

WATER REQUIREMENTS AND MANAGEMENT SKILLS FOR A SUSTAINABLE FOOD PRODUCTION

Joan Girona-Gomis, PhD
Researcher at Efficient Use of Water In Agriculture Programme
IRTA

1



**HOW MUCH WATER IS NEEDED TO
PRODUCE THESE FOODS ?**

 **IRTA**⁹

©JGirona/IRTA(2022)

2



3

WATER REQUIREMENTS AND MANAGEMENT
SKILLS FOR A SUSTAINABLE FOOD PRODUCTION

- **Why plants need water to produce foods**

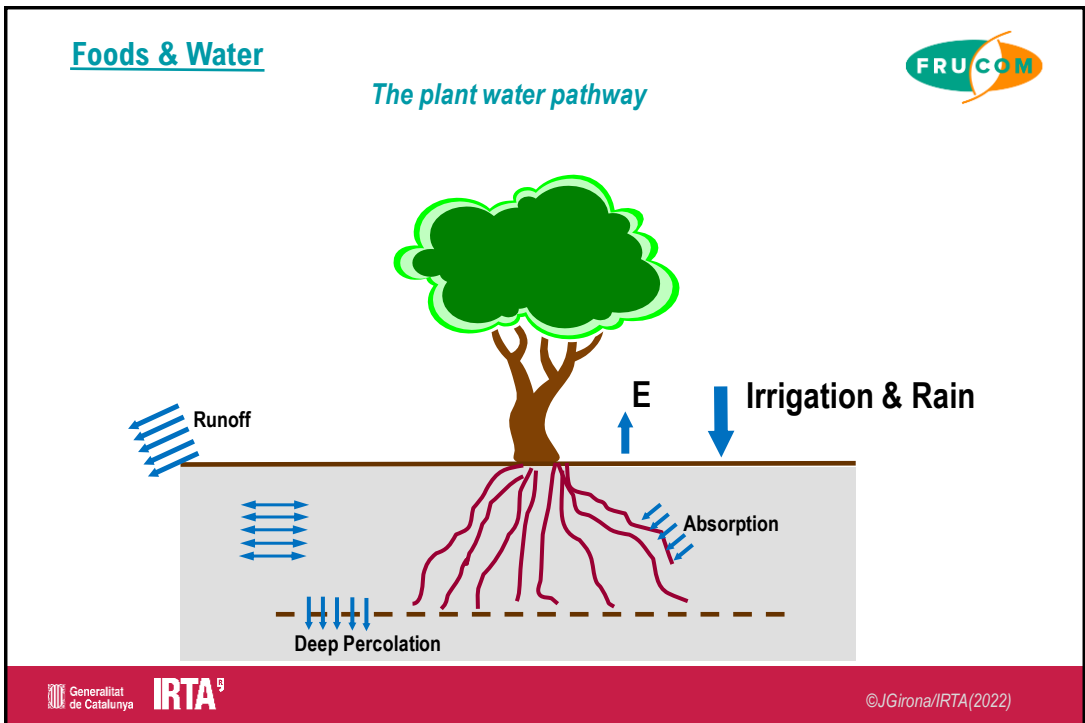
IRTA

©JGirona/IRTA(2022)

4

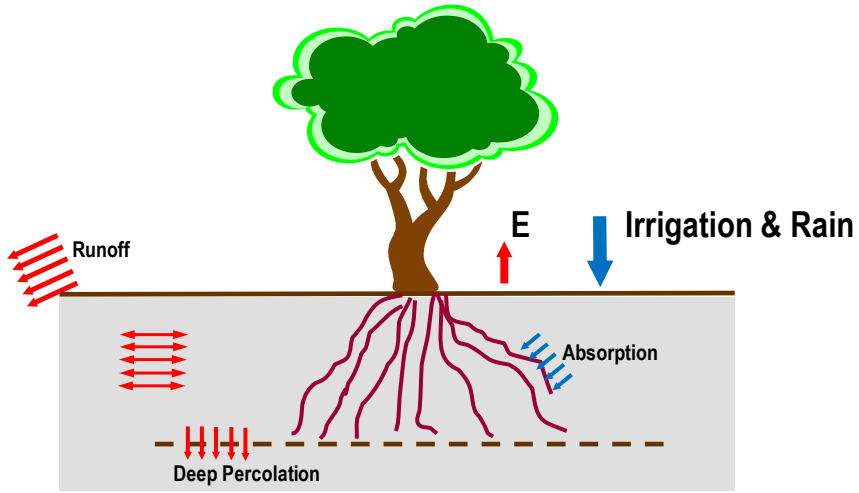


5



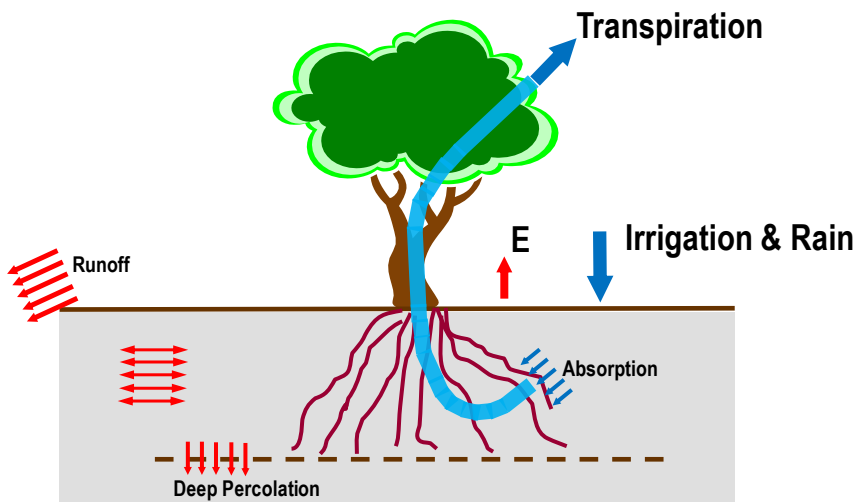
6

The plant water pathway



7

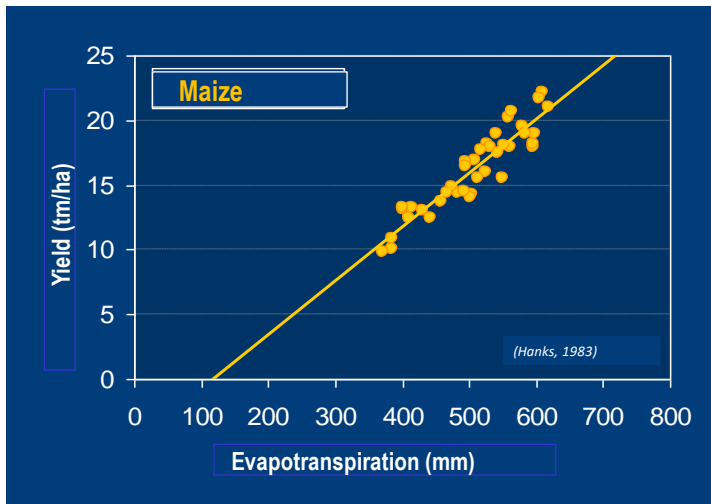
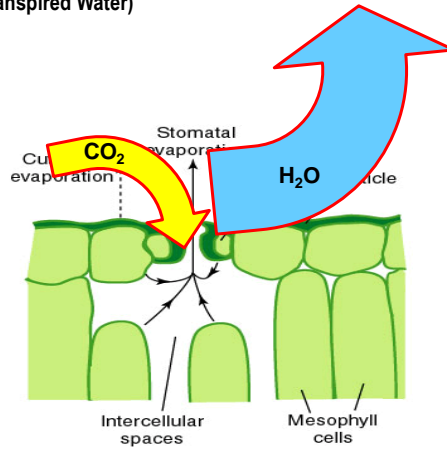
The plant water pathway

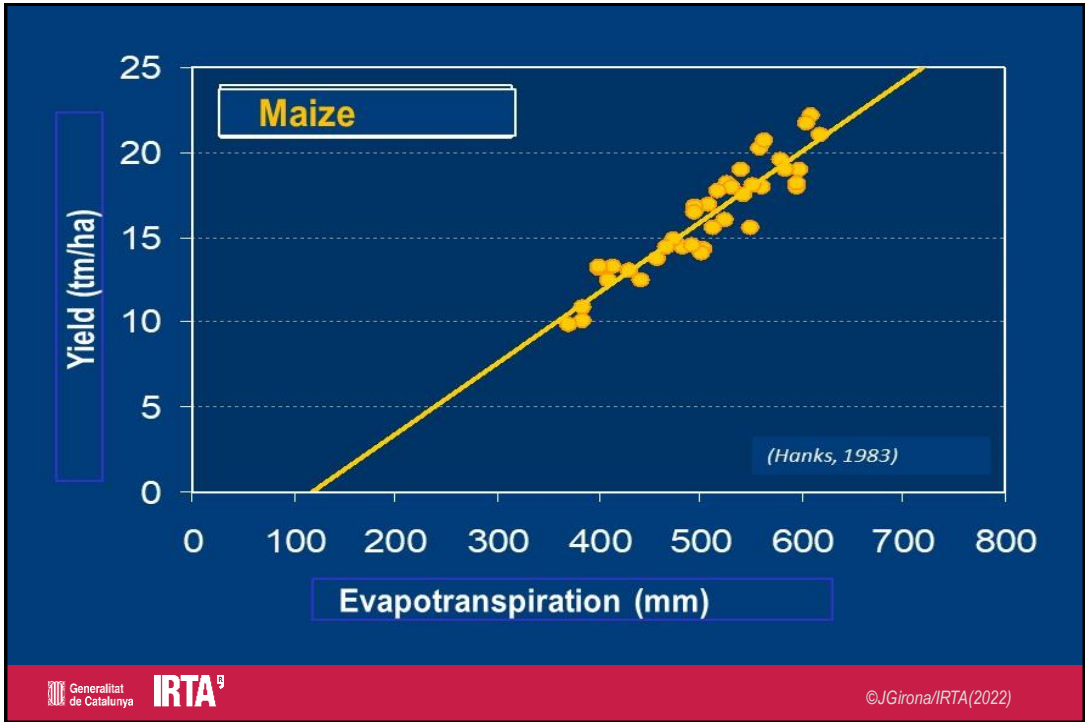


8

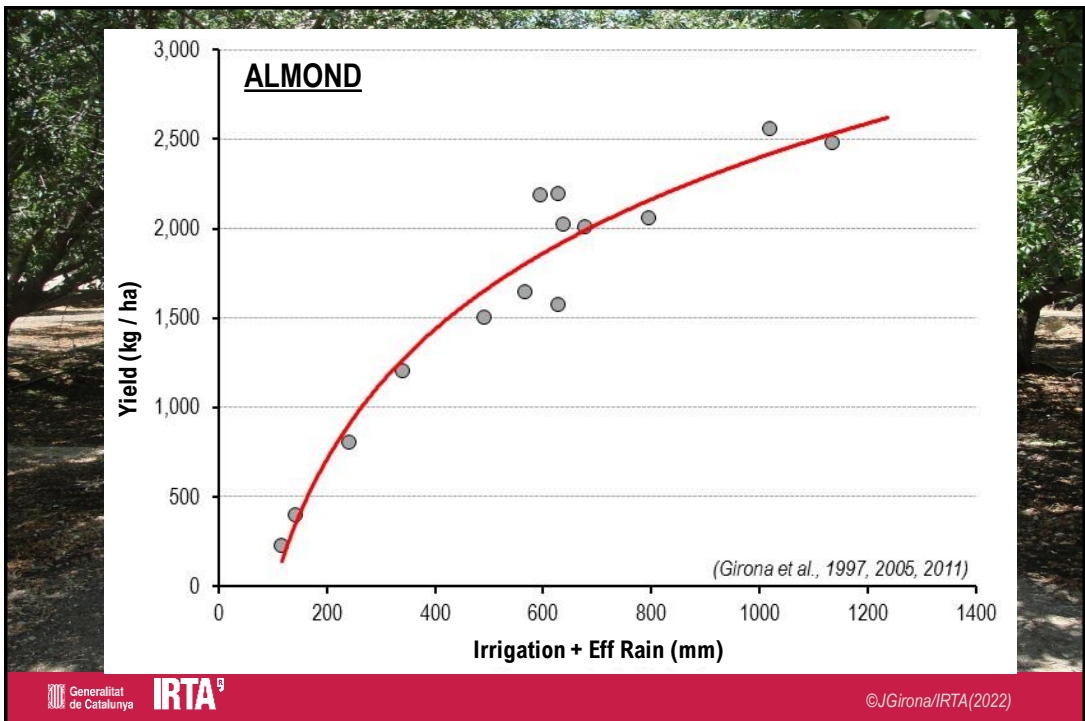
PHOTOSYNTHESIS

$$\text{Biomass Production} = f(\text{Transpired Water})$$





11



12

To take home




- *We need water to produce foods.*
- *Without water there is no food.*

Generalitat de Catalunya IRTA

©JGirona/IRTA(2022)

13



WATER REQUIREMENTS AND MANAGEMENT
SKILLS FOR A SUSTAINABLE FOOD PRODUCTION

- **Why plants need water to produce foods**
- **How much water is needed to produce foods**

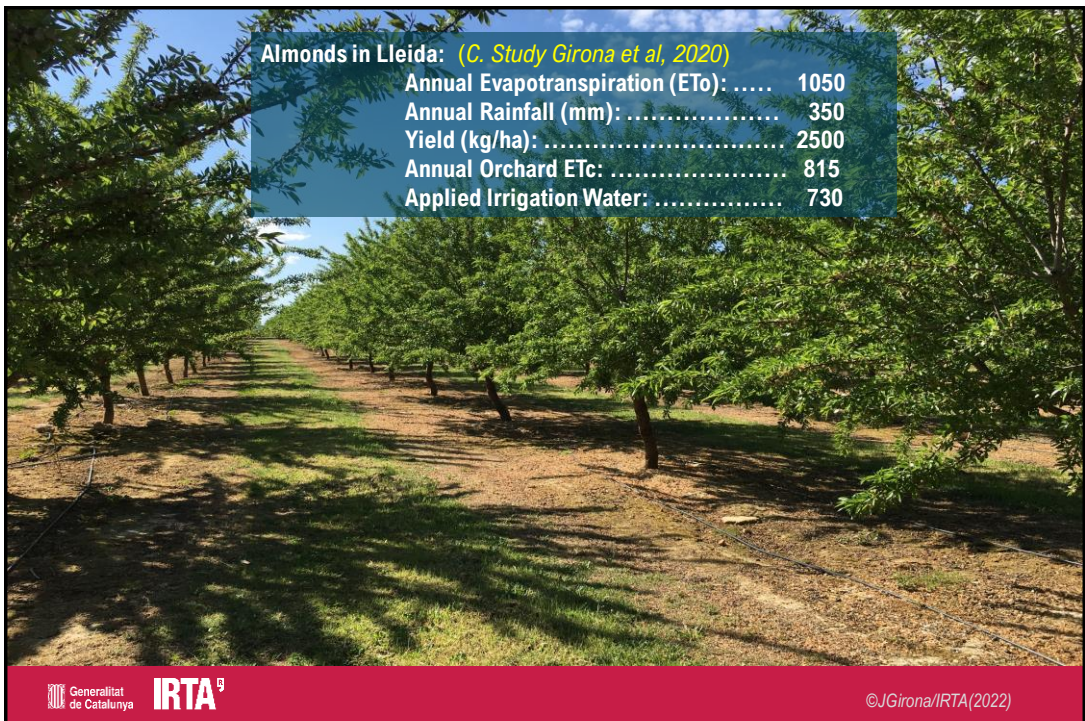
IRTA

©JGirona/IRTA(2022)

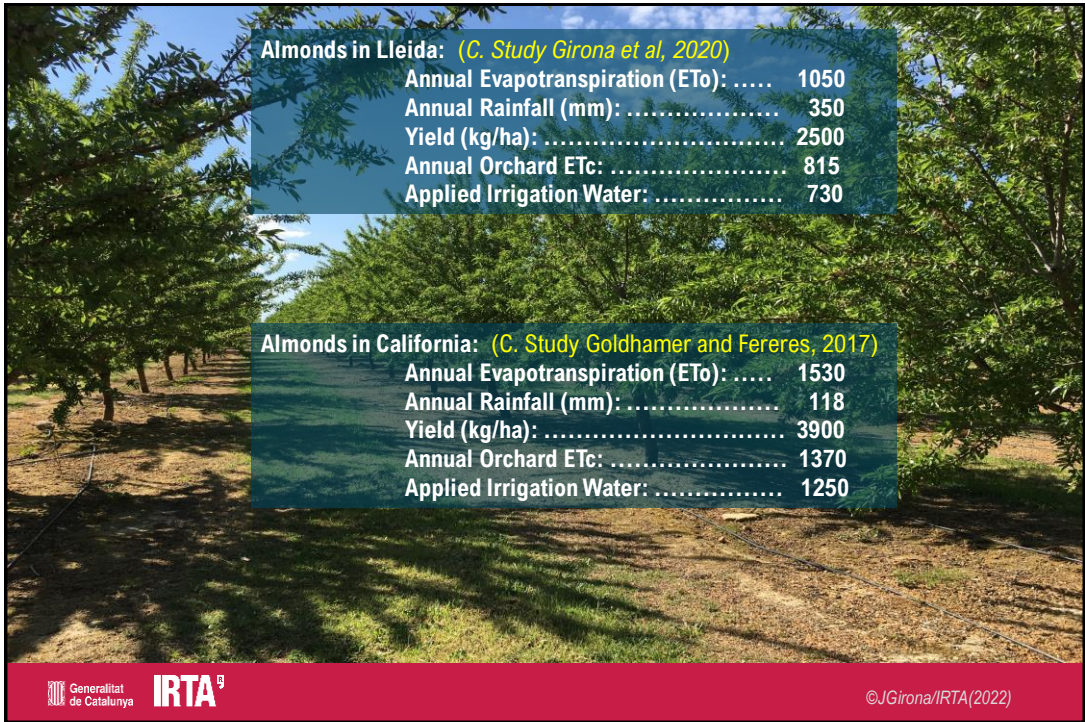
14



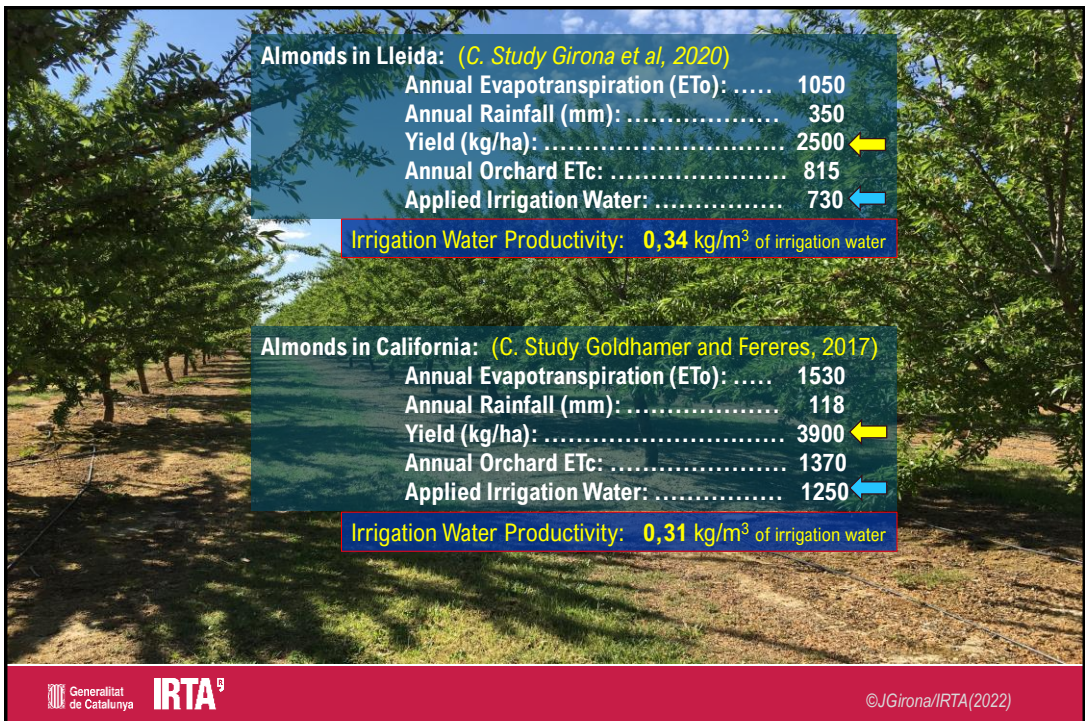
15



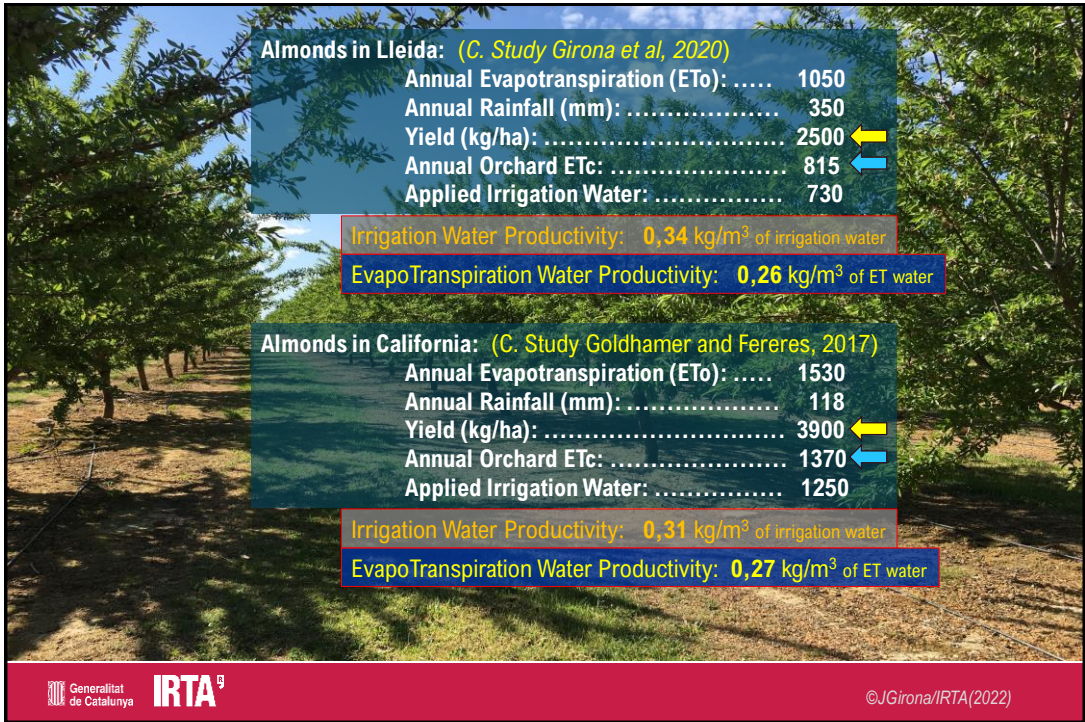
16



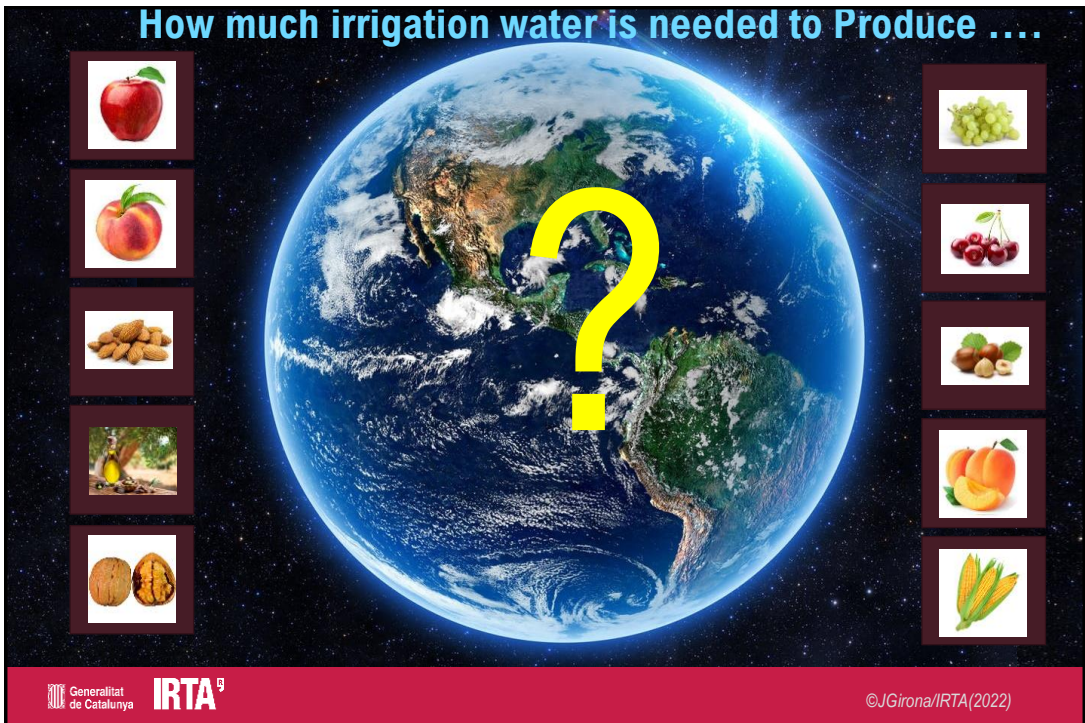
17



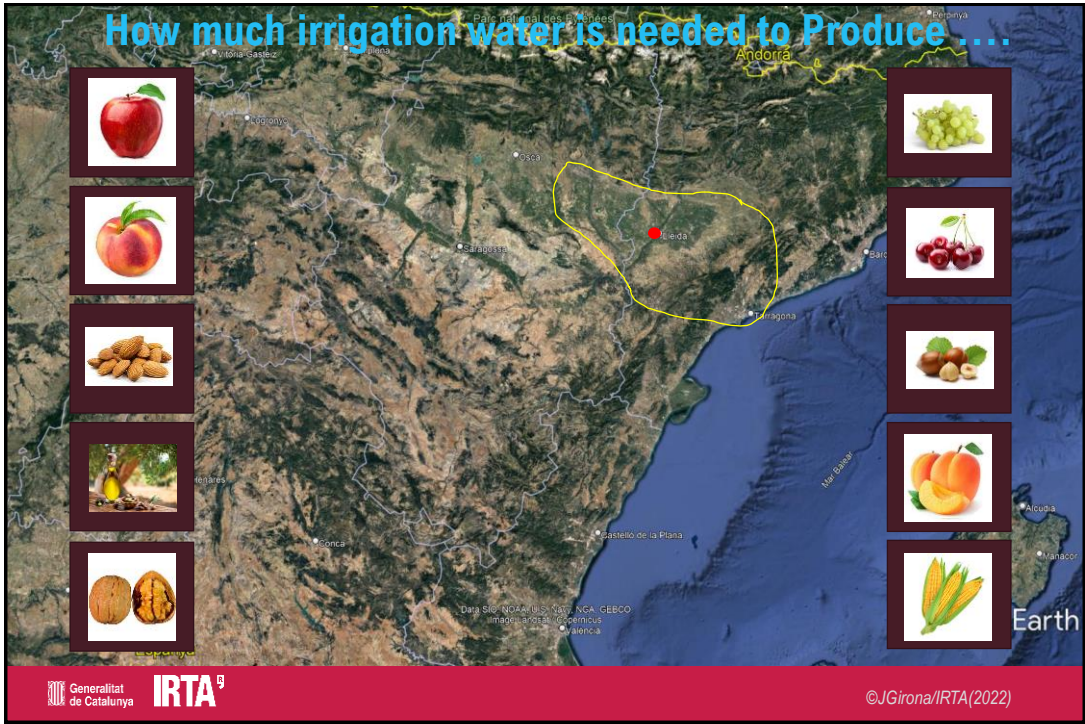
18



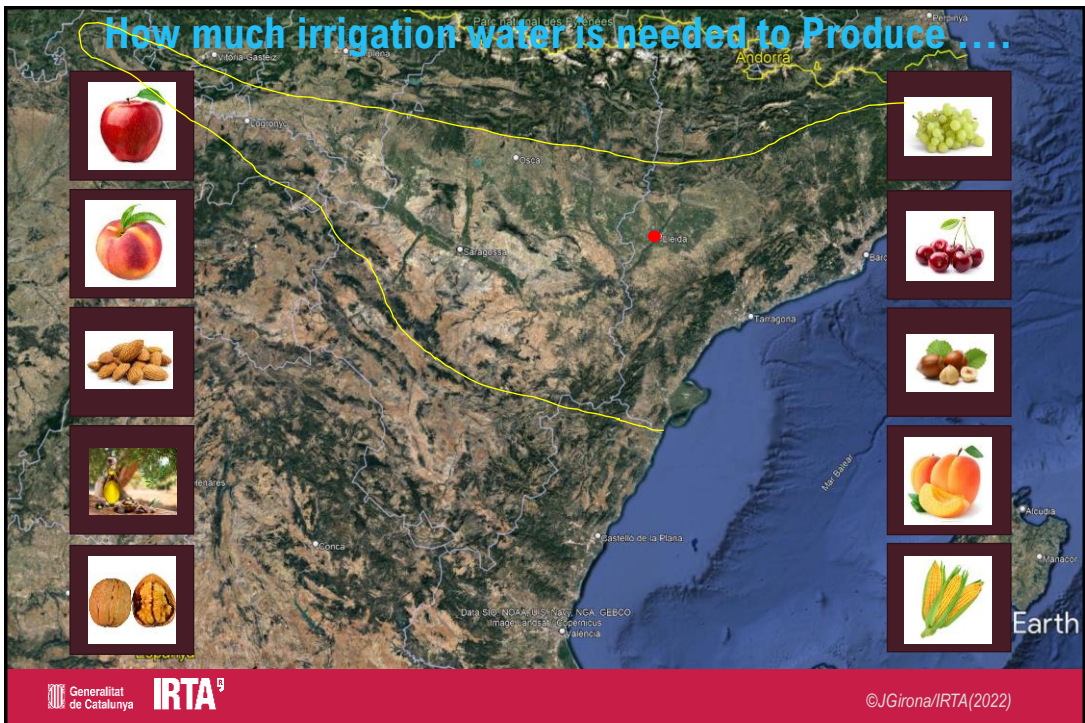
19



20



21













22

How much irrigation water is needed to Produce

	Apples 65000 kg/ha <i>(Girona et al., 2010)</i> 0,10 m³/kg		Wine Grapes 12000 kg/ha <i>(Girona et al., 2006)</i> 0,22 m³/kg
	Peaches 45000 kg/ha <i>(Girona et al., 2003)</i> 0,12 m³/kg		Cherries 35000 kg/ha <i>(Marsal et al., 2010)</i> 0,10 m³/kg
	Almonds 2500 kg/ha <i>(Girona et al., 2020)</i> 2,92 m³/kg		Hazelnuts 2000 kg/ha <i>(Girona et al., 2007)</i> 1,75 m³/kg
	Olives (Olive Oil) 10000 kg/ha <i>(Gispert et al., 2012)</i> 0,20 m³/kg		Apricots 7500 kg/ha <i>(Nicolás et al., 2013)</i> 0,56 m³/kg
	Walnuts 2500 kg/ha <i>(Lampinen and Girona, 2017)</i> 3,00 m³/kg		Maize 15000 kg/ha <i>(Rufat et al., 2006)</i> 0,47 m³/kg

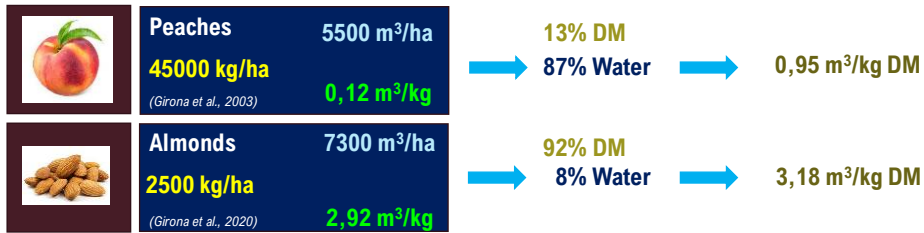
23

How much irrigation water is needed to Produce

	Apples 65000 kg/ha <i>(Girona et al., 2010)</i> 0,10 m³/kg		Wine Grapes 12000 kg/ha <i>(Girona et al., 2006)</i> 0,22 m³/kg
	Peaches 45000 kg/ha <i>(Girona et al., 2003)</i> 0,12 m³/kg		Cherries 35000 kg/ha <i>(Marsal et al., 2010)</i> 0,10 m³/kg
	Almonds 2500 kg/ha <i>(Girona et al., 2020)</i> 2,92 m³/kg		Hazelnuts 2000 kg/ha <i>(Girona et al., 2007)</i> 1,75 m³/kg
	Olives (Olive Oil) 10000 kg/ha <i>(Gispert et al., 2012)</i> 0,20 m³/kg		Apricots 7500 kg/ha <i>(Nicolás et al., 2013)</i> 0,56 m³/kg
	Walnuts 2500 kg/ha <i>(Lampinen and Girona, 2017)</i> 3,00 m³/kg		Maize 15000 kg/ha <i>(Rufat et al., 2006)</i> 0,47 m³/kg

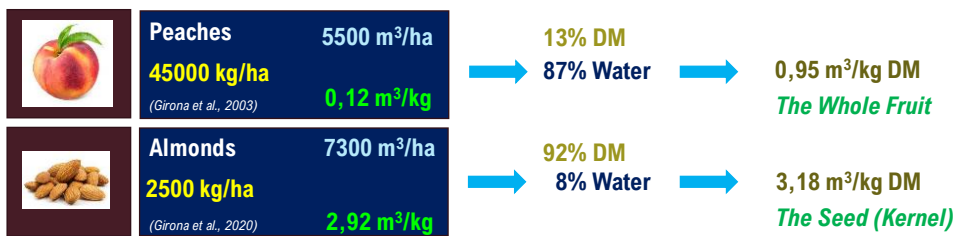
24

How much irrigation water is needed to Produce



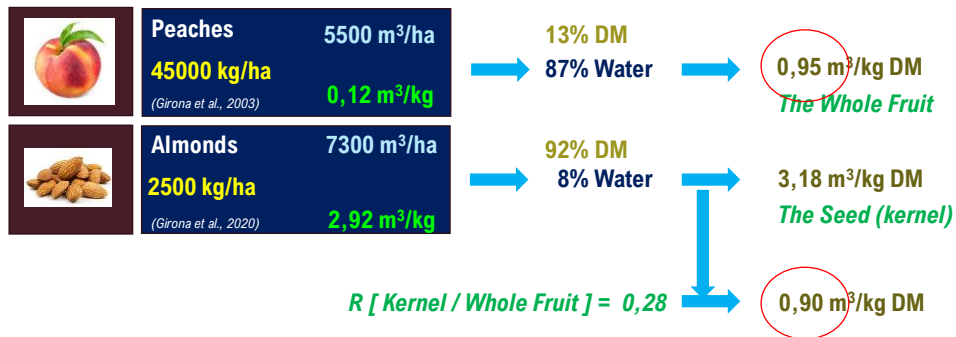
25

How much irrigation water is needed to Produce



26

How much irrigation water is needed to Produce



27

How much irrigation water is needed to Produce

	Apples 65000 kg/ha <small>(Girona et al., 2010)</small> 6400 m ³ /ha 0,10 m ³ /kg		Wine Grapes 12000 kg/ha <small>(Girona et al., 2006)</small> 2600 m ³ /ha 0,22 m ³ /kg
	Peaches 45000 kg/ha <small>(Girona et al., 2003)</small> 5500 m ³ /ha 0,12 m ³ /kg		Cherries 35000 kg/ha <small>(Marsal et al., 2010)</small> 3500 m ³ /ha 0,10 m ³ /kg
	Almonds 2500 kg/ha <small>(Girona et al., 2020)</small> 7300 m ³ /ha 2,92 m ³ /kg		Hazelnuts 2000 kg/ha <small>(Girona et al., 2007)</small> 3500 m ³ /ha 1,75 m ³ /kg
	Olives (Olive Oil) 10000 kg/ha <small>(Gispert et al., 2012)</small> 2000 m ³ /ha 0,20 m ³ /kg		Apricots 7500 kg/ha <small>(Nicolás et al., 2013)</small> 4200 m ³ /ha 0,56 m ³ /kg
	Walnuts 2500 kg/ha <small>(Lampinen and Girona, 2017)</small> 7500 m ³ /ha 3,00 m ³ /kg		Maize 15000 kg/ha <small>(Rufat et al., 2006)</small> 7000 m ³ /ha 0,47 m ³ /kg

28

How much irrigation water is needed to Produce The Water Opportunity Cost

3,50 €/kg

1,25 €/ m³ Water Value



Almonds 7300 m³/ha
2500 kg/ha
(Girona et al., 2020) 2,92 m³/kg

0,20 €/kg

0,43 €/ m³ Water Value



Maize 7000 m³/ha
15000 kg/ha
(Rufat et al., 2006) 0,47 m³/kg

Generalitat de Catalunya

IRTA

©JGirona/IRTA(2022)

29

To take home

- We need water to produce foods.
- Without water there is no food.
- We need a lot of water to produce any food



Generalitat de Catalunya

IRTA

©JGirona/IRTA(2022)

30



WATER REQUIREMENTS AND MANAGEMENT
SKILLS FOR A SUSTAINABLE FOOD PRODUCTION

- Why plants need water to produce foods
- How much water is needed to produce foods
- **We need Food to Feed**



31



32



33



34

We need Water To Feed our People

World Population
Projected world population until 2100

Year	Projected world population (billion)
1990	5.2
2017	7.6
2030	8.6
2050	9.8
2100	11.2

Source: United Nations Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2019 Revision*, Prepared for the World Health Organization by the Institute of Health Metrics and Evaluation

© 2020 UNITED NATIONS GOALS

Generalitat de Catalunya **IRTA**

©JGirona/IRTA(2022)

35

We need Water To Feed our People

World Population
Projected world population until 2100

Year	Projected world population (billion)
1990	5.3
2017	7.6
2030	8.6
2050	9.8
2100	11.2

Source: United Nations Department of Economic and Social Affairs, Population Division, *World Population Prospects: The 2019 Revision*, Prepared for the World Health Organization by the Institute of Health Metrics and Evaluation

© 2020 UNITED NATIONS GOALS

Piràmide de l'alimentació saludable

Generalitat de Catalunya **IRTA**

©JGirona/IRTA(2022)

36

We need Water To Feed our People

World Population
Projected world population until 2100

Year	Population (billion)
1990	5.2
2017	7.6
2030	8.6
2050	9.8
2100	11.2

Piràmide de l'alimentació saludable

Generalitat de Catalunya **IRTA**
©JGirona/IRTA(2022)

37

We need Water To Feed our People

World Population
Projected world population until 2100

Year	Population (billion)
1990	5.2
2017	7.6
2030	8.6
2050	9.8
2100	11.2

Piràmide de l'alimentació saludable

Generalitat de Catalunya **IRTA**
©JGirona/IRTA(2022)

38

To take home




- We need water to produce foods.
- Without water there is no food.
- We need a lot of water to produce any food.
- **With CC, increase in World Population and change in food habits, we need much more food to feed our people, and we don't have enough water to produce these foods if we remain BAU.**

Generalitat de Catalunya **IRTA**

©JGirona/IRTA(2022)

39



WATER REQUIREMENTS AND MANAGEMENT
SKILLS FOR A SUSTAINABLE FOOD PRODUCTION

- Why plants need water to produce foods
- How much water is needed to produce foods
- We need Food to Feed
- **Research, Knowledge and Technology to Improve Water Use Efficiency**

IRTA

©JGirona/IRTA(2022)

40



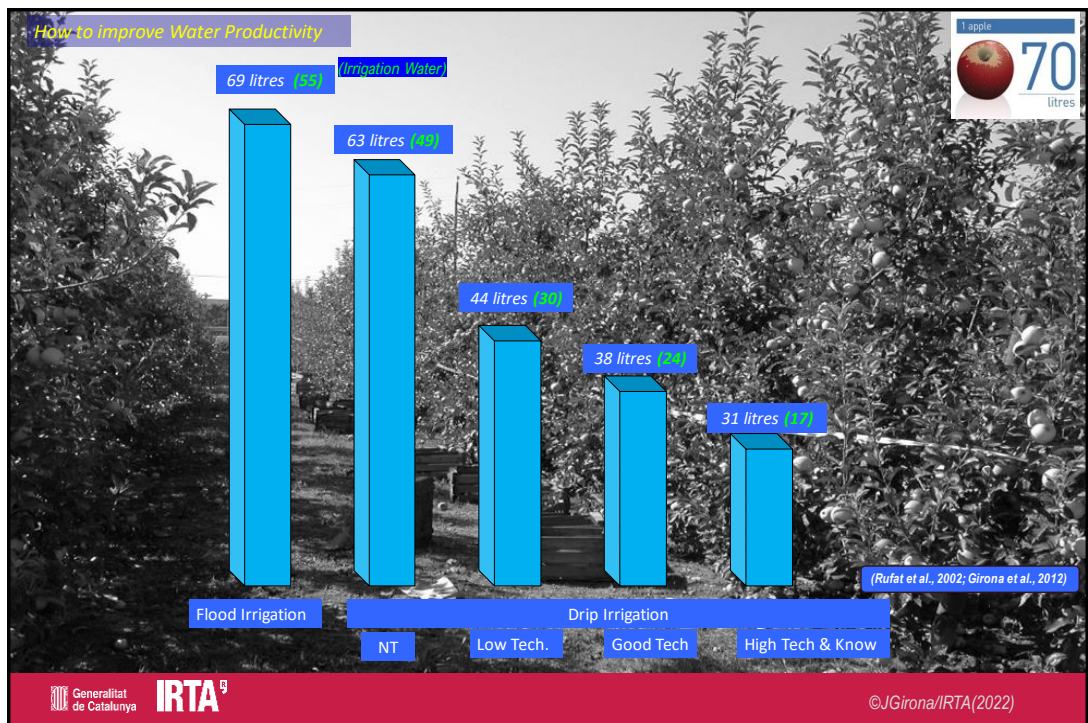
1 apple



70
litres



41



42

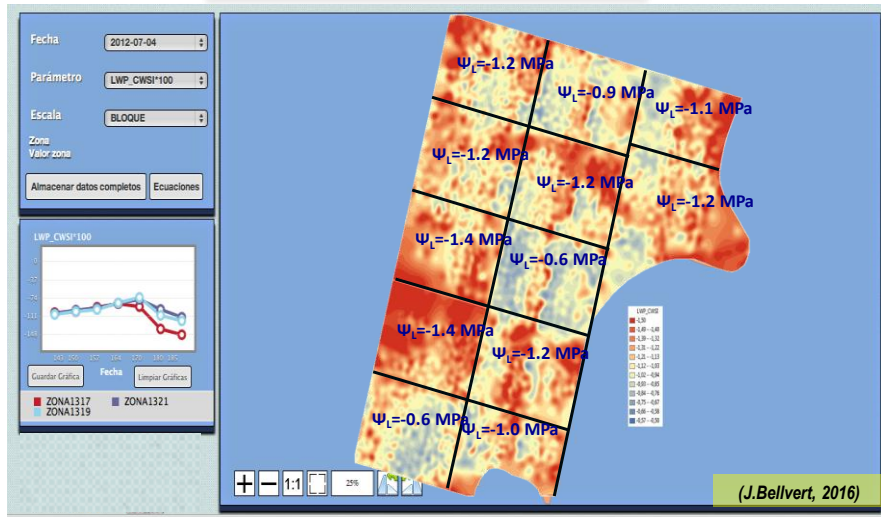
REMOTE SENSING



43

Paso 5. Decisiones de programación de riego

Mapa de estrés hídrico en viña



44



(J.Casadesús, 2016)



To take home




- *We need water to produce foods.*
- *Without water there is no food.*
- *We need a lot of water to produce any food.*
- *With CC, increase in World Population and change in food habits, we need much more food to feed our people, and we don't have enough water to produce these foods if we remain BAU.*
- ***We need to Improve Productive Water Use Efficiency. It's difficult, but possible: RESEARCH & TECHNOLOGY***




©JGirona/IRTA(2022)

47

To take home




- *We need water to produce foods.*
- *Without water there is no food.*
- *We need a lot of water to produce any food.*
- *With CC, increase in World Population and change in food habits, we need much more food to feed our people, and we don't have enough water to produce these foods if we remain BAU.*
- ***We need to Improve Productive Water Use Efficiency. It's difficult, but possible: RESEARCH & TECHNOLOGY***




©JGirona/IRTA(2022)

48

WATER REQUIREMENTS AND MANAGEMENT SKILLS FOR A SUSTAINABLE FOOD PRODUCTION

This presentation and all its contents are protected by current legislation on industrial and intellectual property. Therefore, it is expressly forbidden to reproduce, copy, modify or transform it without the express permission of IRTA.

Joan Girona-Gomis, PhD
Researcher at Efficient Use of Water In Agriculture Programme
IRTA