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Fakultät für Naturwissenschaften und Technik
Facoltà di Scienze e Tecnologie
Faculty of Science and Technology

XI Giornate Scientifiche SOI
14–16 settembre 2016
Bozen – Bolzano

SOI

LIFE 14 CCA/GR/00389 - AgroClimaWater

Water resilient agriculture: sustainable irrigation strategies in fruit tree orchards

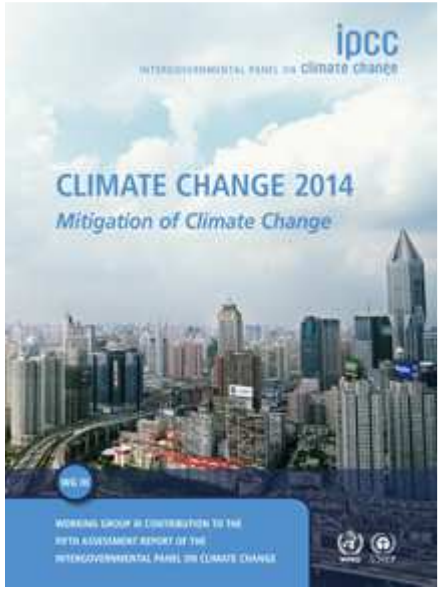
Bartolomeo Dichio

Dichio B., Mininni A. N., Xylogiannis E., Montanaro G

Università degli Studi della Basilicata /DiCEM




Report Intergovernmental Panel for Climate Change (Ipcc)



September 2013 – Stockolm Approved Berlin, Germany (7-11 April 2014)

There are not significant effects on mitigation of Climate Change

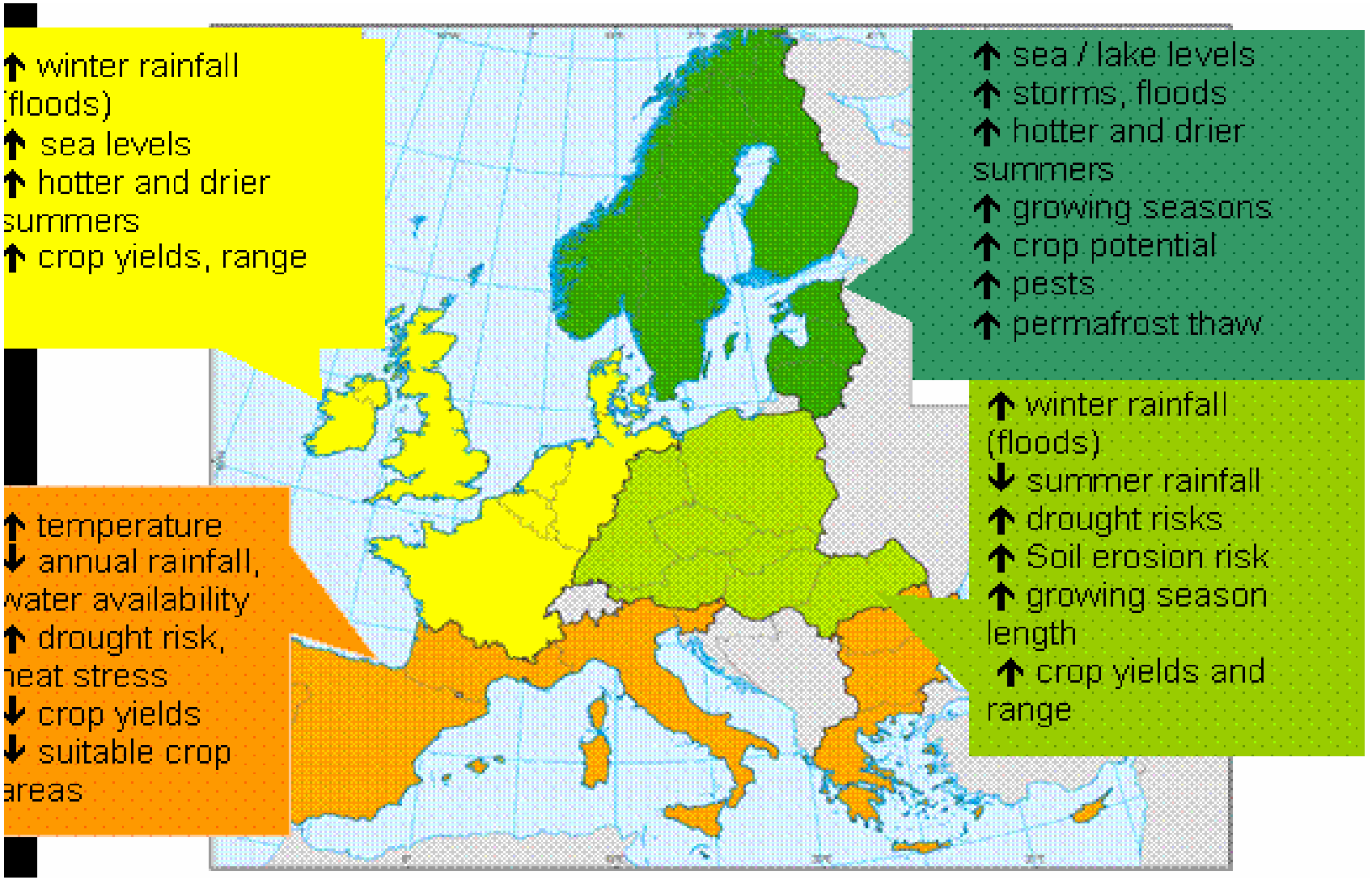
- ***GLOBAL TEMPERATURES ARE LIKELY TO RISE BY 0.3 TO 5 °C BY THE END OF THE CENTURY.***

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

Parties to the U.N. Framework Convention on Climate Change (UNFCCC) reached a landmark agreement on December 12 in Paris

Reaffirm the goal of limiting global temperature increase well below 2 degrees Celsius, while urging efforts to limit the increase to 1.5 degrees

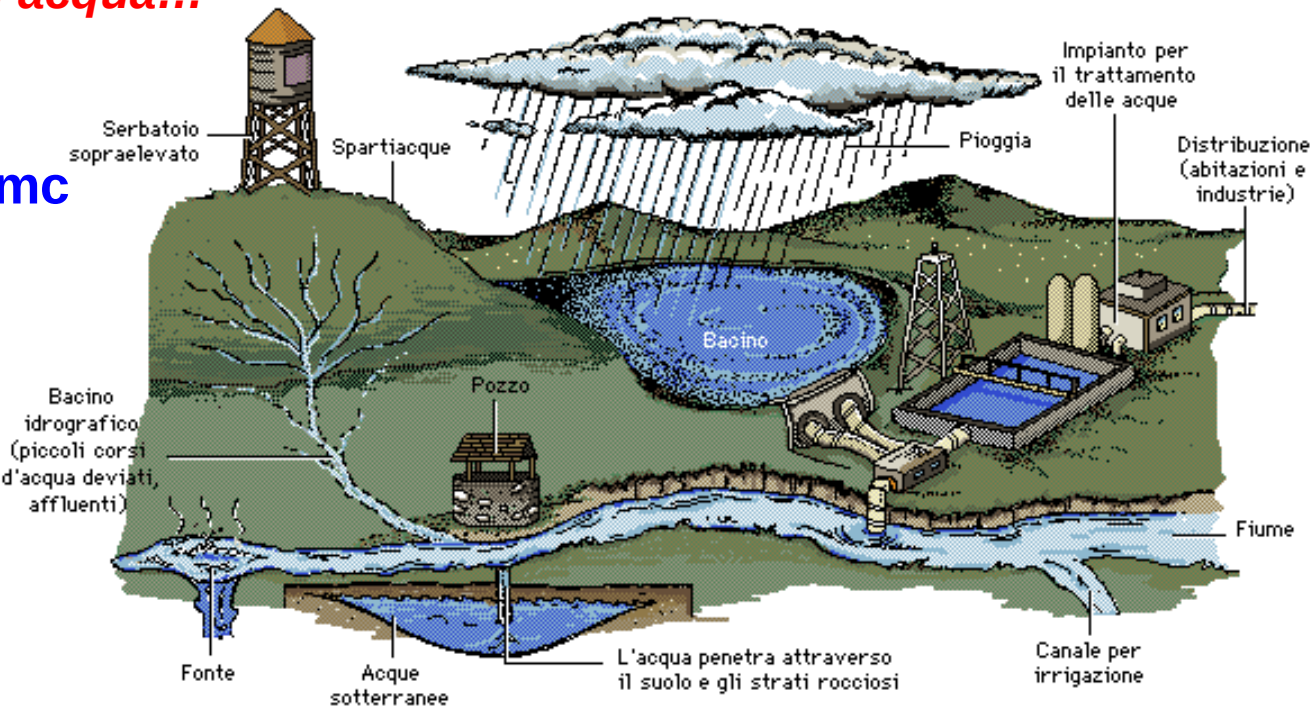
Cambiamenti Climatici in Europa



http://ec.europa.eu

…il valore energetico dell'acqua…

1 mc di acqua = 1kWh/mc (valor medio in Italia);



ogni spreco di acqua si traduce in :

- **riduzione della risorsa idrica disponibile**

- **un peggioramento delle emissioni globali di gas serra nella misura necessaria a produrre l'energia associata ai mc di acqua persa**

….quindi, per mitigare il fenomeno dei cambiamenti climatici e desertificazione vanno ottimizzate tutte le fasi del ciclo dell'acqua

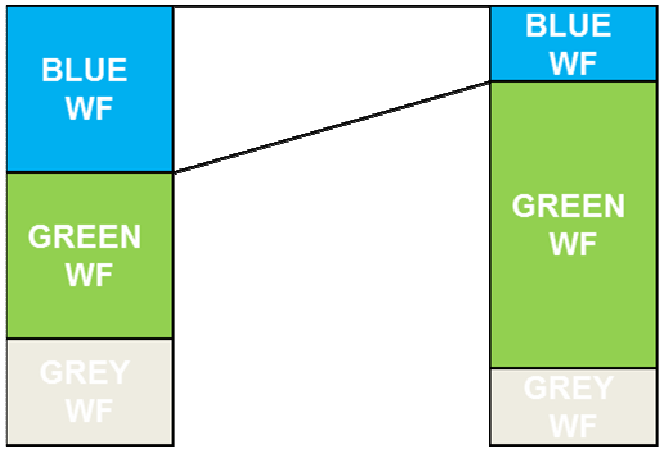
Climate-Smart Agriculture (sustainable) is needed

CSA is agriculture that

- **increases yields (poverty reduction & food security),**
- **makes yields more resilient in the face of worsening weather conditions (adaptation), and**
- **transforms the farm into a solution to the climate change problem (mitigation).**

(World Bank , 2012)

Strategie



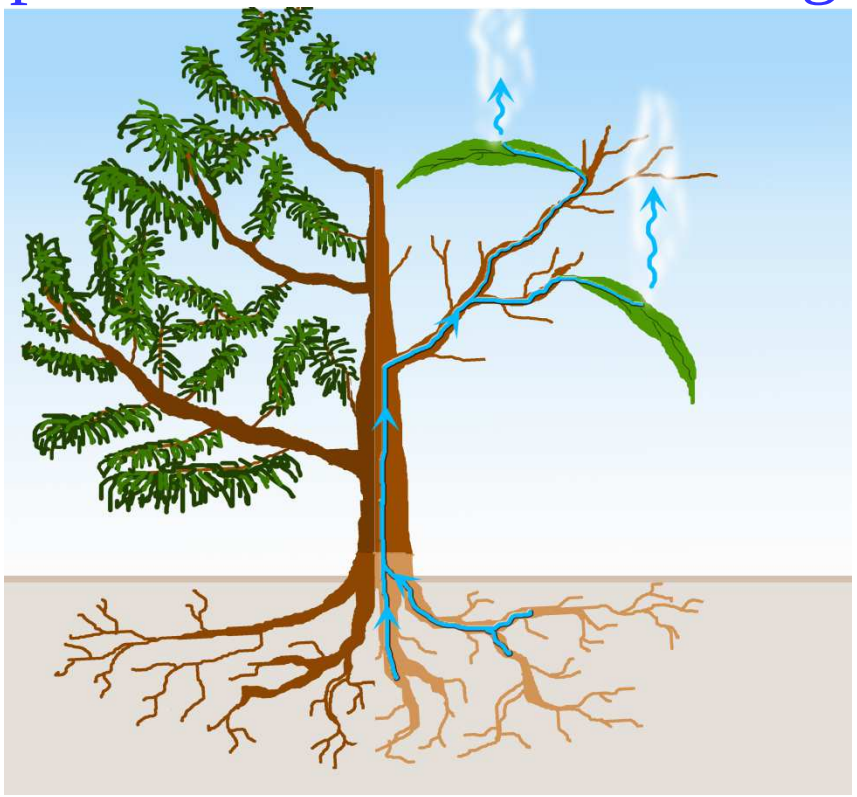
- Ottimizzare la gestione del metodo irriguo
  - corretta gestione dei contenitori
  - strategie di deficit idrico controllato

- Integrare attuali conoscenze di fisiologia dell'assorbimento e trasporto idrico

- migliorare l'efficienza dell'uso dell'acqua della pianta

- migliorare l'immagazzinamento nel suolo dell'acqua piovana

Optimization water use in Agroecosystem

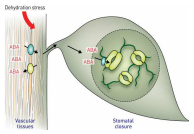


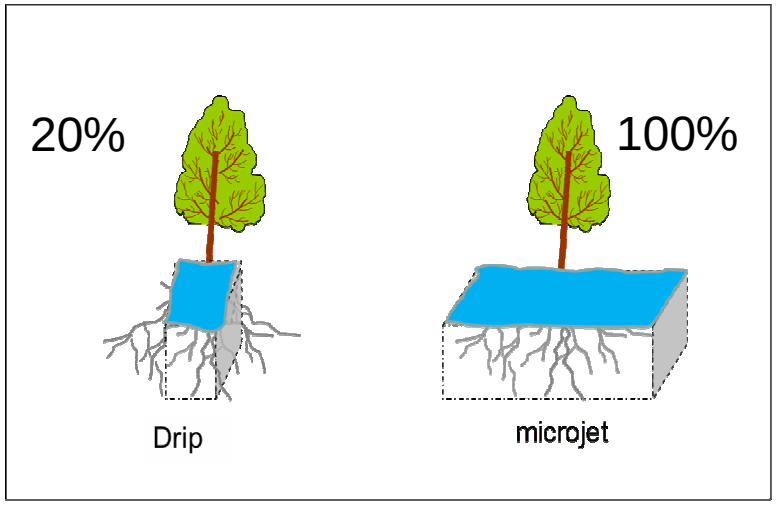
$$WUE = \frac{\text{Biomass (Kg)}}{\text{Transpired Water } (m^3)}$$

$$WP = \frac{\text{Marketable Yield value}}{\text{Irrigation water}}$$

WP = Water Productivity

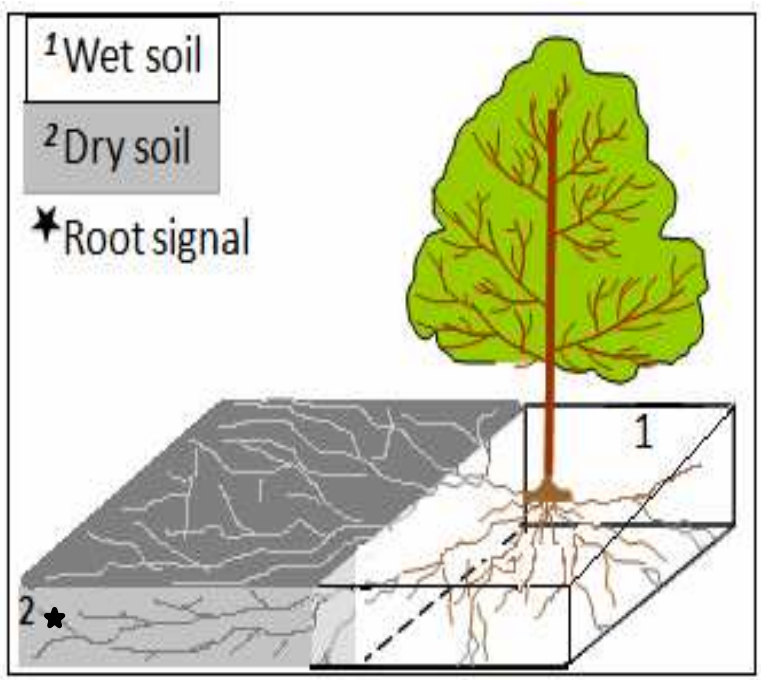
Irrigation requirement for drip-irrigated Trees Is different?

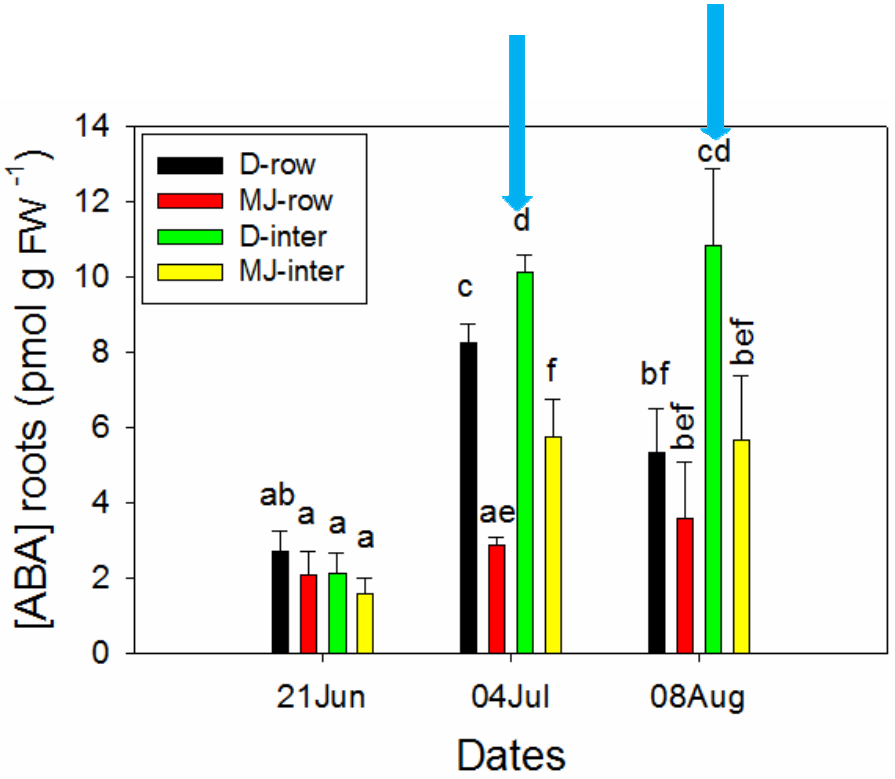




Research Hypothesis:

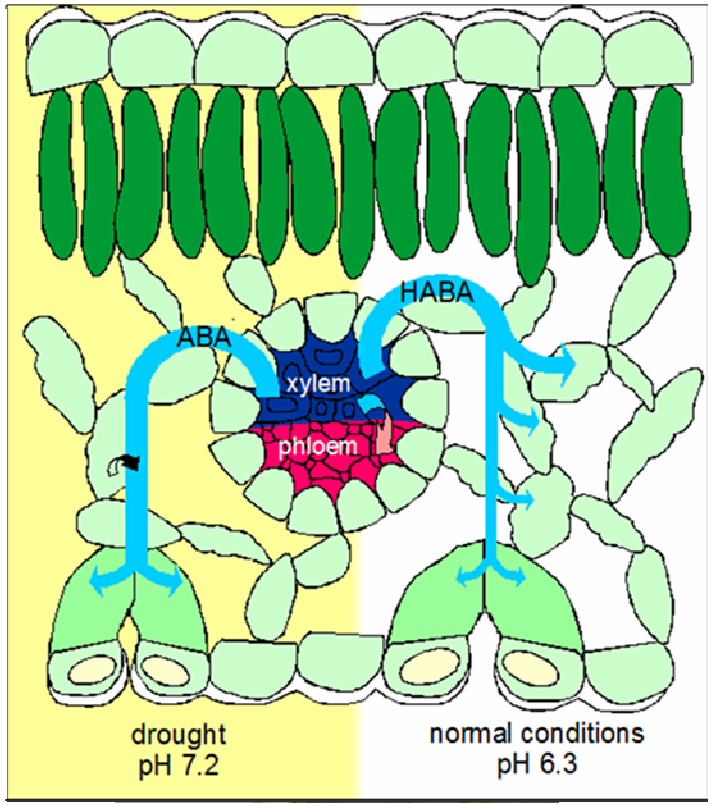
Drip-irrigated trees Although plant water status is optimal, dehydrated roots at inter-row increase [ABA] reducing gs, leading to higher WUE.



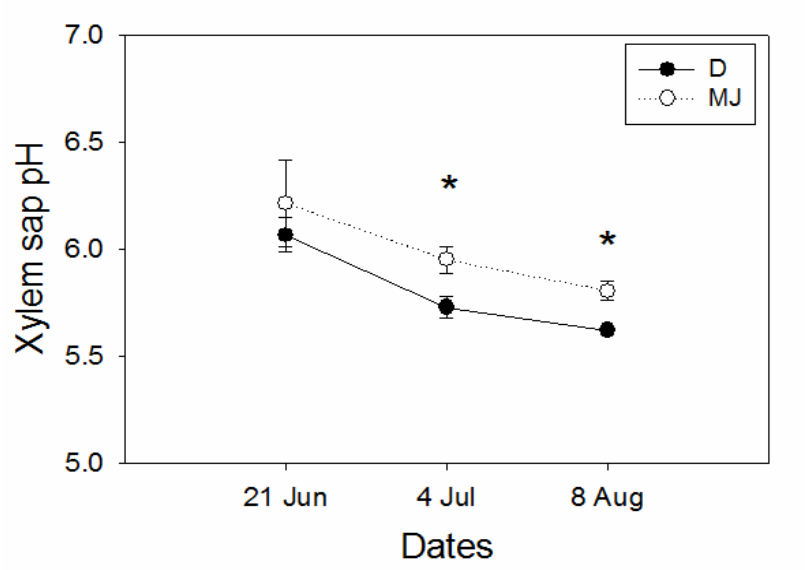


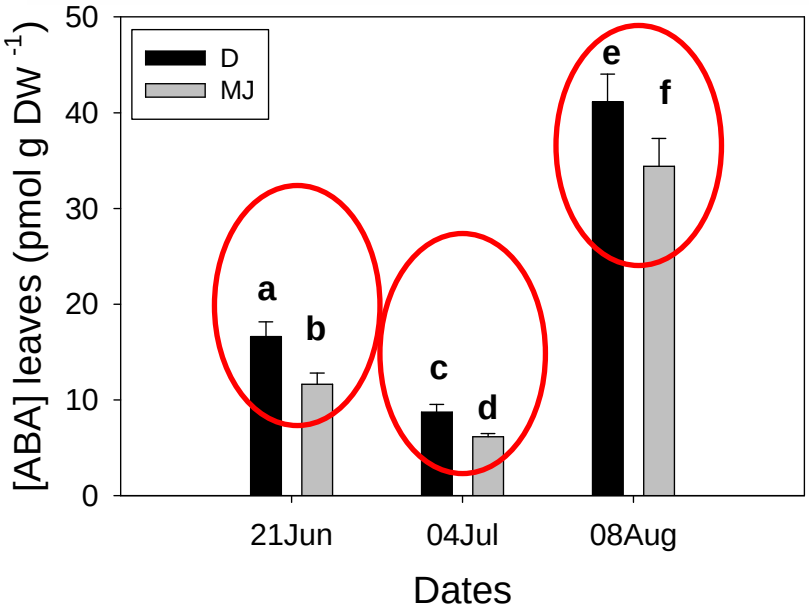
Drip-inter shown a big increase a about 2-fold compared the MJ –row and inter

- The low pH increase the → protonated ABA → increase the transport to other departments (e.g., leaves) (Slovik and Hartung 1992)
- Leaf [ABA] was significantly higher in D plants. In both treatments, [ABA], and strongly increased on 8/8 reaching their highest values.



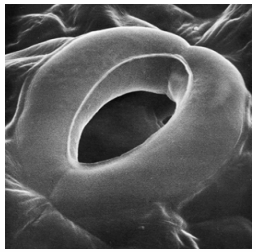
Wilkinson et al. 1997

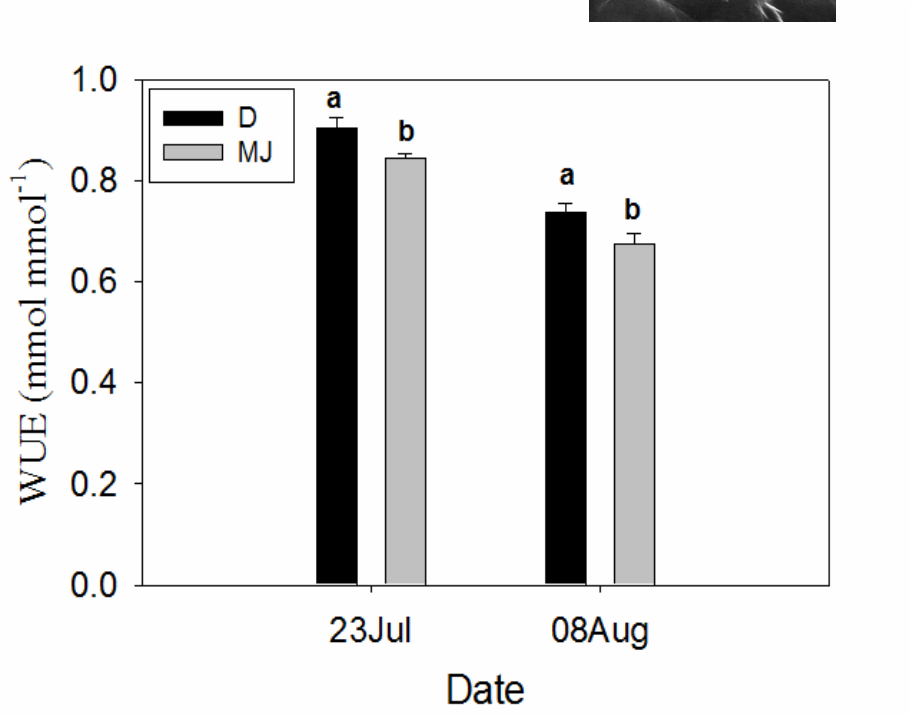


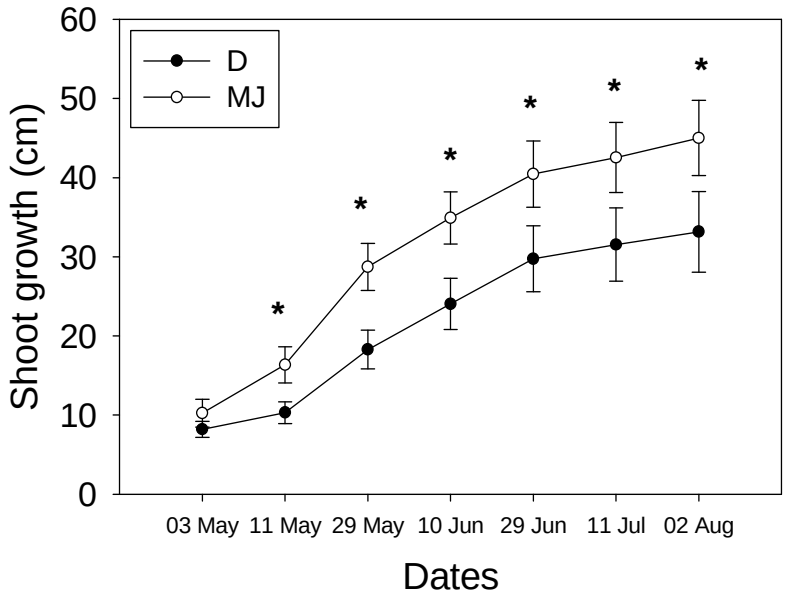


Chemical signalling … Affect growth and stomatal behaviour

•WUE (*A/E*) was 13.74% and 9.02% higher





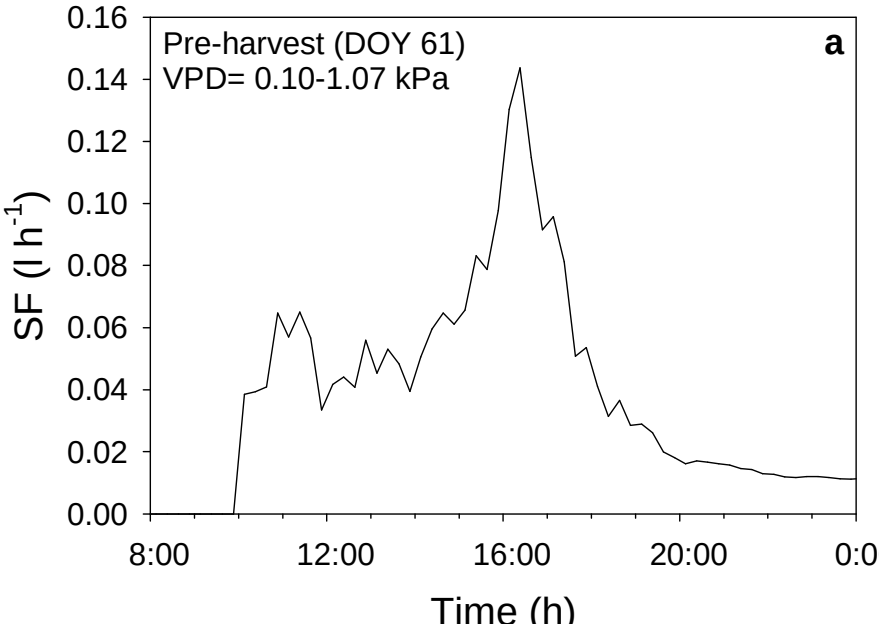


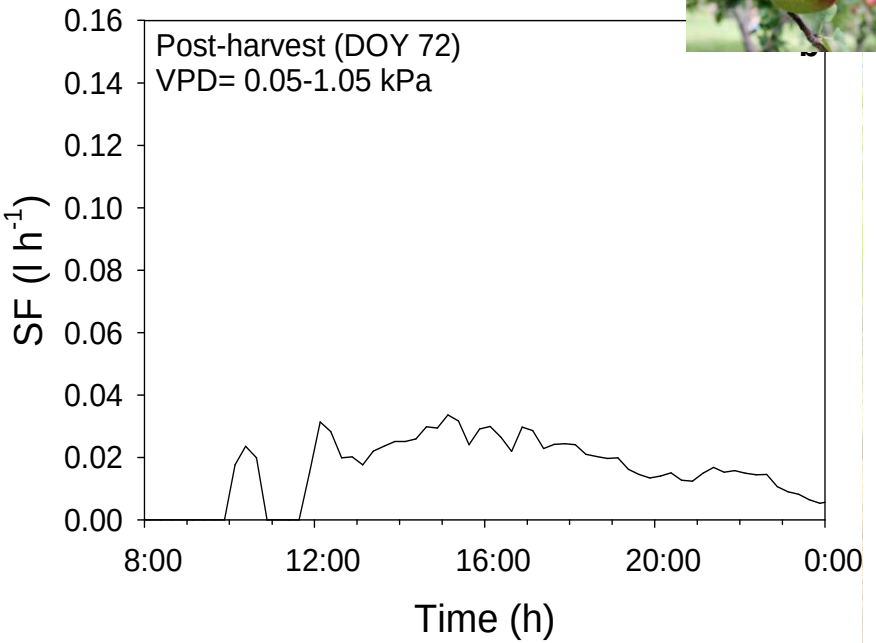
Chemical signalling … Affect growth and stomatal behaviour

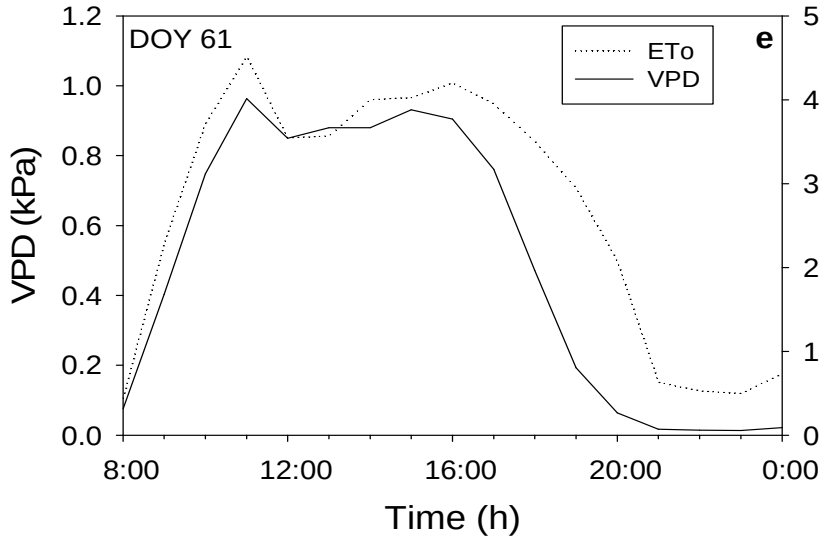
even when shoot water status is unaffected

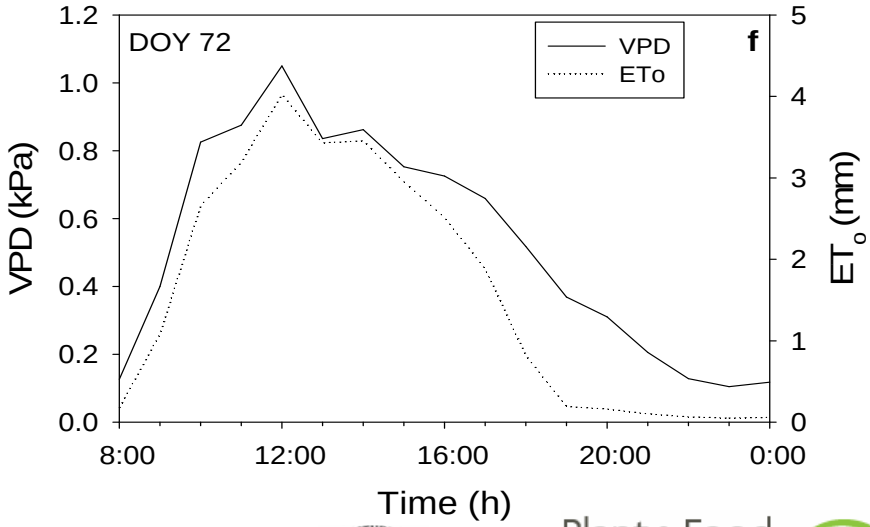
(Henson et al. 1989 Zhang and Davies, 1987; Gowing et al., 1990; Wilkinson and Davies, 1997;2002. Seo and koshiba 2011)

Transpiration reduction after fruit Harvest









Evangelos Xilogiannis 2014 PhD thesis

Plant & Food RESEARCH
RANGAHAU AHUMĀRA KAI

SITI DI INTERESSE

azienda agricola Sabato Vito
(Nettarina)

azienda agricola Laino Pasqualina
(Agrumeto)

azienda agricola Manolio Vittorio
(Nettarina in serra)

azienda agricola Fortunato Annalisa
(Albicocco)

azienda agricola De Filippis Maria
(ALBICOCCO)

azienda agricola Lepenne Donato
(ACTINIDIA)

azienda agricola Sabato Antonio
(PESCO)

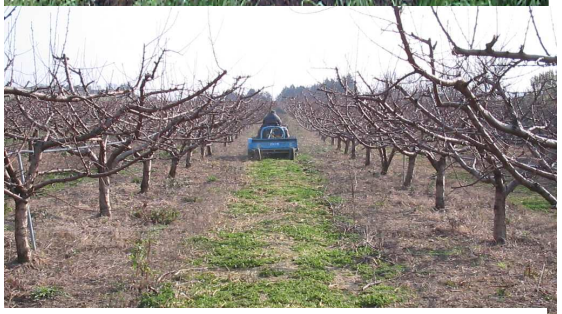
Peach orchard
cv.Super Crimson/GF667
500 tree/ha

Sustainable

Untilled soil
spontaneous grass

Soil management

Compost (15 t ha-1)
Mineral N if necessary



Cipping pruning residues into the soil

Fertilization

Pruning material

Guided drip irrigation
Crop evapotraspiration and Soil Water Balance

conventional

Mineral fertilizers

Optimization and Application of Regulated deficit irrigation

From bud break

To Harvest 100% ETc

Post - harvest

Deficit application
50% ETc

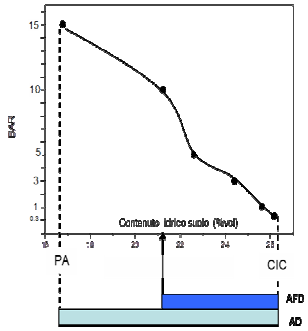
march/July.

At the end of september

B. DICHIO, C. XILOYANNIS, A. SOFO, G. MONTANARO (2007). Effects of post-harvest regulated deficit irrigation on carbohydrate and nitrogen partitioning, yield quality and vegetative growth of peach trees. PLANT AND SOIL (ISSN:0032-079X). 127- 137. 290;

Water balance implementation

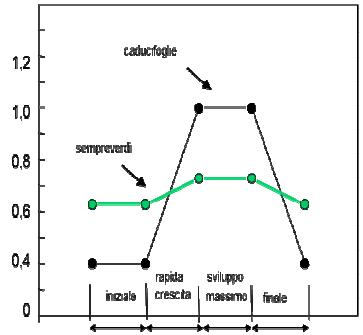
Weather Parameters (ET_0)



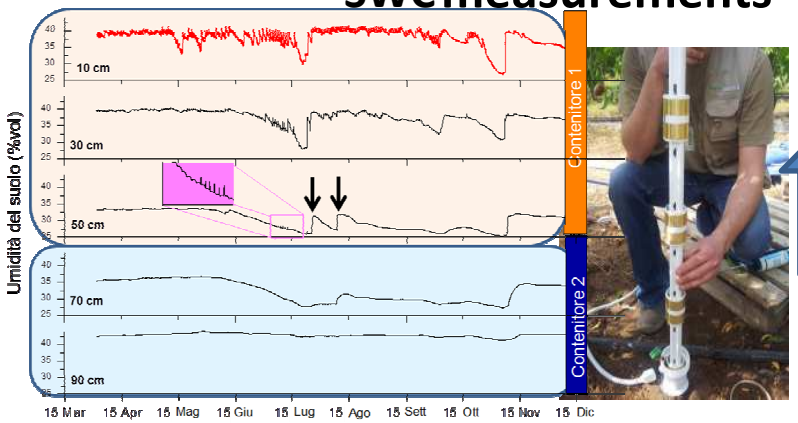
Soil data

Soil water balance

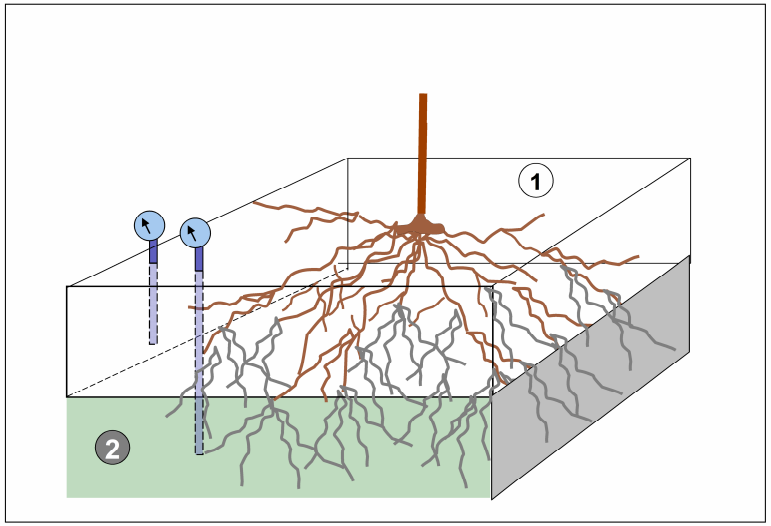
Crop data



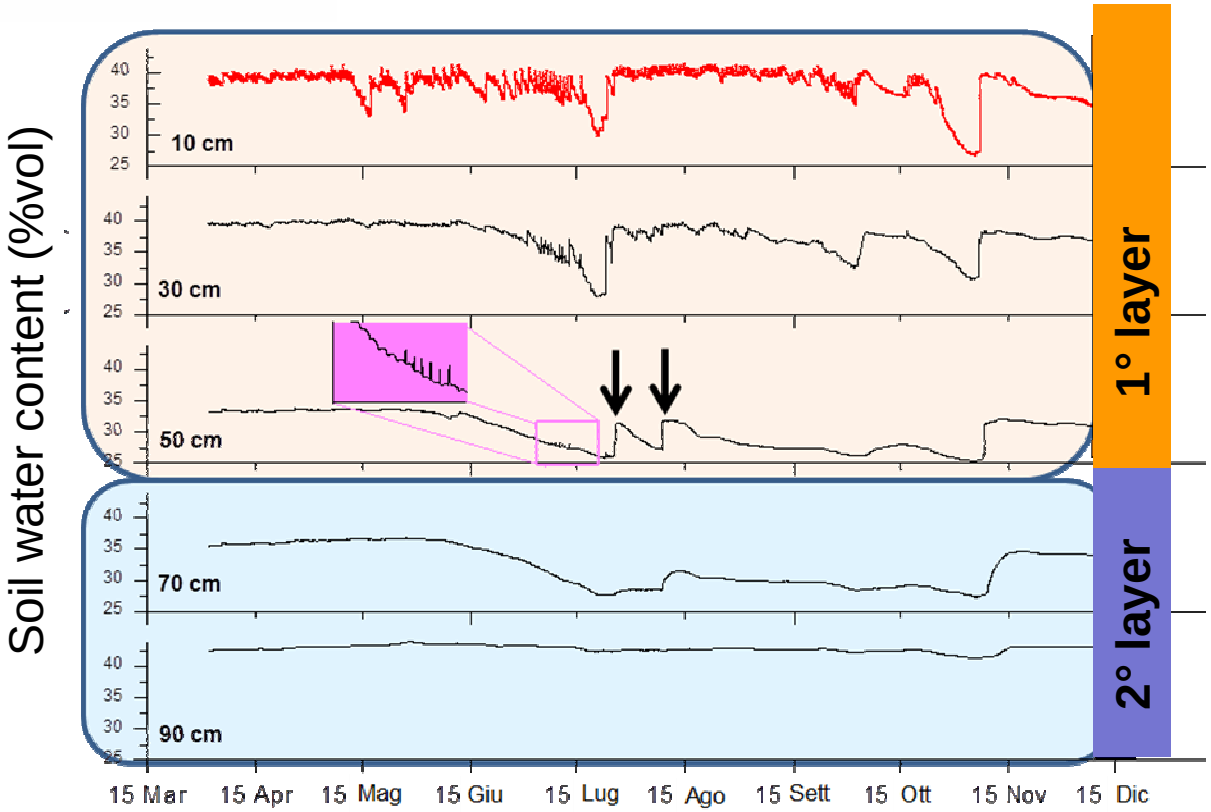
SWC measurements

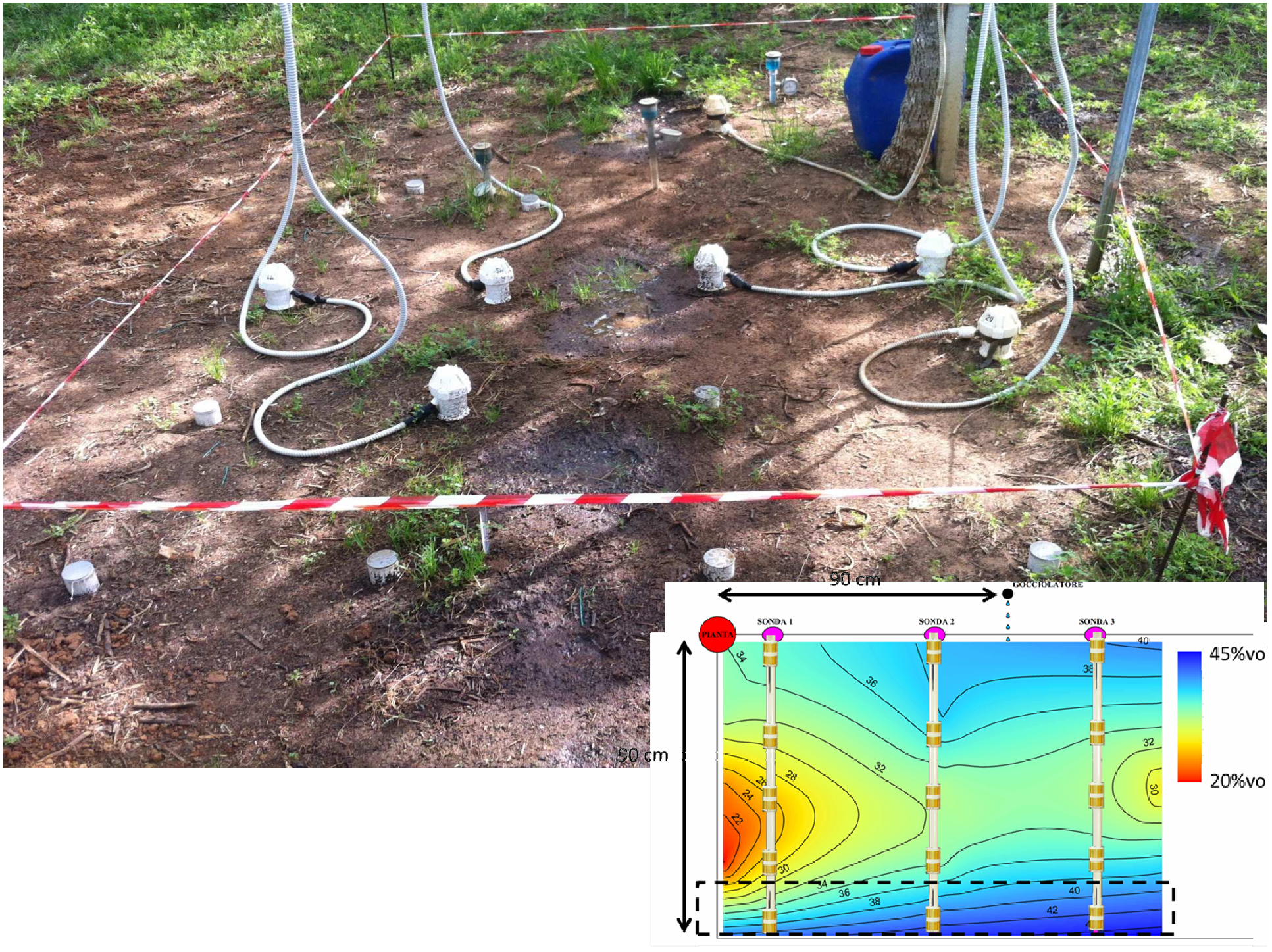


Water balance Optimased



the continuous monitoring of soil water content along the soil profile give us information to correct the irrigation scheduling



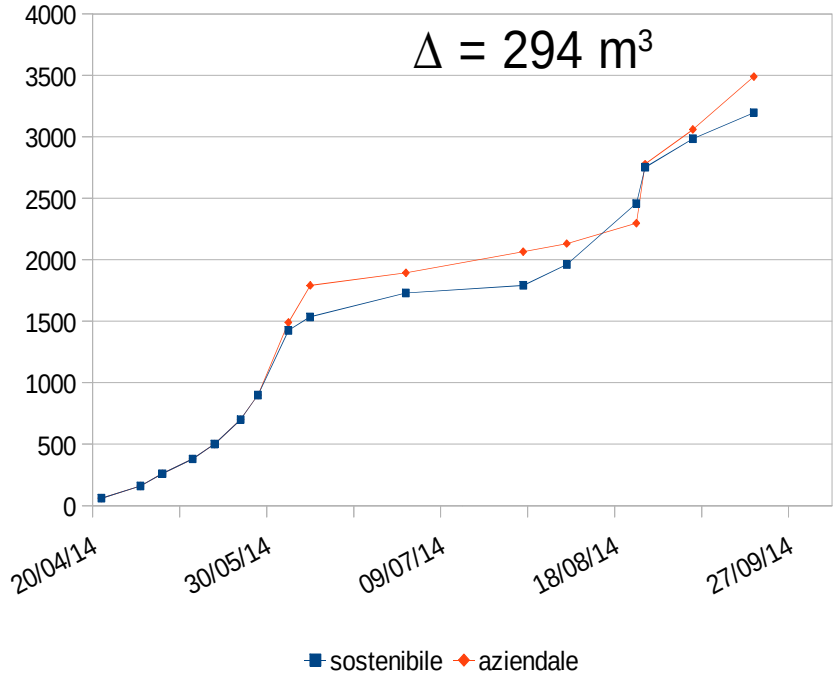

90 cm
GOCCIOLATORE
SONDA 1
SONDA 2
SONDA 3
PIANTA
90 cm
45%vo
20%vo

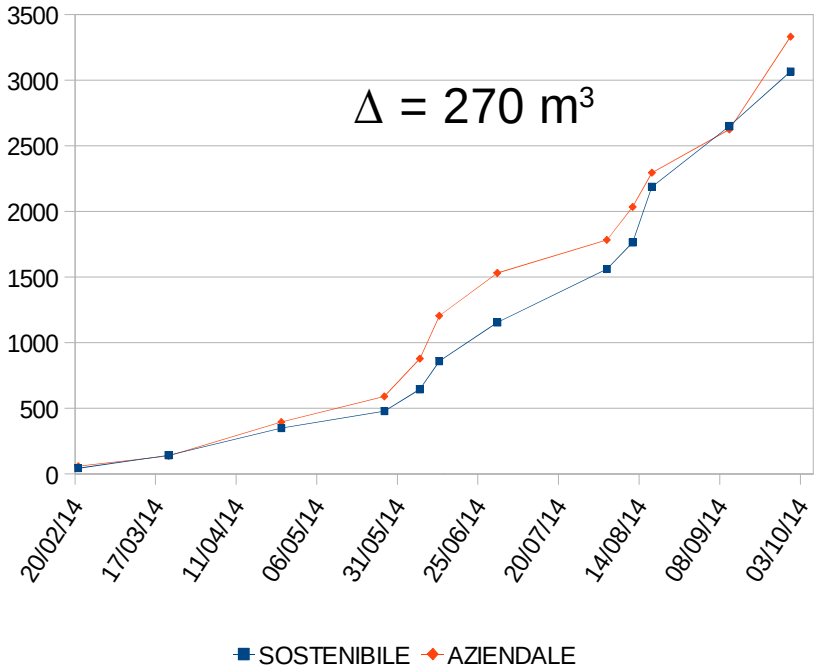
GESTIONE IRRIGUA PROGETTO IQUASOPO

AZ. DEFILIPPIS (ALBICOCCO)

PRODUZIONE: 17 Kg/pianta in Entrambi i sistemi

RIDUZIONE CONSUMO IDRICO: 8%

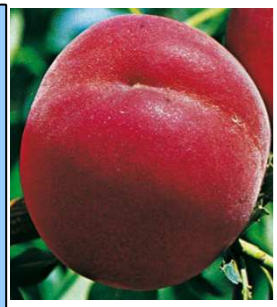




AZ. SABATO VITO (PESCO)

PRODUZIONE:
40 Kg/pianta (tesi sostenibile)
34 kg/pianta (tesi aziendale)

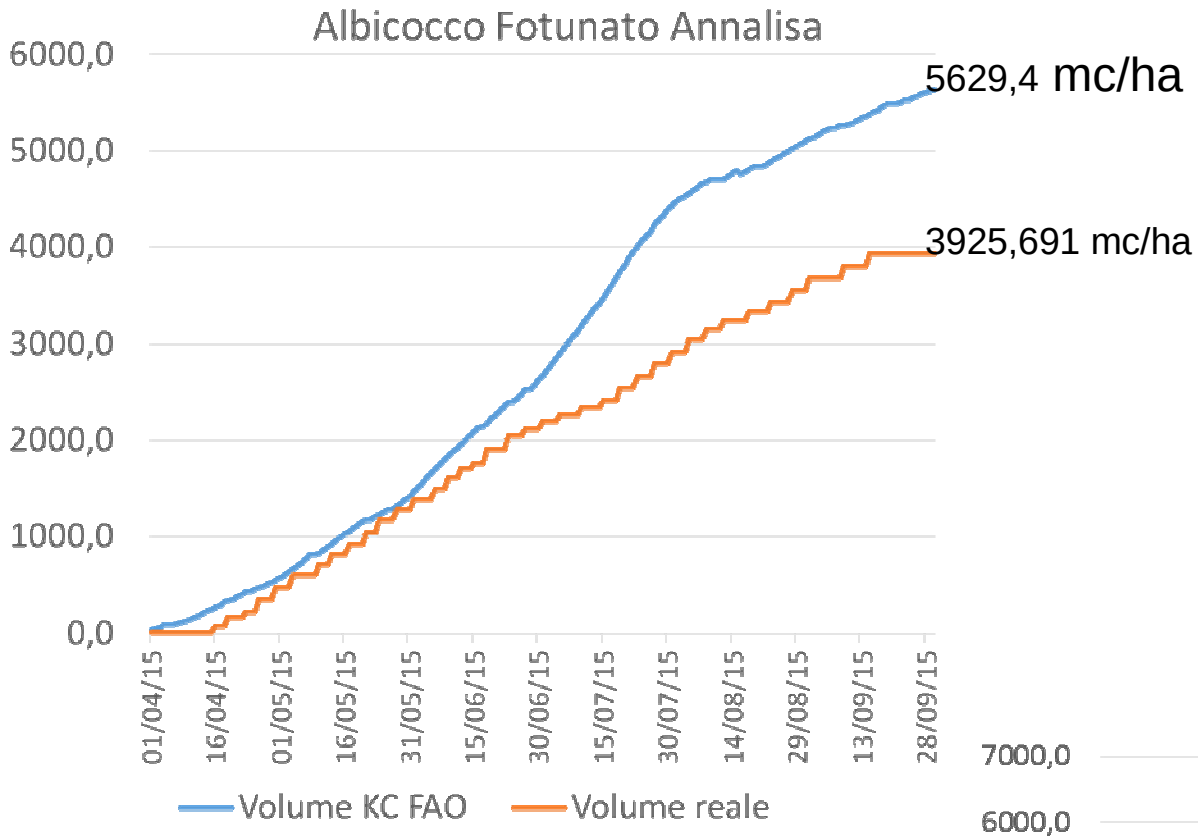
RIDUZIONE CONSUMO IDRICO: 9%



Azienda	coltura	fase vegetativa	periodo	Volume medio erogato	Eto mm Alsia medio	Kc medio derivato
		pre-invaiatura	*2014-2015*	897,9	170,9	0,5
Defilippis Maria	Albicocco	*invaiatura-raccolta*	*2014-2015*	805,1	175,7	0,5
	Orange Rubis	*post raccolta*	*2014-2015*	*1749,8*	*705,1*	*0,2*
Volumi totali				***3452,7***		
		pre-invaiatura	*2014-2015*	816,8	141,9	0,6
Fortunato A.Lisa	Albicocco	*invaiatura-raccolta*	*2014-2015*	995,5	154,5	0,6
	Orange Rubis	*post raccolta*	*2014-2015*	*2294,1*	*503,7*	*0,5*
Volumi totali				***4106,3***		
		pre-invaiatura	*2014-2015*	440,0	155,0	0,3
Sabato Vito	Nettarina	*invaiatura-raccolta*	*2014-2015*	800,0	154,5	0,5
	Big Bang	*post raccolta*	*2014-2015*	*1950,0*	*592,9*	*0,3*
Volumi totali				***3190,0***		
		pre-invaiatura	*2014-2015*	512,4	155,0	0,3
Sabato Antonio	Nettarina	*invaiatura-raccolta*	*2014-2015*	835,6	154,5	0,5
	Big Bang	*post raccolta*	*2014-2015*	*2392,5*	*592,9*	*0,4*
Volumi totali				**3740,5**		

15/20 giugno

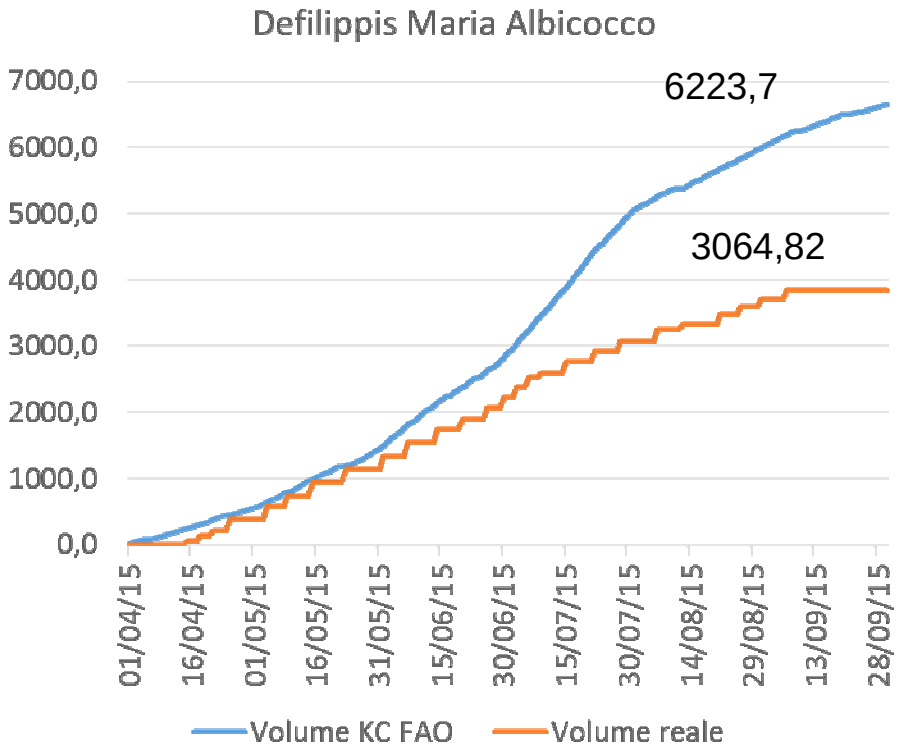
7/8 giugno



5629,4 mc/ha

3925,691 mc/ha

Orange Rubis

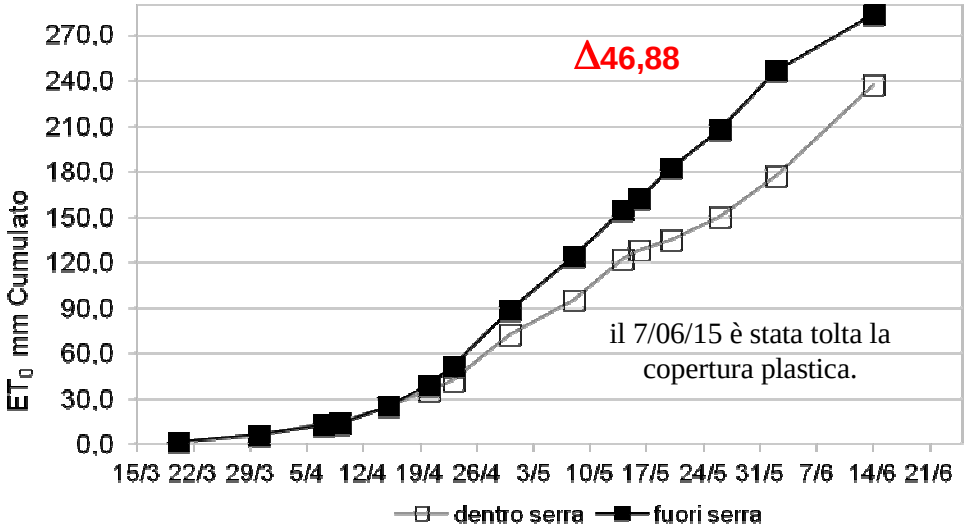


6223,7

3064,82

Azienda	coltura	tesi	Volume irri 2014 (mc)	Volume irri 2015 (mc)	Produzione 2014 (t/ha)	Protuzione 2015 (t/ha)	WUE mc/Kg 2014	WUE mc/Kg 2015	Water Pr euro/mc
Defilippis Maria	Albicocco	*Prova*	3064,8	3840,7	*11,48*	*58,74*	0,267	0,065	6,94
"	"	*Controllo*	3300,0	3954,0	*17,31*	*53,02*	0,191	0,075	6,92
Fortunato A.Lisa	Albicocco	*Prova*	4287,0	3925,7	*22,3*	*40*	0,192	0,098	5,78
"	"	*Controllo*	5087,0	5502,0	*22,1*	*40*	0,230	0,138	4,39
Sabato Vito	Nettarina	*Prova*	2780,0	3600,0	*26,04*	*28,72*	0,107	0,125	4,97
"	"	*Controllo*	3074,0	3747,0	*22,44*	*27,84*	0,137	0,135	4,24
Sabato Antonio	Nettarina	*Prova*	4026,0	3455,0	*11,41*	*18,45*	0,353	0,187	2,38
"	"	*Controllo*							
Lepenne Donato	Actinidia	*Prova*		6843,0		*63,5*		0,108	3,25
"	"	*Controllo*		9252,0		*64,9*		0,143	2,46

monitoraggio Eto frutticoltura coperta



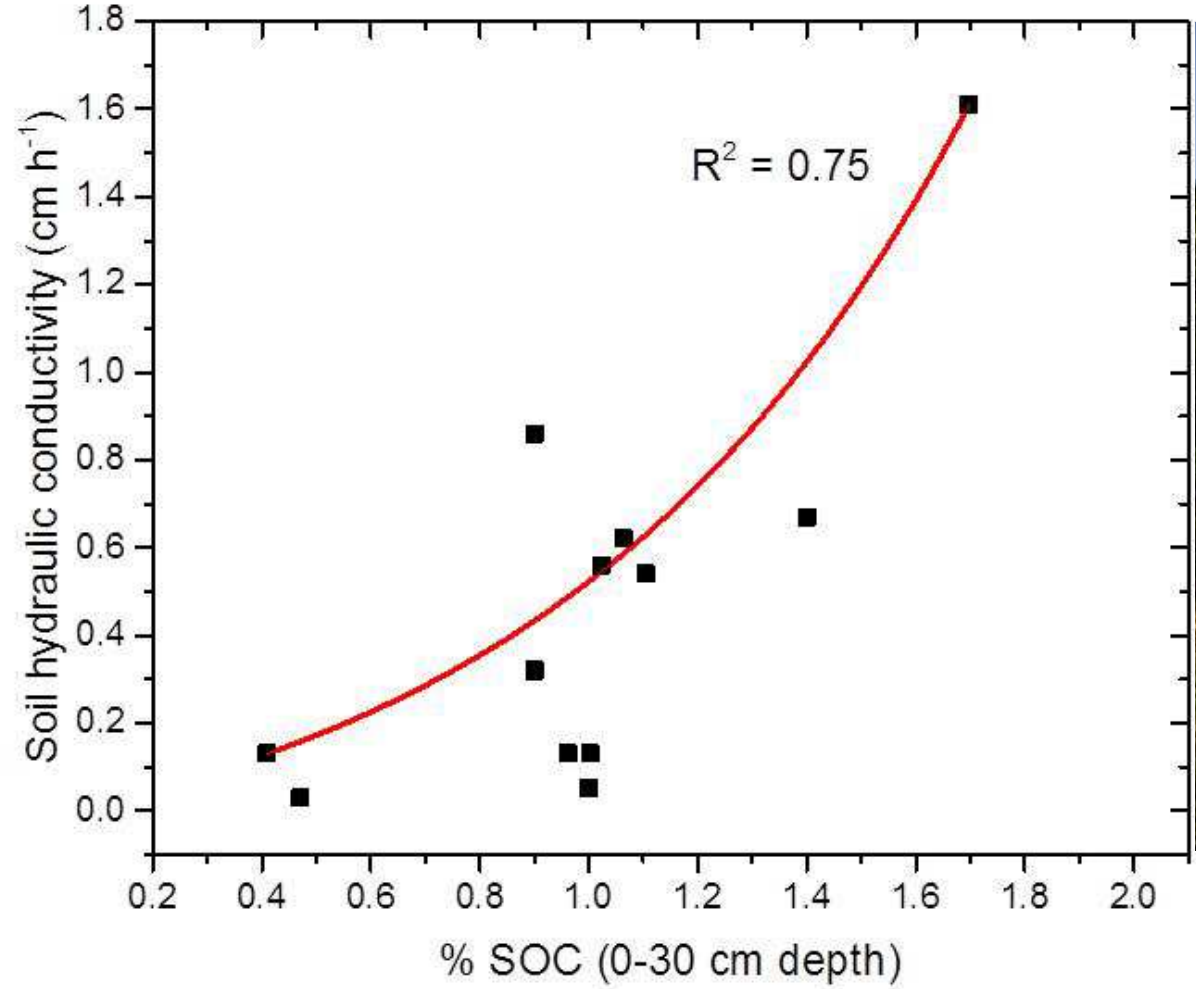
il 7/06/15 è stata tolta la copertura plastica.

Effect of soil management on soil water holding capacity

Soil hydraulic conductivity

Increasing SOC improves soil hydraulic conductivity

data from peach, kiwifruit, apricot and olive orchards are grouped

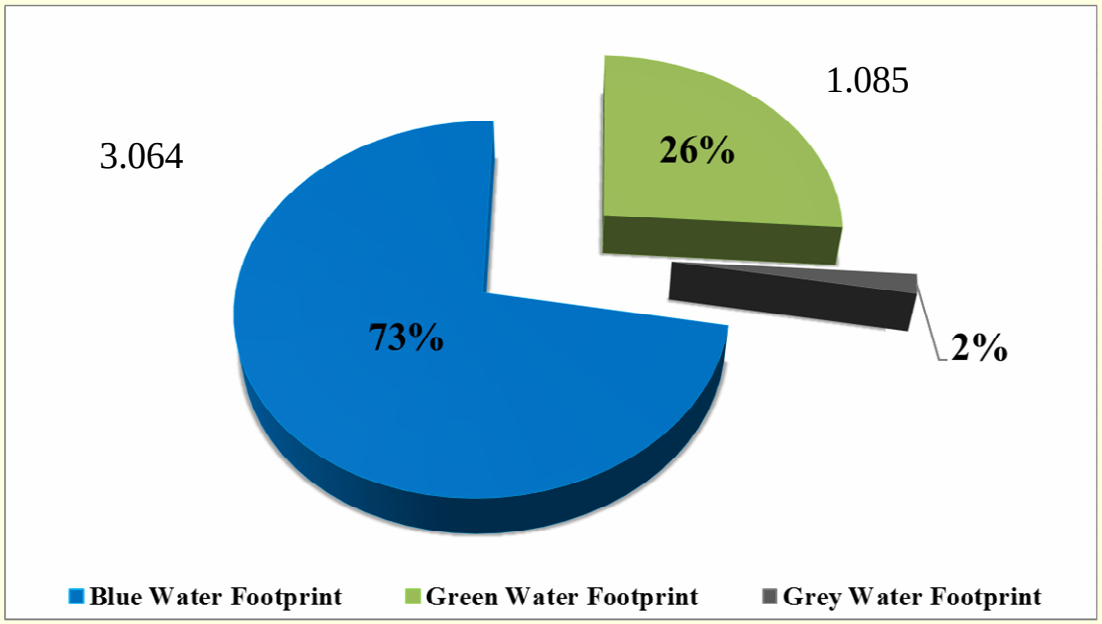


$$WF_{proc,green} = \frac{CWU_{green}}{Y} \quad [volume/mass]$$

$$CWU_{green} = 10 \times \sum_{d=1}^{lgp} ET_{green} \quad [volume/area]$$

WATER FOOTPRINT PER LA CRESCITA DELLA COLTURA			
Componente	**Simbolo**	**Unità di Misura**	**Valore**
Blue Water Footprint	WF_{blue}	m^3/ton	266,98
Green Water Footprint	WF_{green}	m^3/ton	94,54
Grey Water Footprint	WF_{grey}	m^3/ton	6,18
Resa della Coltura	Y	ton/ha	11,48
Water Footprint	**WF**	**m^3/ton**	**367,70**

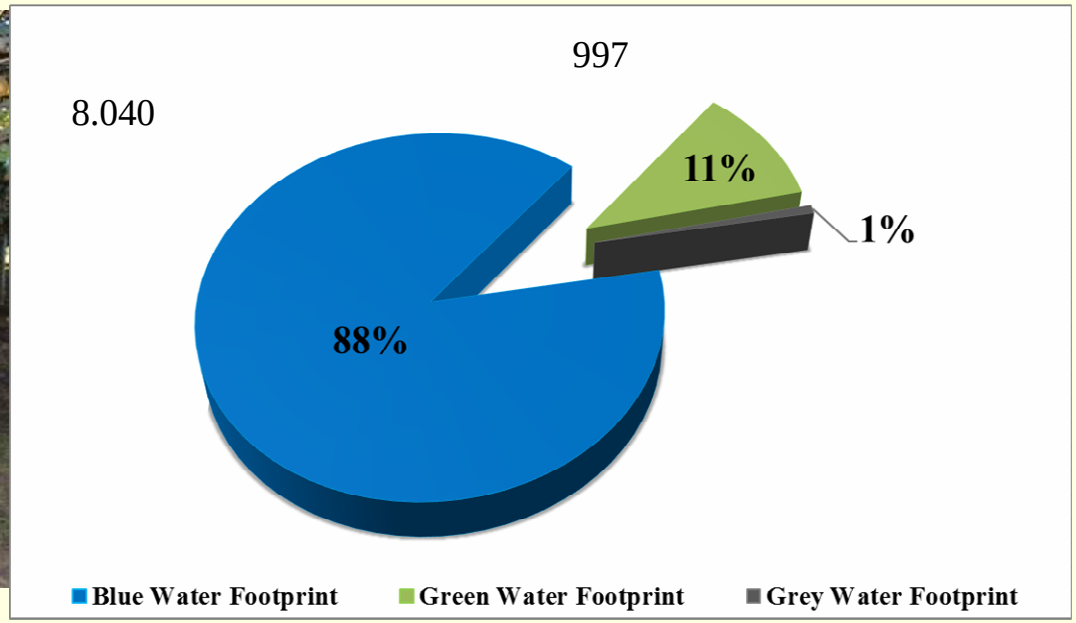
ALBICOCCO
(azienda agricola De Filippis Maria)



OUTPUT

WATER FOOTPRINT PER LA CRESCITA DELLA COLTURA			
Componente	**Simbolo**	**Unità di Misura**	**Valore**
Blue Water Footprint	WF_{blue}	m^3/ton	266,66
Green Water Footprint	WF_{green}	m^3/ton	33,07
Grey Water Footprint	WF_{grey}	m^3/ton	2,29
Resa della Coltura	Y	ton/ha	30,15
Water Footprint	**WF**	**m^3/ton**	**302,02**

ACTINIDIA
(azienda agricola Lepenne Donato)



LIFE 14 CCA/GR/00389 - AgroClimaWater

LIFE 14 CCA/GR/00389 - AgroClimaWater

Promoting water efficiency and supporting the shift towards a climate resilient agriculture in Mediterranean countries

Project Beneficiaries:

SPYRIDIS A. - ROUTALOU V. G.P. ΥΕΤΟΣ (Coordinator) www.yetos.gr

Hellenic Agricultural Organization "Demeter" Directorate General of Agricultural Research - Institute for Olive Tree, Subtropical Plant and Viticulture. www.nagref-cha.gr - Soil and Water Resources Institute www.ini.gr

RodosAgro Ltd Environment & Quality www.rodosagro.gr

University of Basilicata Dipartimento delle Culture Europee e del Mediterraneo www2.unibas.it/dicem/index.php/it

Agricultural Cooperative Partnership Mirabello Union S.A. www.ouzo.gr

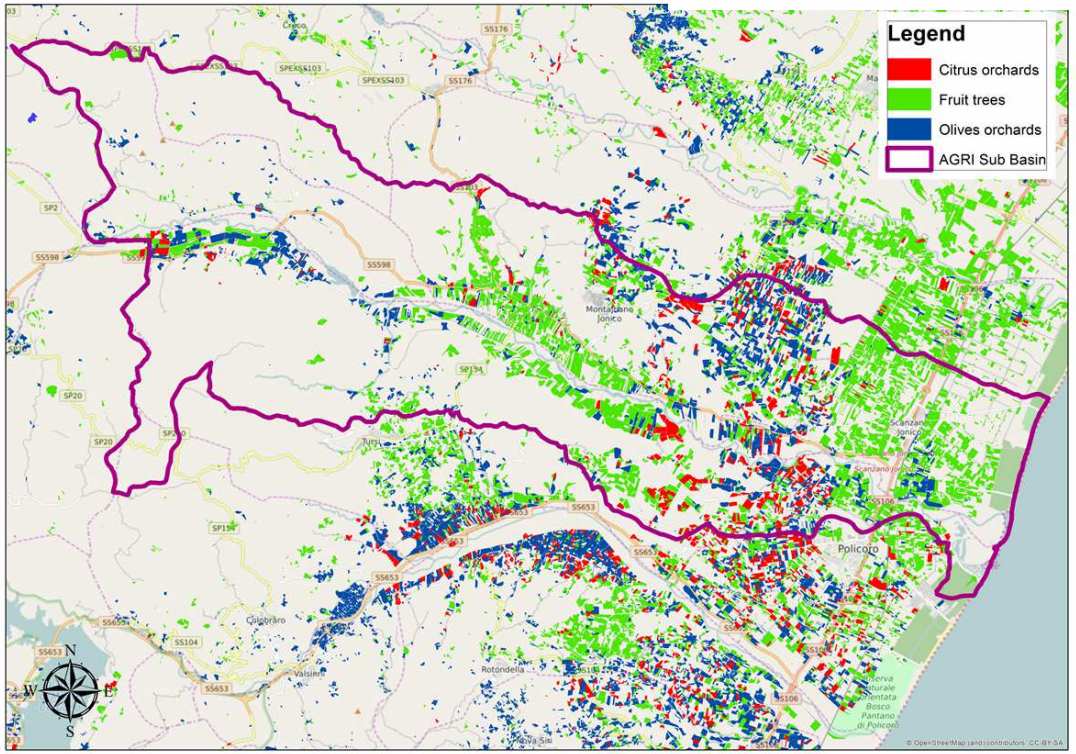
Platanias Municipality Development Enterprise www.platanias.gr

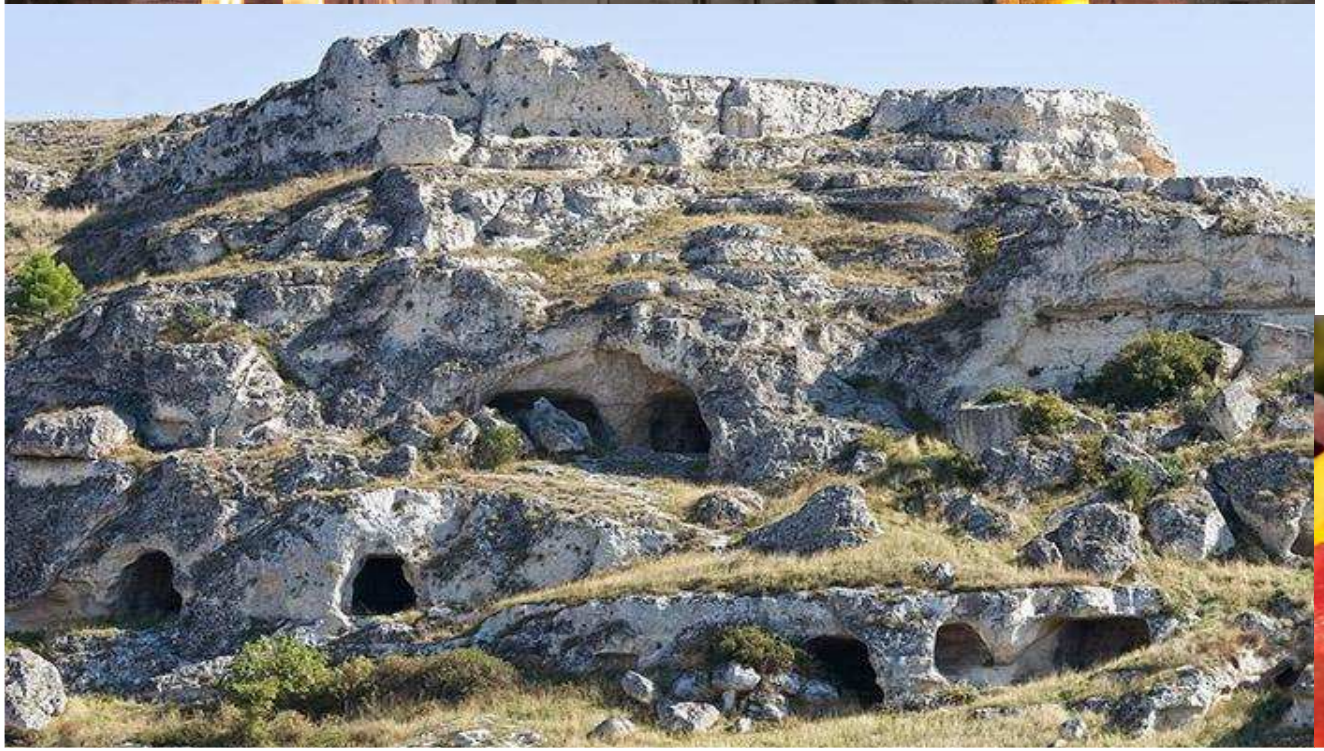
Assofruit Italia Società Cooperativa Agricola www.assofruit.com

Project LIFE14 ENV/GR/000389 – AgroClimaWater is implemented with the contribution of the LIFE Programme of the European Union and project's partner scheme

INFORMATION

T.: +30 2310 250601-3, **e-mail:** yetos@otenet.gr, **site:** www.lifeagroclimawater.eu





THANKS

MATERA 2019
EUROPEAN CAPITAL OF CULTURE

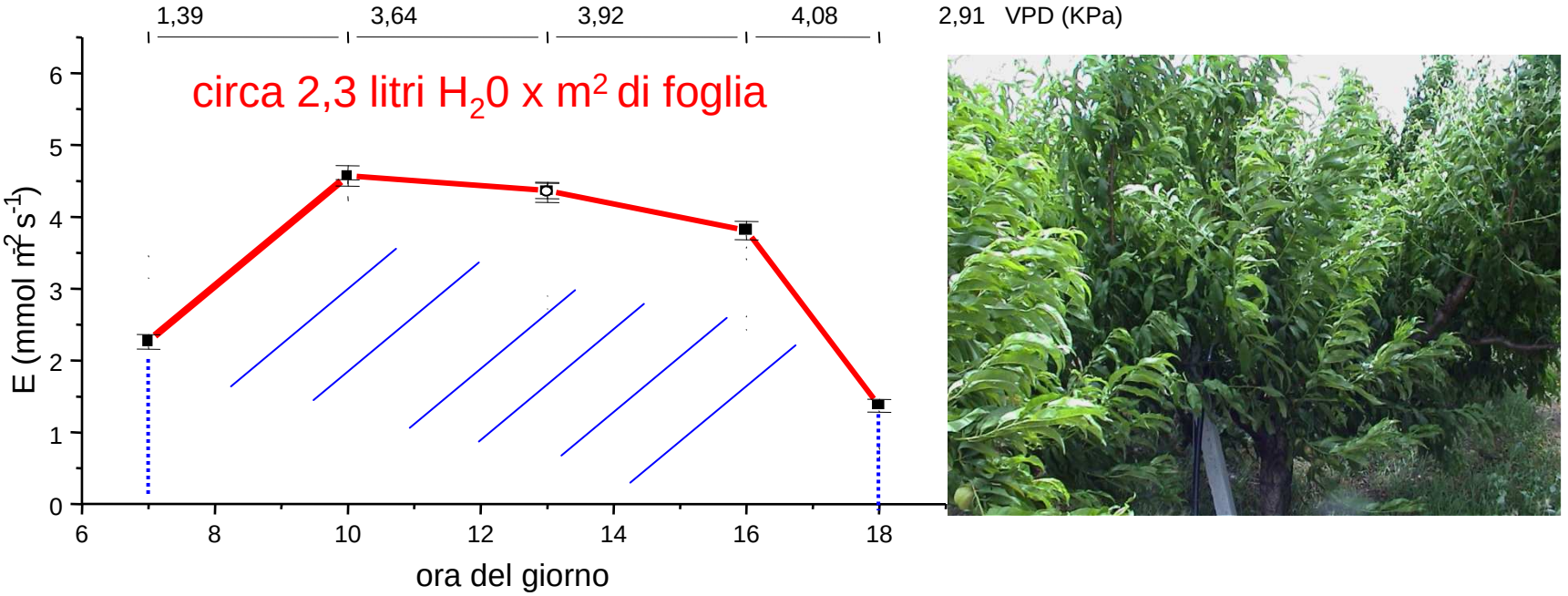
VENUE FOR

IX ISHS INTERNATIONAL SYMPOSIUM
ON IRRIGATION OF HORTICULTURAL CROPS.

Conveners

Prof. Bartolomeo Dichio **Prof. Cristos Xiloyannis**

Quanta acqua si può risparmiare con la potatura verde?



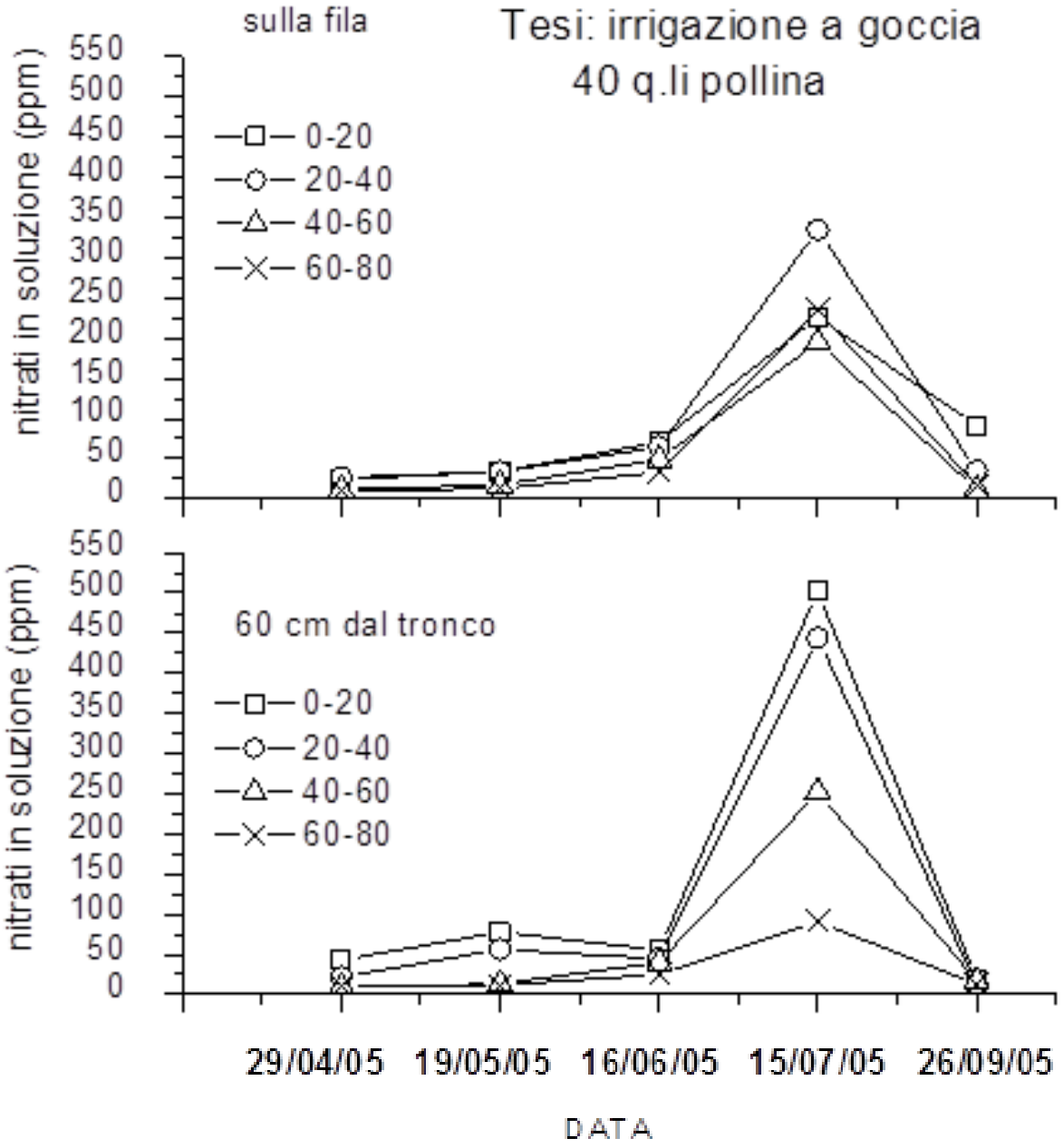
Traspirazione giornaliera 66 lt/pianta

Potatura verde 10,34 m^2 p^{-1}

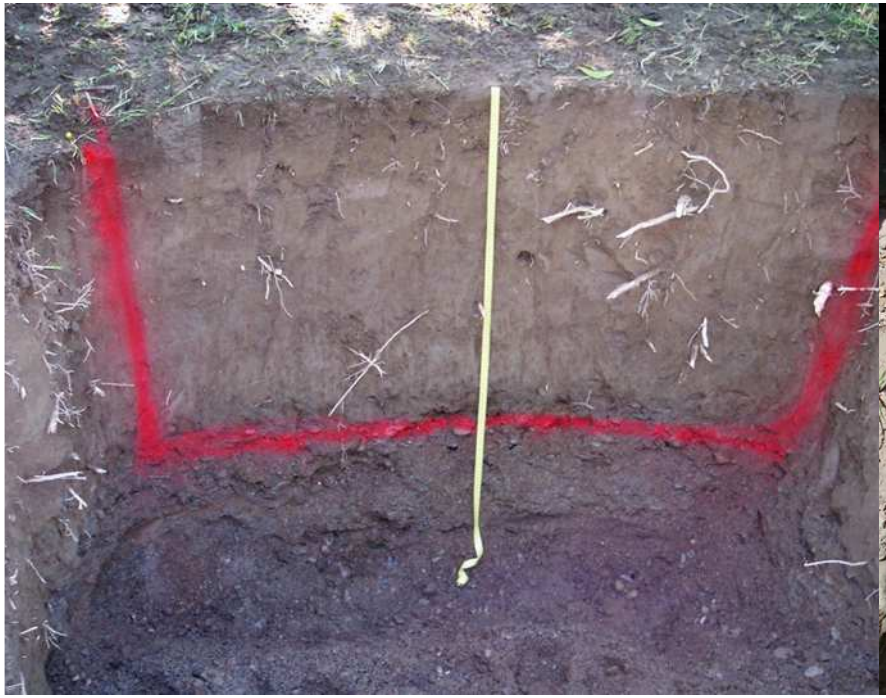
24 litri $g^{-1}p^{-1}$ → 60-80 g

circa 750 m^3/ha

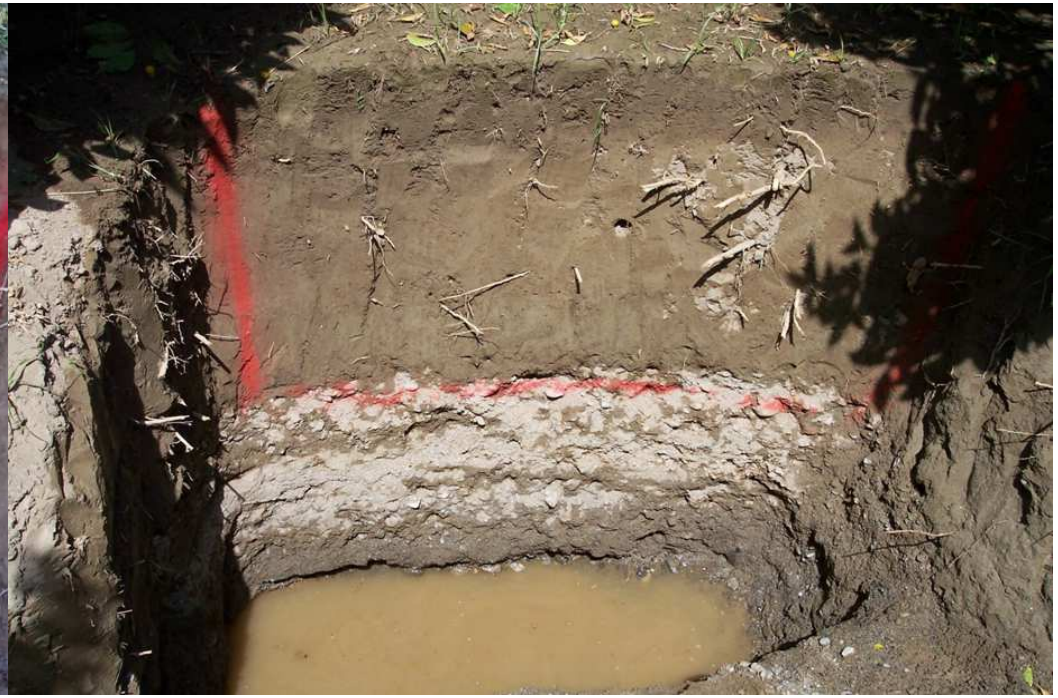
circa 1000 m^3/ha


sulla fila
Tesi: irrigazione a goccia
40 q.li pollina
nitrati in soluzione (ppm)
550
500
450
400
350
300
250
200
150
100
50
0
0-20
20-40
40-60
60-80
60 cm dal tronco
29/04/05
19/05/05
16/06/05
15/07/05
26/09/05
DATA


Zetafert
POLLIN
CONCIME ORGANICO NP
POLLINA ESSICCATA
CONSENTITO IN
AGRICOLTURA BIOLOGICA
PESO NETTO Kg. 25



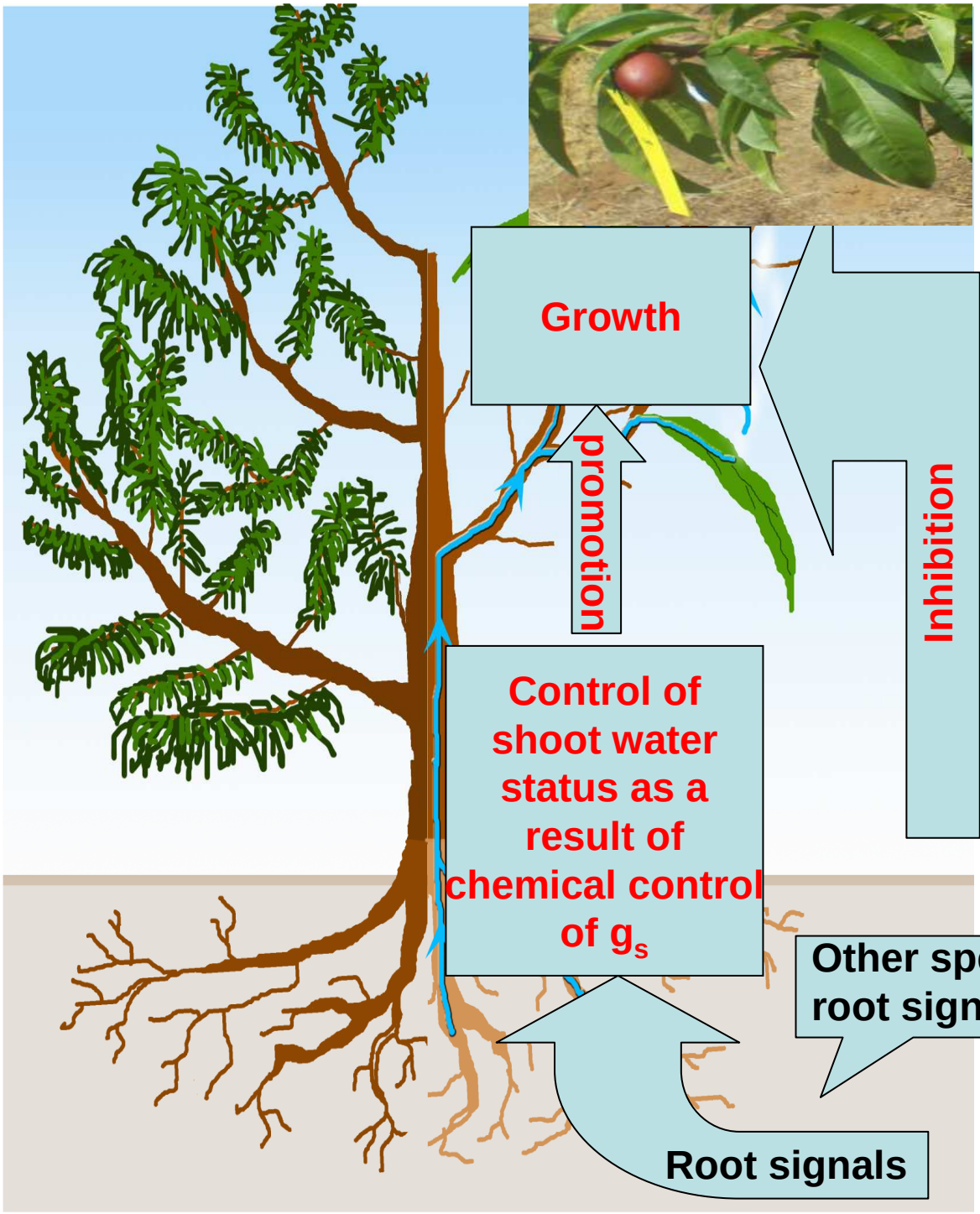
Il volume di terreno bagnato dall’acqua arriva ad una profondità di 90 cm la linea rossa delimita il terreno bagnato

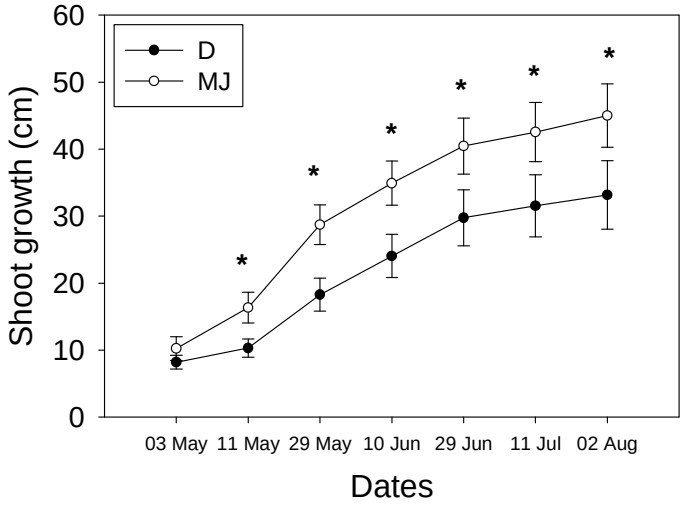


La situazione della falda freatica al 02/07/2005

Efficiency of water application of irrigation systems

Flooding	45%
furrow	55-75 %
microject	65-75%
Drip irrigation	90-95%





Chemical signalling … Affect growth and stomatal behaviour <u>even when shoot water status is unaffected</u>

(Henson et al. 1989 Zhang and Davies, 1987; Gowing et al., 1990; Wilkinson and Davies, 1997;2002. Seo and koshiba 2011)