FLOW-AID, a farm level tool for irrigation management under deficit conditions: Pre-liminary case-study results

STRIVER

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Outline

- Introduction
- Technology “building blocks”
- Case study results
- Conclusions

Water Management Challenges

- Over irrigation in cases of high (fresh) water availability
  - Irrigation amounts depend on availability
  - Leaching or run-off of water and nutrients
- Deficit irrigation if water availability and irrigation water quality is low
  - Use of marginal water resources
  - Yield losses and crop damages

Objectives

- Efficient use of available water (SAVE WATER)
- Rational use of nutrients and marginal water resources (SAVE NUTRIENTS)
- Economically and socially accepted farming (EARN MONEY)

By:

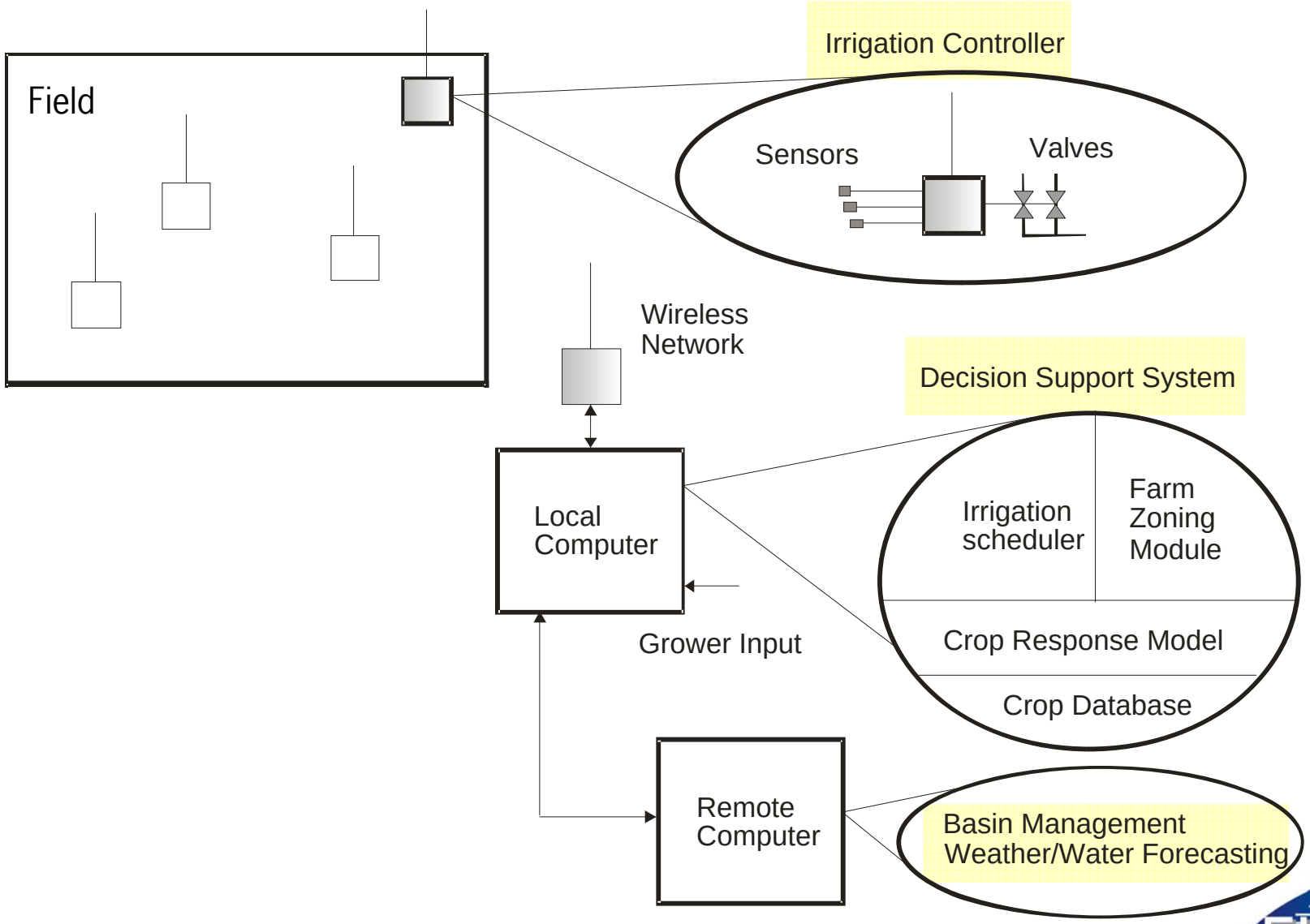
Improving current irrigation practices by introducing new tools:

- Decision Support System for optimal irrigation
- Sensitive, simple and affordable tools to determine optimal irrigation amount and the source of water

For:

- High value horticultural crops
- Arid, semi-arid as well as humid areas
- Protected and non-protected cultivation

System Layout

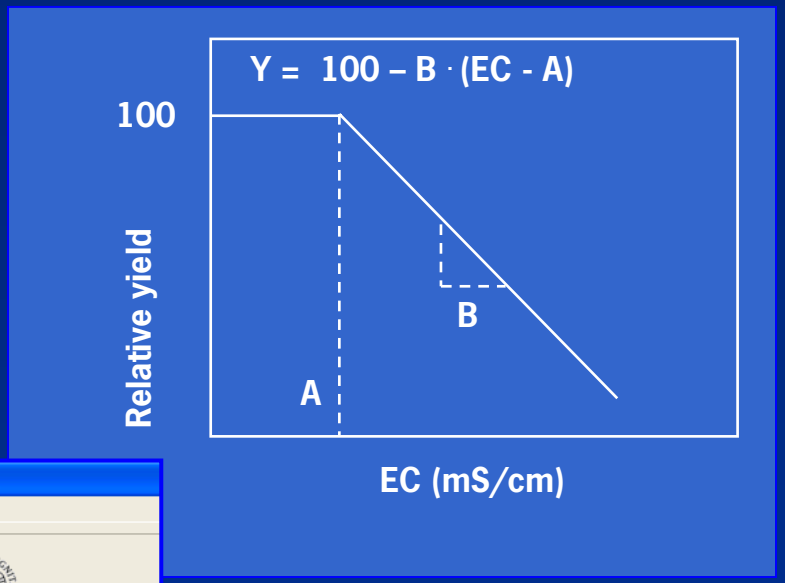


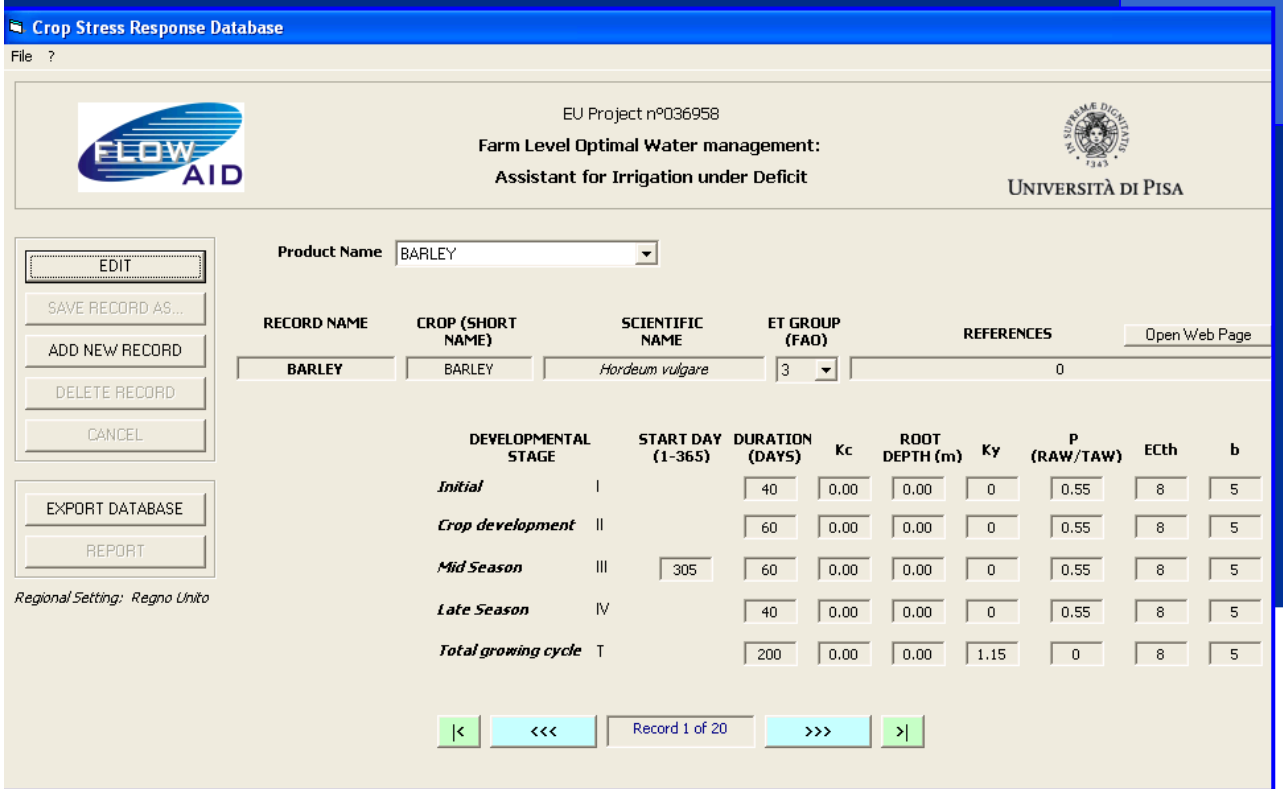
Crop Planning (where to plant what crop?)

- Advising tool (long term planning)
- Optimal crop planning in view to water availability and basin constraints
- MOPECO, model for Optimal Economic Water Use Efficiency (Maximum Gross Margin)
- Input: farm data - crops, sizes, machines, water constraints …
- Use crop model for deficit irrigation
- Output: Annual Crop Plan

Crop Response Model and Database for Deficit

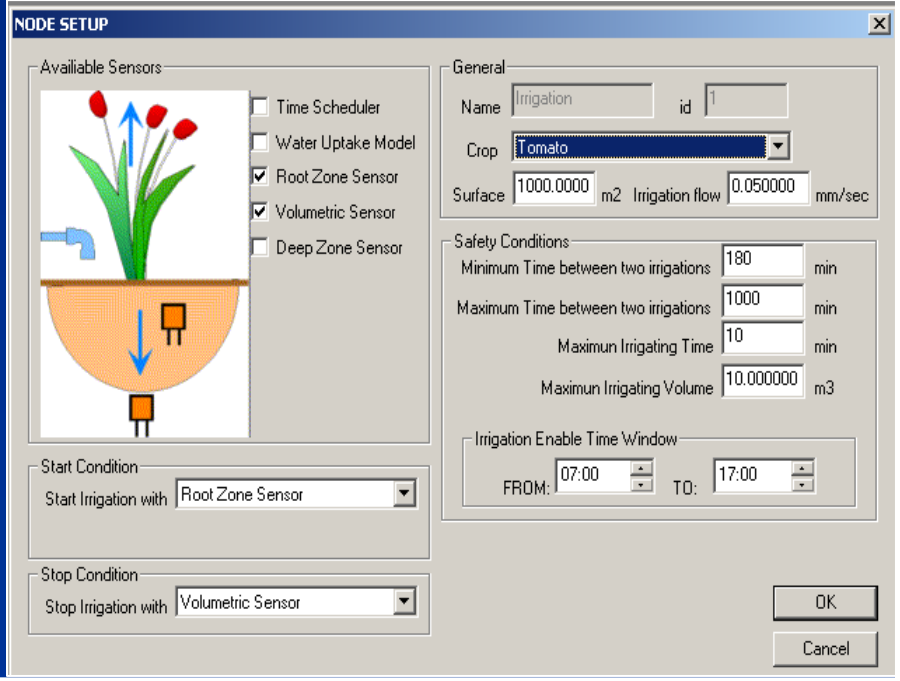
- Yield response to
  - Water Quantity (ET-based)
  - Water Quality (Salinity model)





DSS-Irrigation Scheduler

- Farm-level tool
- Day to day planning
- Short-term Water Availability
- Weather Forecasts
- Plant Status (monitoring)
- Crop Stress Model
- Set Irrigation Controllers



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Irrigation (Fertigation) Controller

- Stand-alone operation
  - Remotely programmed
  - Parameterized
  - Wired or Wireless
- Activation On/Off
  - Timed
  - Sensor controlled
  - Model based (f.i. ET)
  - Multiple valves
  - Multiple water sources

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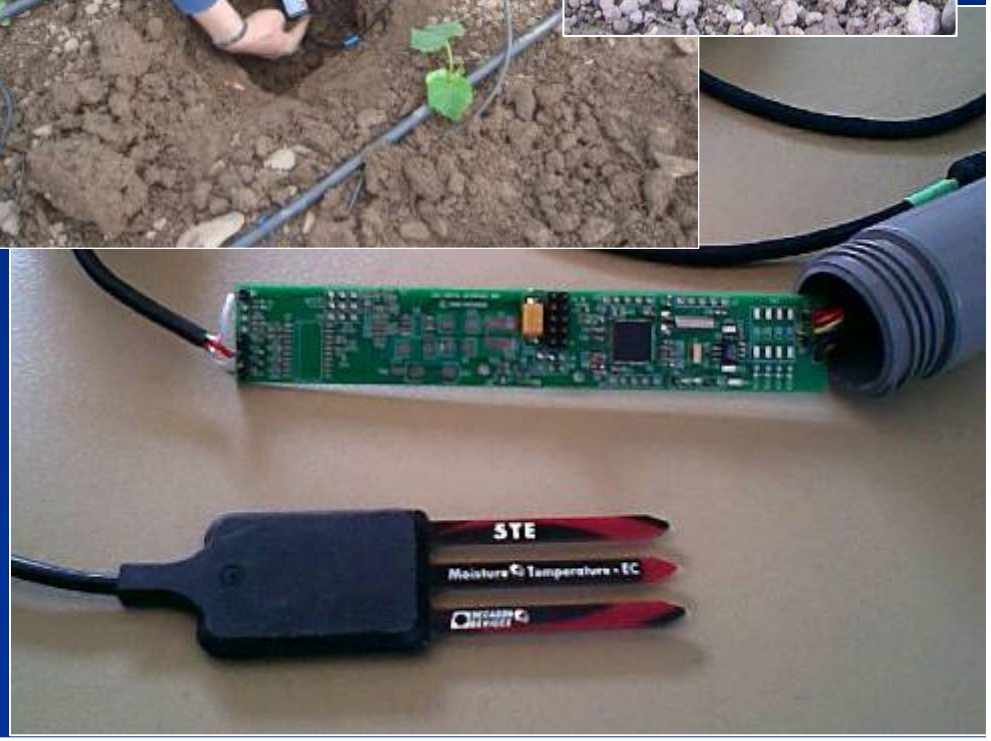
Improved Soil Sensor Performance

- Soil Moisuture Content
  - Soil calibrations
- Electrical Conductivity (EC)
  - Total Nutrient Concentration
  - WET-sensor, ECHO-probe
  - Pore Water EC calibration



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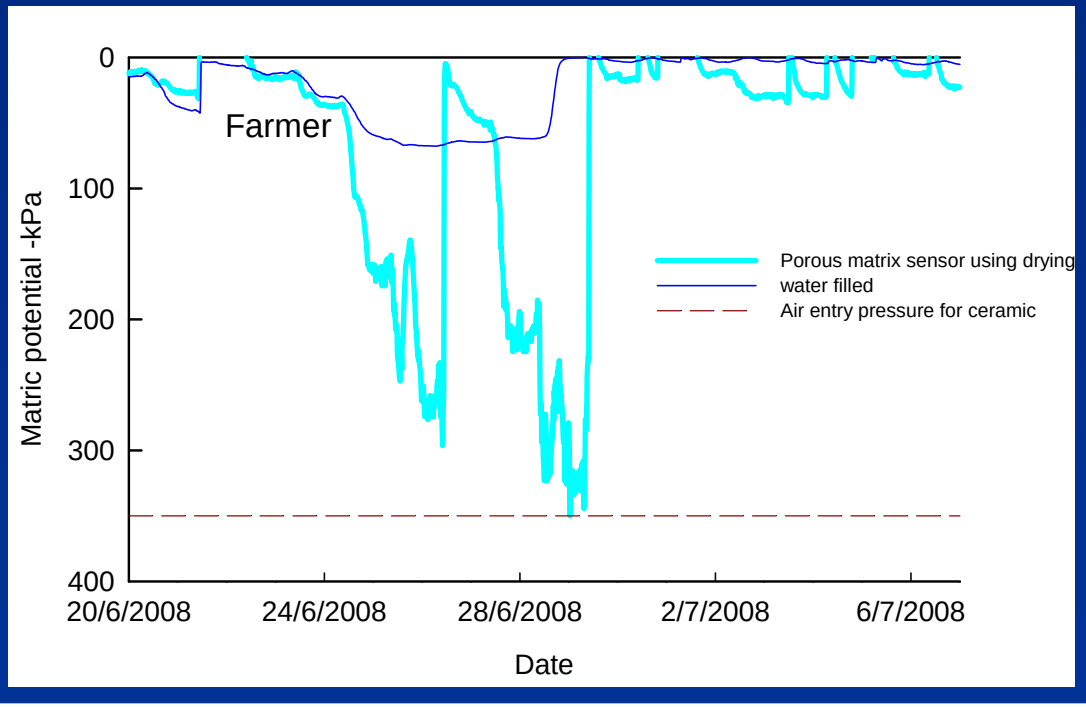
Robust tensiometer

- Porous Matric Sensor
- Large range
- No air entry at dry end

- Water filled tensiometer
- Small range
- Air entry at dry end



Wireless Sensor Network

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

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Case Studies

Preliminary Results

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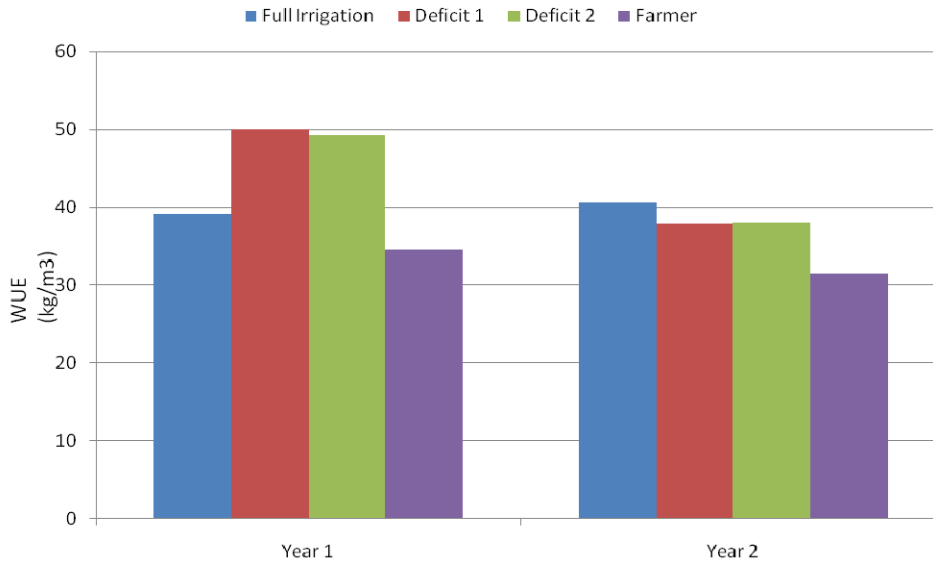
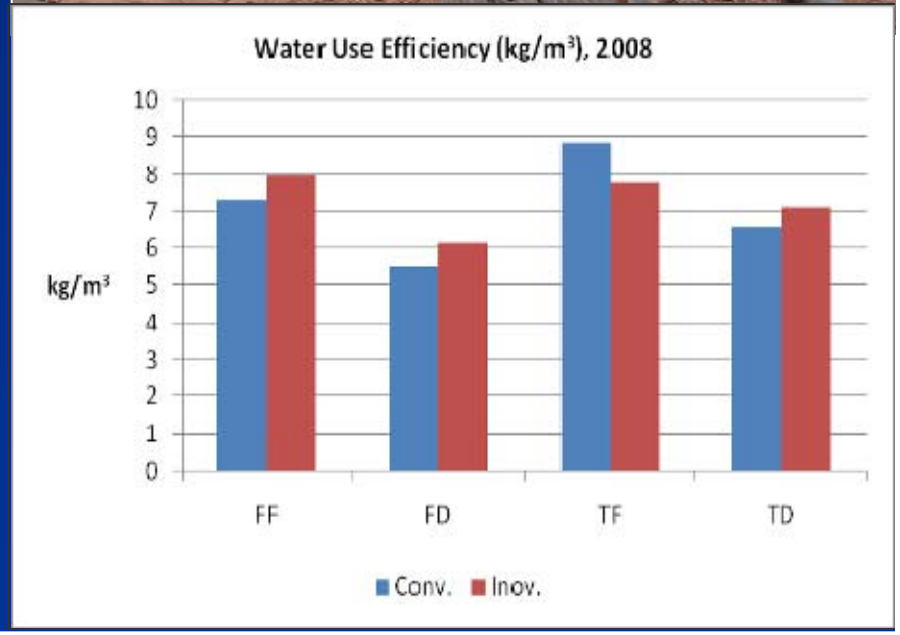
Turkey

- Region Izmir (Tahtalı Dam)
  - Preservation area
  - Greenhouses permitted
  - Water from wells, no leaching
- Objectives
  - Local farmer (Cucumber)
  - Zero drainage (reduce water use)
  - Compensate Yield Losses
  - Sensor activated control
- Water Use Efficiency
  - Marketable yield - applied irrigation
  - Highest in Deficit and Full Irrigation
  - Lowest in Farmers' treatment



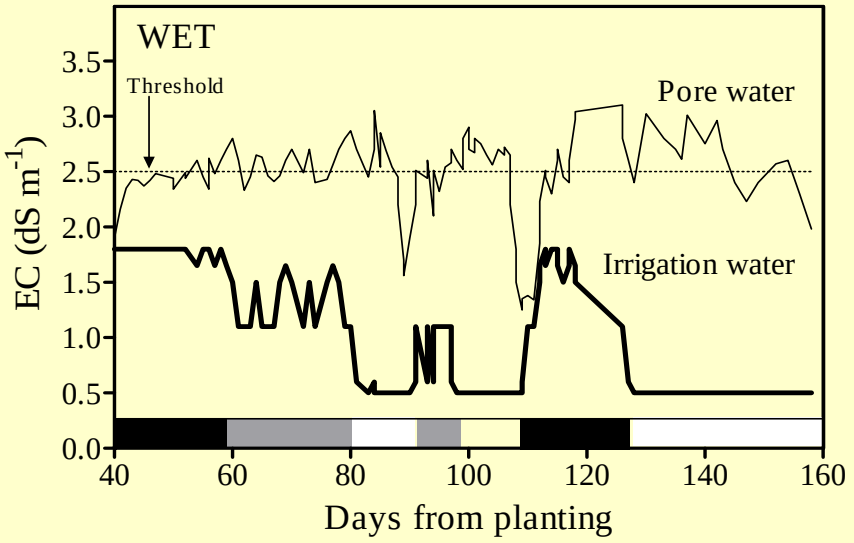
Jordan

- Irbid, Jordan Valley
  - Fruit and oriental trees, vegetables
  - Limited water resources
  - Poor water management at farm level
  - Low water use efficiency
- Objectives
  - Maximize Water Use Efficiency
  - Soil grown tomatoes
  - Dual water quality irrigation: Treated Waste Water (T) and Fresh Water (F)
  - Sensor Activated Irrigation
  - FULL (F) and DEFICIT irrigation (D)
- Results
  - 5-10% Higher WUE with Innovative Irrigation Strategies



Italy

- Pistoia, Tuscany
  - Nursery stock production
  - Farm sizes: 10 - 100 ha
  - Container plants (drip/sprinkler)
  - Many crop types + sizes/plot
  - Need to use saline water
- Objectives:
  - Dual water irrigation: Cleaned Waste Water and Fresh Water
  - Prevent Plant Stress
  - Maintain maximum pore water EC-level using WET-sensors

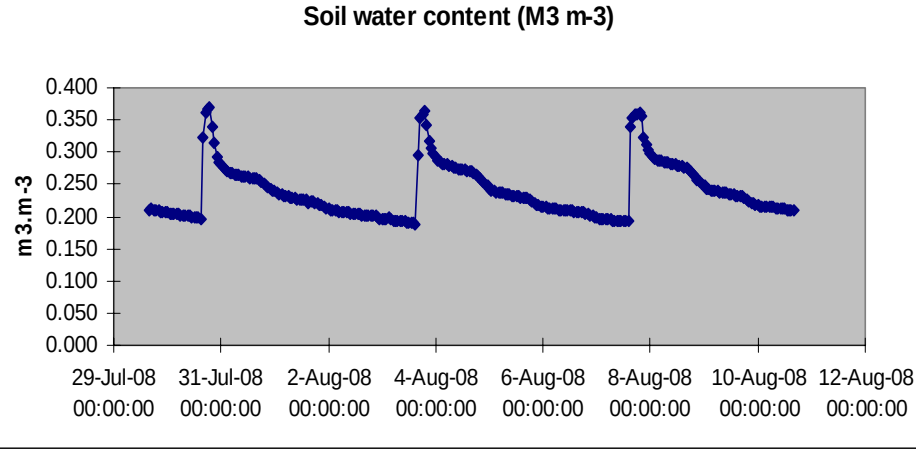


Saline water (1.5 dS/m) Fresh water (0.5 dS/m)

Saline + Fresh water

Lebanon

- South Bekaa Valley, Litany River
  - Tal Amara Research Station
  - Fruit trees and vegetables
  - Water sources:
    - Surface irrigation
    - Pressurized pipelines (sprinklers and tricklers)
  - Poor water management
- Objectives
  - Deficit irrigation performance (potato, eggplant)
  - Enhance Water Use efficiency
  - Evaluate New Technologies
    - Compare drip and furrow irrigation
  - Transfer of knowledge to farmers



The Netherlands

- Limburg – Vredepeel
  - Slight loamy-sandy soils
  - Rain-fed agriculture
  - High water tables
  - Leaching of Nitrate (WFD)
- Objectives
  - Prevent leaching
  - Iceberg lettuce crop
  - Use plastic cover to block rain
  - Use shallow sensor activated control
  - Use deep sensor adapt irrigation dose and monitor leaching
  - Evaluate DSS (remote Host)

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Pre-liminary findings and statements

- “Technology (sensors and control) offers farmers more possibilities to efficiently use water and nutrients under sub-optimal conditions (deficit), and to minimize run-off, percolation losses and crop damage.”
- “Technology can be used in a broad range of farming conditions,
  - in soil or substrate based crop production;
  - in protected or non-protected cultures;
  - in arid or humid zones;
  - and it is usefull to manage multiple quality water sources.”
- “New ICT-tools offer possibilities to link farm and basin management to further optimize Water Use Efficiency, making it a suitable tool for IWRM”.

Thanks for your attention, and …

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