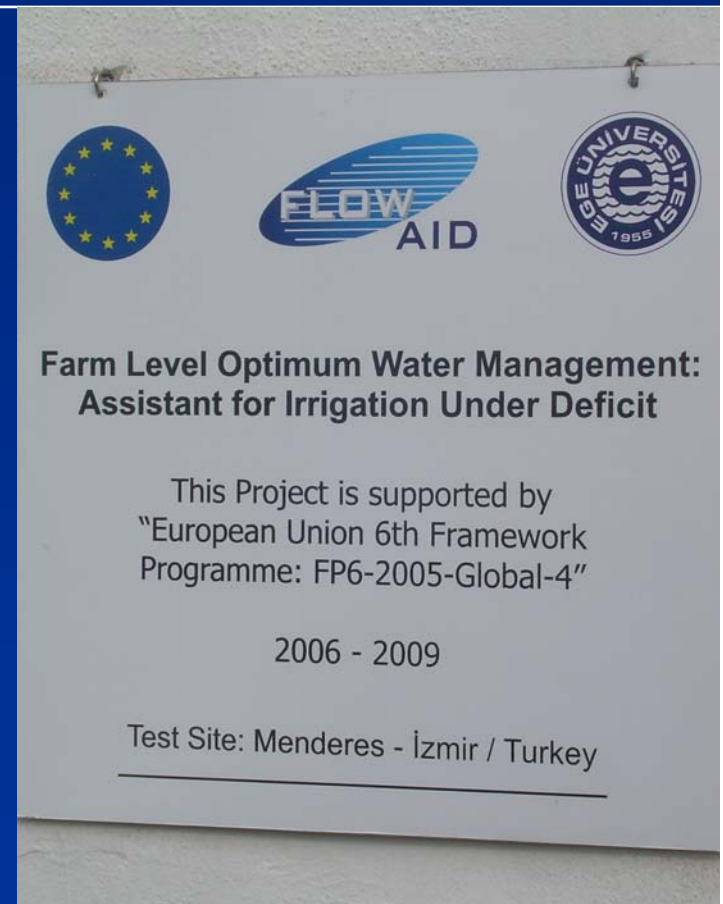# Assistance for Irrigation under Deficit

International Workshop on

"Innovative irrigation technologies for greenhouse vegetables"

Menderes-Izmir (Turkey)

23 June 2009

Jos Balendonck

Farm Level Optimum Water Management:
Assistant for Irrigation Under Deficit

This Project is supported by
"European Union 6th Framework
Programme: FP6-2005-Global-4"

2006 - 2009

Test Site: Menderes - İzmir / Turkey

WAGENINGEN UR
For quality of life

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Objectives

- **SAVE WATER**
  - Efficient use of available water
- **SAVE NUTRIENTS**
  - Rational use of nutrients and marginal water resources
- **PROTECT FARMER INCOME**
  - Maintain crop yields at affordable investments

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European Project

- 7 universities + 3 companies
- 5 European + 3 other (Mediterranean) countries
- Budget from European Commission: 1.7 M€
- 2006 - 2009

EUROPE

Vredepeel
(the Netherlands)

Pistoia
(Italy)

Tahtali Dam
Menderes,
Turkey

Litany River
(Lebanon)

Irbid
(Jordan)

Barents Sea

400 mi
400 km

Volga

Ural Mountains

Shannon

Atlantic Ocean

Baltic Sea

Rhine

Elbe

Oder

Thames

Seine

Danube

Loire

Po

Rhone

Danube

Black Sea

Bay of Biscay

Tagus

AFRICA

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Experimental Site in Turkey

- Region Izmir (Tahtalı Dam)
  - Preservation area
  - Greenhouses
  - Irrigation water from wells
  - No leaching of fertilizer allowed

- Objectives
  - Local farmer (Cucumber)
  - No drainage (reduce water use)
  - Maintain a good marketable yield
  - Evaluate and promote sensor activated control
  - Test new tensiometers

(See presentation by: H. Tuzel)

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Activities in Izmir – Menderes - Antalya

- 3 Years of experiments in Menderes (2007-2009)
- Meeting and field visit Flow-Aid project group (April 2008)
- International Symposium (Antalya, April 2008)
- Farmers and local authorities meeting (June 2008)
- Workshop for farmers and companies (June 2009)

No restriction on water use

- **Target Farmer**
  - Give the crop enough water and fertilizer to maximize crop yield
 - Give more, to be sure that all plants get enough (variability)

- **Results**
  - Good crop yield, high income
  - Leaching or run-off of water and fertilizers
  - Slightly higher costs due to over use of water and fertilizers

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Leaching Restrictions

- **Less water and fertilizer result in:**
  - Yield loss
  - Crop damage
  - Lower income

- **Farmer target**
 - Avoid or minimize crop losses
  - But … with more work

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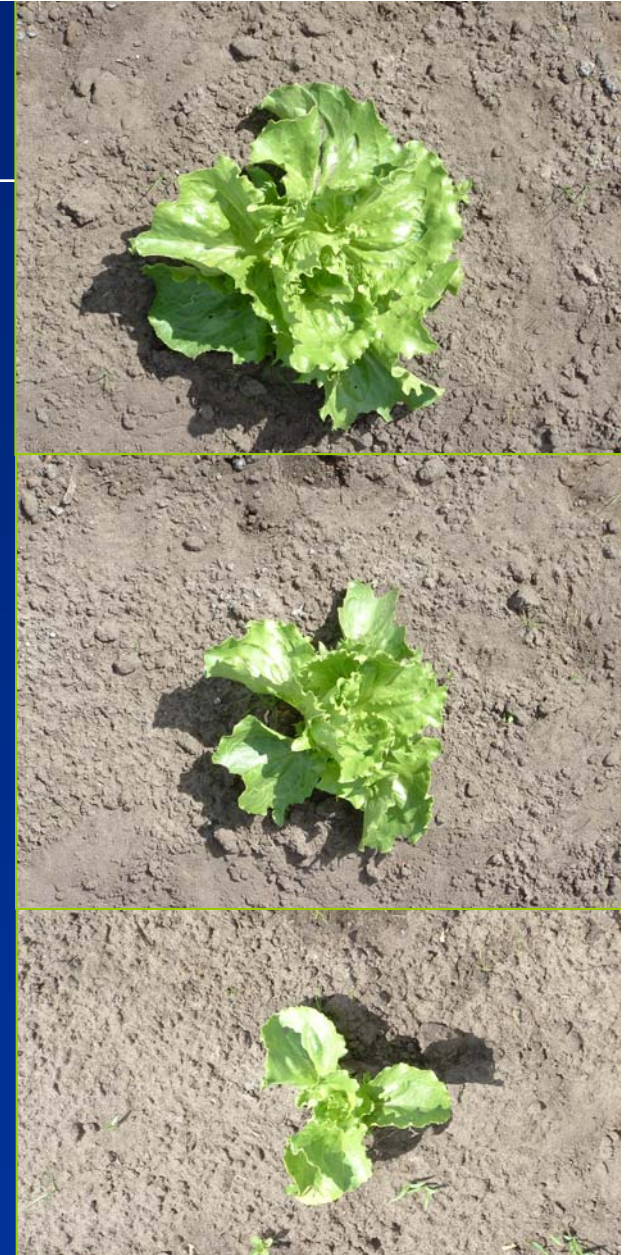
Solutions

- **Substrates and recirculation**

    if not

- **Drip irrigation with fertigation**
- **Automate the control**

How to support farmers?
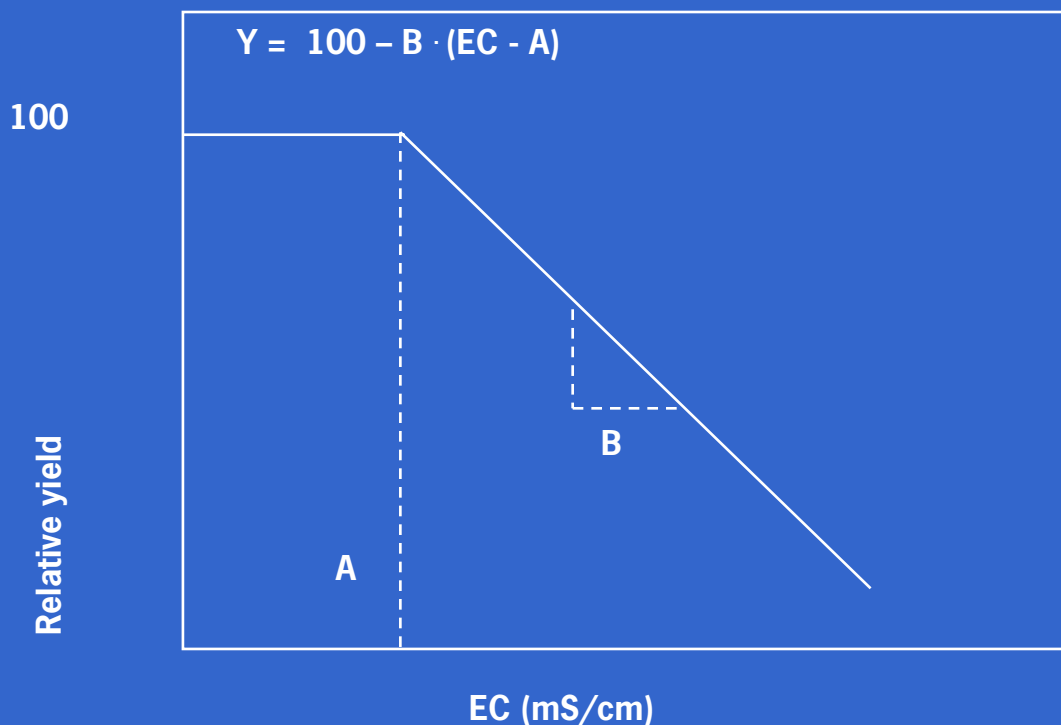
- Advice <u>when</u> and <u>how much</u> to irrigate
- Advice <u>when</u> and <u>how much</u> to fertigate
- Continuous feed-back about crop status
- Sensors, controllers, computer software
- Process automation: less work
- Affordable technologies

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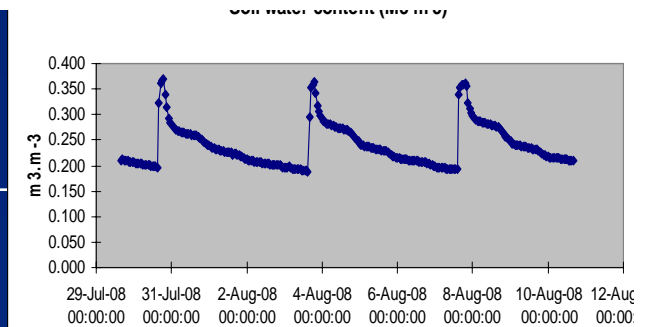
Yield Response to Deficit Irrigation

- Water Quantity (Evapo-Transpiration)
- Water Quality (Salinity)

$$Y = 100 - B \cdot (EC - A)$$

100

Relative yield

A

B

EC (mS/cm)

See also presentation by: A. Pardossi

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File   ?

EU Project n°036958

Farm Level Optimal Water management:

Assistant for Irrigation under Deficit

UNIVERSITÀ DI PISA

Product Name BARLEY

EDIT

SAVE RECORD AS...

ADD NEW RECORD

DELETE RECORD

CANCEL

EXPORT DATABASE

REPORT

Regional Setting: Regno Unito

RECORD NAME	CROP (SHORT NAME)	SCIENTIFIC NAME	ET GROUP (FAO)	REFERENCES	Open Web Page
BARLEY	BARLEY	*Hordeum vulgare*	3	0	

DEVELOPMENTAL STAGE		START DAY (1-365)	DURATION (DAYS)	Kc	ROOT DEPTH (m)	Ky	P (RAW/TAW)	ECth	b
Initial	I		40	0.00	0.00	0	0.55	8	5
Crop development	II		60	0.00	0.00	0	0.55	8	5
Mid Season	III	305	60	0.00	0.00	0	0.55	8	5
Late Season	IV		40	0.00	0.00	0	0.55	8	5
Total growing cycle	T		200	0.00	0.00	1.15	0	8	5

|<	<<<	Record 1 of 20	>>>	>|

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# Irrigation and Fertigation Controllers

- Timer
- Sensor controlled
- ET-control
- Multiple valves
- Multiple water sources
- Stand-alone operation
- Computer programmed

See presentation by: D. Jenkins

Irrigation Scheduler

- **Automate Irrigation**
  - Full or Deficit Regimes
- **Day to day planning**
  - Dose and Time
- **Plant Status (monitoring)**
- **Crop Stress Model**
- **Set Irrigation Controllers**
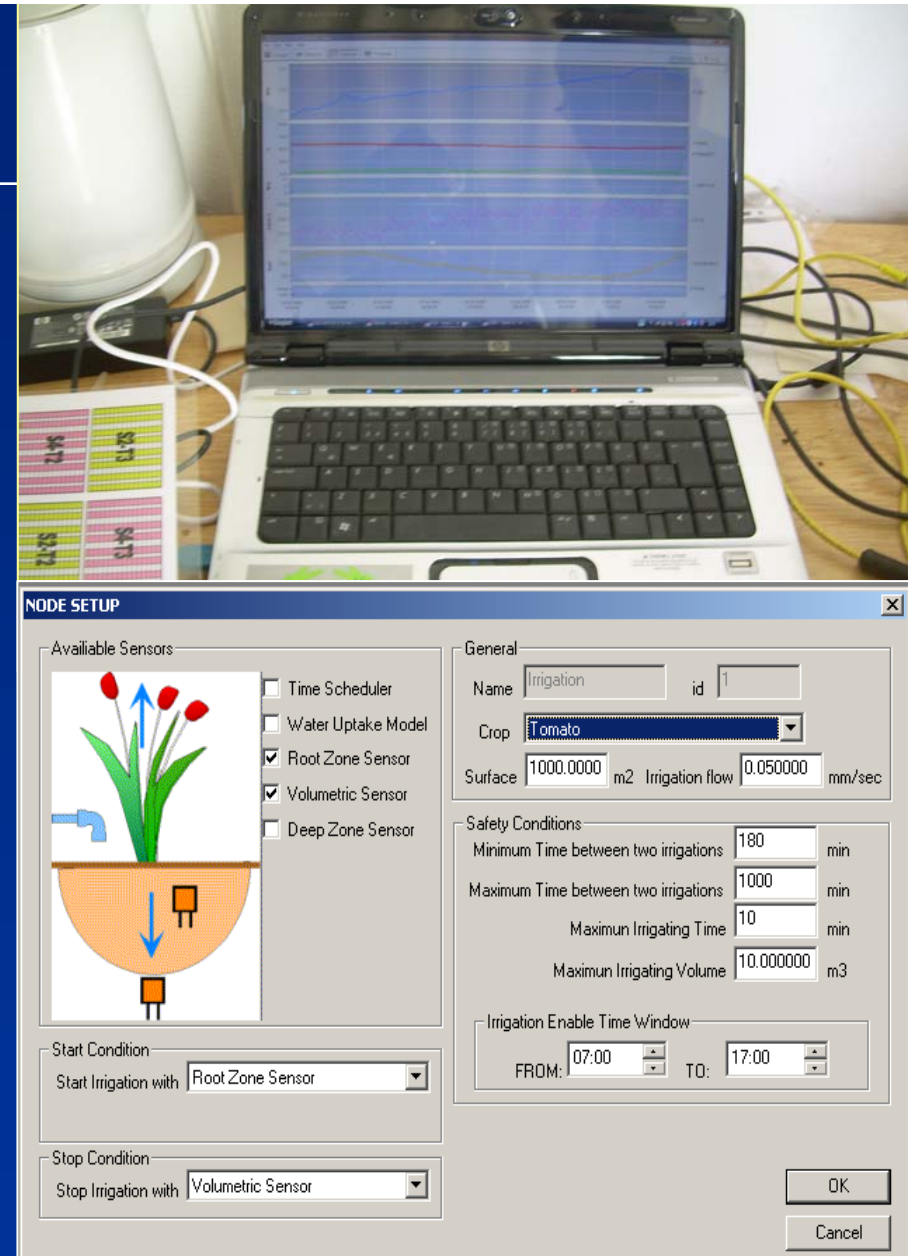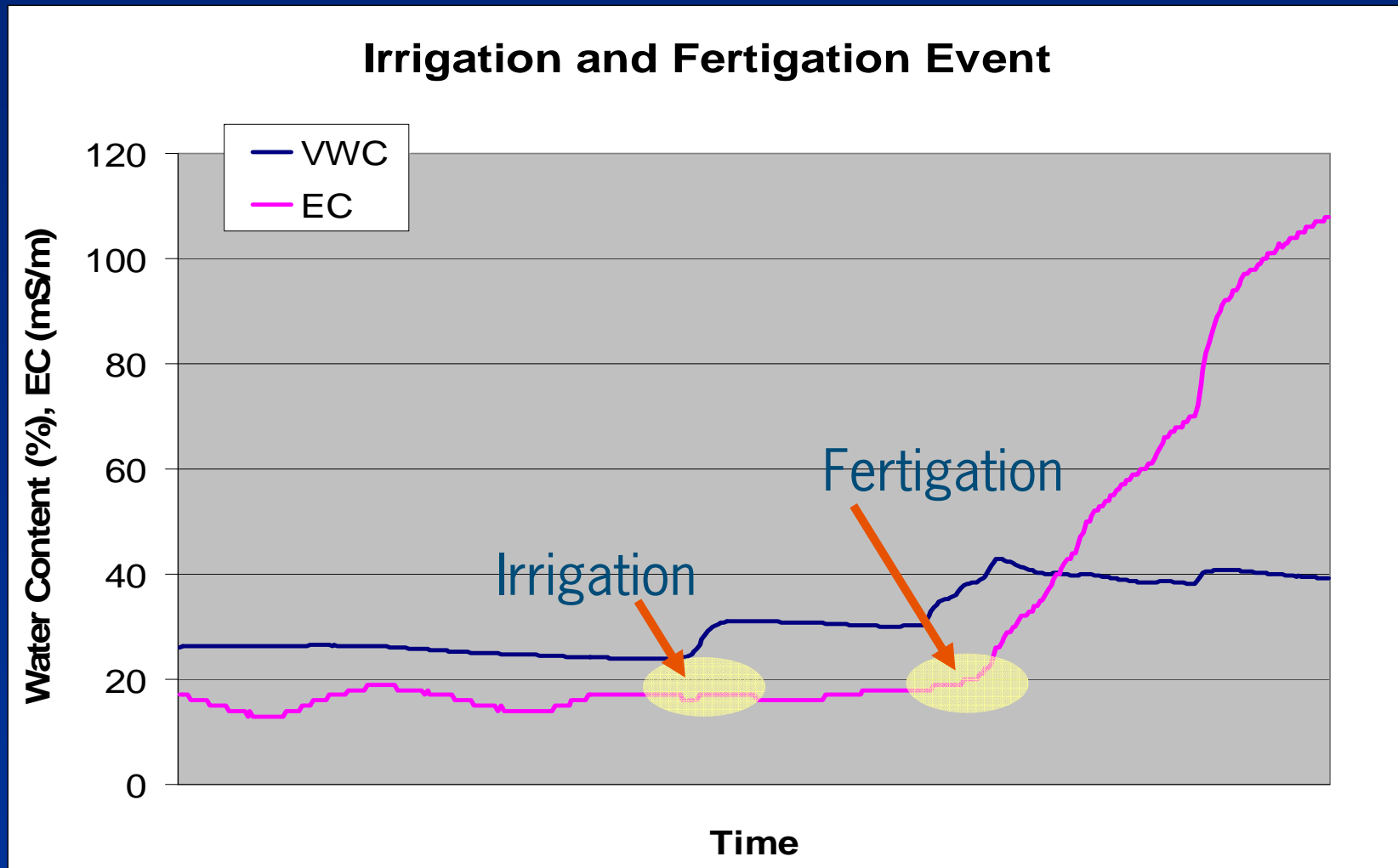
See presentation by: N. Sigrimis

Sensors for Water and Fertilizers
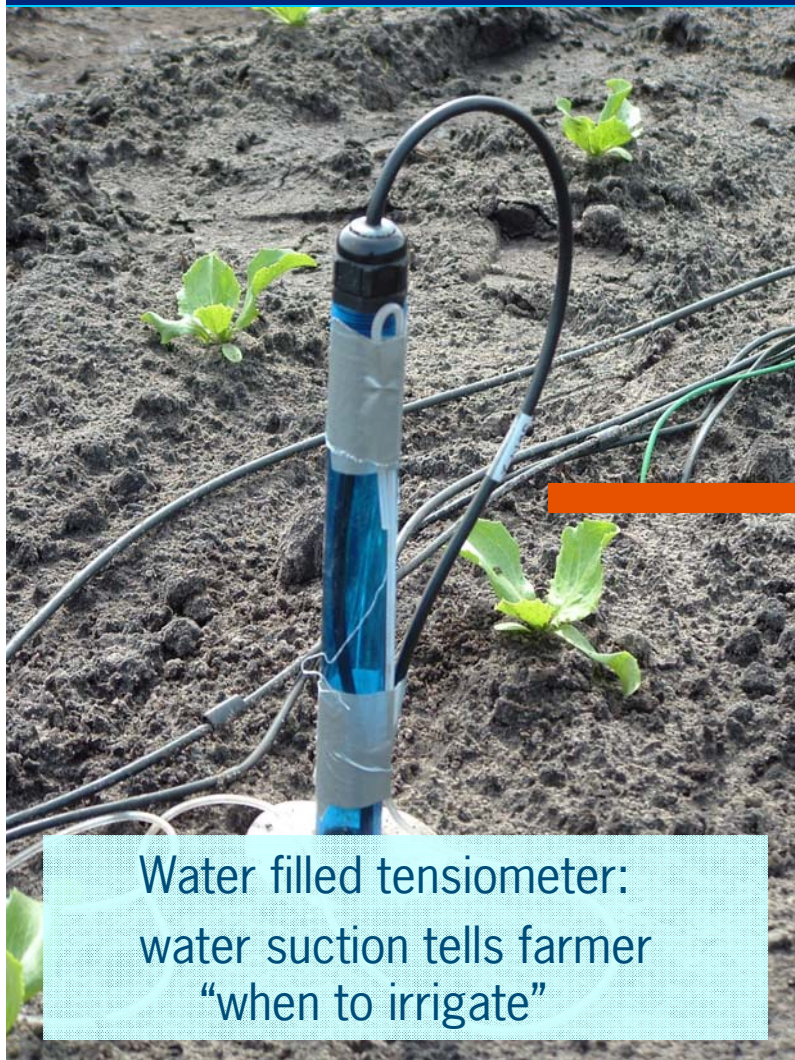
- **Soil Water Content**
  - Water available to crop

- **Electrical Conductivity (EC)**
  - Pore Water EC
  - Total Nutrient Concentration

- **Examples**
  - WET-sensor (Delta-T-Devices)
  - ECHO-5TE probe (Decagon)

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Example of WET-sensor readings

Irrigation and Fertigation Event

Robust tensiometer

Water filled tensiometer:
water suction tells farmer "when to irrigate"

Tensiometer <u>without water</u>:
Larger range
No air entry at dry end
Less maintenance
Easy installation

See presentation by: R. Whalley

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Wireless Sensor Network

- **Monitoring in field**
- **No cabling, easy installation**
- **Multiple nodes and sensors**
- **Robustness in field**
  - Long Range (100m – 500m)
  - Weather proof
  - Solar powered

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Under sub-optimal growing conditions,
technology can offer farmers more possibilities to:

- Efficiently use water and nutrients
- Minimize run-off, percolation losses
- Prevent crop damage

Technology be used in a wide range of farming practices

- Soil or substrates
- Protected or non-protected
- Arid or non-arid zones
- Multiple quality water sources

Many more questions …

- Does it work … When are these tools available … Is it really affordable?

- You are invited to listen to the participants from the FLOW-AID project:
  - R. Whalley, UK: New technology to control irrigation
  - H. Tuzel, Turkey: Results from test site
  - A. Pardossi, Italy: Estimating ET for irrigation scheduling in greenhouse crops
  - N. Sigrimis, Greece: Irrigation Scheduling for Water Saving – Green Technologies
  - D. Jenkins, UK: SME's presentation

- Visit the test-site and share your ideas !!!

Thanks for hosting our experiments!

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Thanks for your attention

visit us at:
www.flow-aid.eu