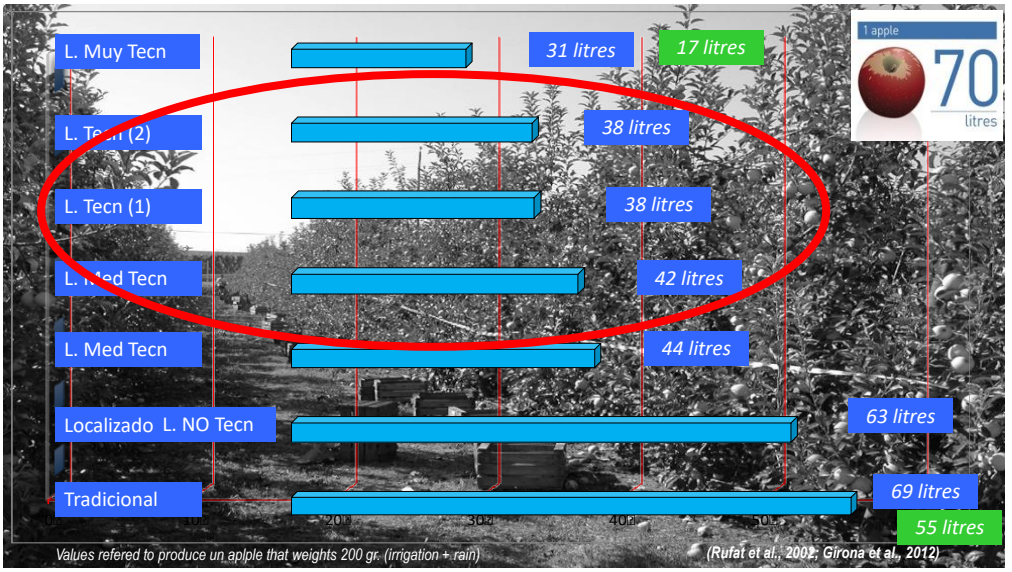

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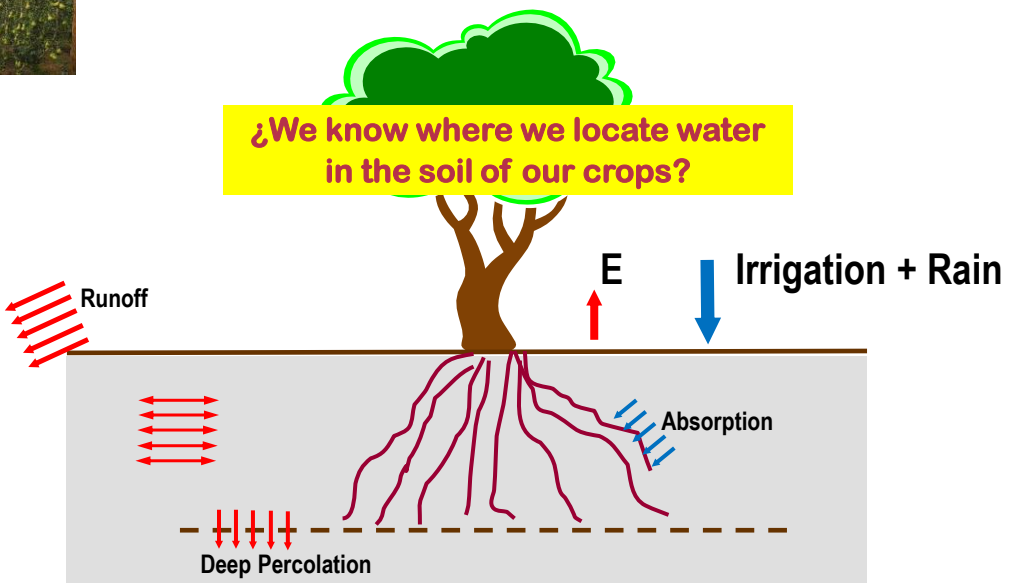
"Efficient use of water in fruit crops"



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48. Bundessteinobstseminar
11. - 14.12.2023

Steinobst bahnt sich einen Weg in die Zukunft!

“Bewässerung im Steinobst bei zunehmender Wasserknappheit - Ressourcenschonende Strategien aus Spanien”

Dr. Joan Girona
IRTA – *Programm zur effizienten Wassernutzung in der Landwirtschaft*
joan.girona@irta.cat

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