Challenge 2. Decision Support Systems (DSS) and Application Techniques (AT) for efficient irrigation and fertilization

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Reducing water and fertilizer used not affecting crop productivity and quality

Irrigation was controlled by soil sensors, to maintain pre-set soil water content and EC levels

FLOW-AID consortium, 2010 (EU-FP6, WUR Greenhouse Horticulture)
The decision itself is the responsibility of the user, and the DSS is not designed to replace the decision maker but to help in making choices by providing additional information.
Decision support systems for sustainable agriculture

In the design and development of new DSSs, the implementation problem has to be specifically addressed by:

• focusing on holistic approach, integrating mechanistic models
• using automation and integration in data collection, and supporting flexible input efforts by the user;
• delivering the DSS through the Web with user-friendly interface
• involving potential users, sector companies and other stakeholders during the DSS development
• communicating the benefits of the DSS via seminars and visits to demonstration vineyards;
• developing a two-way communication mode with the end-users, i.e., by combining “push” and “pull” systems.
State of the art (greenhouses)

- **Soil crops:**
  - proof-of-principle of smart irrigation is given
  - yet barely applied

- **Soilless crops:**
  - best way to smart management is recirculation
  - common practice in NL
  - virtually not done in the Mediterranean in spite of proof-of-principle
State of the art (outdoor)

Soil crops:
• Proof-of-principle of smart irrigation is given, yet barely applied
• Smart irrigation reduces water amount
• Smart fertigation reduces fertiliser use
• Smart fertigation reduces leaching
• Smart fertilization reduces fertiliser use

Soilles crops:
• Proof-of-principle of smart irrigation and fertigation is given
• Recycling management
• Smart irrigation reduces lost
Challenges for irrigation DSS

- Implementation and integration in holistic DSS for crop management
- Scaling up (from pilot to large scale application)
- Different levels of detail: Simple system needed for large group, complex system for expert growers
- Monitoring, registration and evaluation
- Become more user friendly
- ICT possibilities: hardware and software
- Water and nutrients demand in time
- Weather history and forecast
Challenges of AT smart irrigation

• Cost / Benefit off the systems
• Risk and investment
• Labour
• Robustness
• Controlling and monitoring techniques (water, salt)
• Integration
• Automation
Challenges of smart DSS fertilization

• Not farm / parcel specific
• From advisor to grower (more user friendly)
• Demand in time and space
• Registration
• Amount of input needed (modelling)
• Feed back system
Challenges of AT fertilization

- Just In Time
- Relation with organic matter
- Location specific application
- Method and time of application
- Registration of amount applied
- GIS, precision agriculture
ACTION 1
Improve application systems & techniques

• WATER
  – Related to growing systems
  – Desinfection of water
  – Costs and benefits

• OTHER
  – Chemigation, fungigation, bactigation

• FERTILIZATION
  – Related to growing systems
  – New application techniques
  – Nutrient specific
  – Injection
  – Recirculation
  – New types of fertilizers
  – Costs and benefits
ACTION 2
Develop “grower and crop specific” DSS’s

• Hardware (PC, tablet, smartphone, ...)
• ICT technology
  – local vs web-based (APP vs Internet)
  – User friendly
  – Availability / flexibility
  – Robustness
• Software
  – Interpretation system, integration of models (plant growth and development, water balance, water stress) and sensor information
  – Crop demand: not only ET but also plant water potential; growth curves for N and other cropping practices?
  – Calculation amount of application (H₂O, nutrients)
  – Interaction with hardware (controllers)
ACTION 3
Sensors for feedback

- **WATER**
- **NUTRIENTS**
  - Nutrient specific and/or EC
  - Soil, Crop
  - Mass balance (model; simple)
  - Combination of all
  - Trend analysis
  - Maintenance
  - Calibration
  - Impeding soil management
  - As applied systems
ACTION 4
Water quality and water storage

• Storage rain
• Storage drain (recirculation)
• Quality of rain water and drain water
• Required quality of irrigation/fertigation water
Action 5
Implementation in horticulture

- Skills and knowledge of the growers
- From kg/ha to mmol/l
- Acceptation by growers
- Demonstration, region specific
- Monitoring savings
- Show economic advantages
- Irrigation/fertigation strategy
- Interaction and networking

EFFIDRIP: ICT-based platform for advanced irrigation services
(www.EFFIDRIP.eu)
Action 6
Integration of techniques and (DSS) strategy’s

• Investment (stimulation)
• Water strategy
• Fertilizer strategy
• Hygiene strategy
• Integration
Action 7
Water use efficiency and product quality

• Water deprivation vs. water excess
• Drive crop management for vegetative and productive balance
• Water management for final product quality (increase crop value)
Summary of actions

1. Improve application systems & techniques
2. Develop “grower and crop specific” DSS’s
3. Sensors for feedback
4. Water quality and water storage
5. Implementation in the horticulture
6. Integration of techniques and (DSS) strategy’s
7. Water use efficiency and product quality
DSS

DSS – IrriHort

- Evapotranspiration
- Root zone water status

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\text{Irrigation (when, duration)}
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Weather data

Crop model (LAI)

Sensor data
Root zone mass balance (model)

Irrigation

Irrigation control
Pest management
Temperature control

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Decision support systems for sustainable agriculture
water balance functionality

vite.net example