BF EDUCATIONAL

SUMMER SCHOOL

DIGITAL WATER MANAGEMENT FOR SUSTAINABLE IRRIGATION

2ND EDITION

From September 23rd to 27th, 2024

PURPOSE

To minimize the impact of drought, soil needs to capture the rainwater that falls on it, store as much of that water as possible for future plant use, and allow for plant roots to penetrate and proliferate. Problems with or constraints to one or several of these conditions cause soil moisture to be one of the main limiting factors for crop growth.

Recognizing the importance of irrigated agriculture to food security improved management strategies must be developed to improve water productivity within present farming systems. Under low and variable rainfall conditions, efficient soil moisture management is a good way to improve water use efficiency.

The question is how to optimize soil moisture and water use efficiency, which is a key parameter for drought-proofing the soil and increasing productivity in irrigated agriculture while protecting water resources.

In order to create a drought-resistant soil it is necessary to understand the most important factors influencing soil moisture. There are management options that can increase the soil's ability to store water for plant use. Soil can be managed in ways that reduce the need for supplementary watering and increase the sustainability of the farm. Any worthwhile strategy for drought management optimizes the following factors:

- capture of a high percentage of rainfall (infiltration)
- maximum storage of water in the soil for later use (water holding capacity)
- efficient recovery of stored water (plant rooting)

To address these issues, this workshop and study tour will feature a variety of presentations representing emergent issues on soil moisture management and conservation for annual crops and orchards given by several speakers.

Attendees (maximum 25 participants)
- PhD students
- Researchers
- Extension services

Workshop language
English will be the official language

Venue
The workshop will take place in
Jolanda di Savoia (FE), Cadriano (BO) and Budrio (BO)

Organizing and Scientific Committee

Stefano Caselli
University of Parma

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Diagram Group

Michele Pisante
University of Teramo, PhD Course 'Crop Science' University of Padova

Raffaella Zucaro
Canale Emiliano Romagnolo

PROGRAMME
Monday, 23rd September

Morning
Participant's arrival at Bonifiche Ferraresi Campus, Jolanda di Savoia (FE)

Afternoon

15:00 > 16:00	**Registration of participants**
16:00 > 16:15	**Welcome** *(M. Pisante)*
16:15 > 16:30	**Introduction and programme briefing** *(M. Pisante, S. Caselli, L. Corelli Grappadelli, M. Mastrorilli)*
16:30 > 17:00	**Remote, ground and proximal measurement: design/methodology/approach for long-term plan/vision and management** *(D. Cillis)*
17:00 > 19:00	**Field demonstration** *(M. Mastrorilli, G. Pagnani, G. Dottori)* **Technology for integrating digital soil mapping** **Visual soil assessment** **Ground reference data Elementary Sampling Units**

Methodologies for in situ determination of:
- soil properties: granulometry, structure, porosity
- infiltration: at the soil surface in saturated and unsaturated regime, surface crust, cracking
- direct evaporation from the soil: bare soil and cropped soils
- drainage: within the soil profile and deep percolation
- water rising: from soil horizons of different water content and from the water table
- surface runoff: in and off

Methodologies for determining water status:
- soil sampling techniques
- monitoring techniques and soil moisture sensors

Methodologies for determining root system development:
- destructive observations
- monitoring techniques
- indirect determinations through proximal sensing systems

20:00	Dinner at BF Educational restaurant

Tuesday, 24th September

Morning

09:00 > 10:30	**Mapping intra-field variability: data interpolation and clusterization** *(L. Ranghetti)*
10:30 > 11:00	Coffee break
11:00 > 13:00	**Mapping intra-field variability: field sampling and MUZ creation** *(L. Ranghetti)*
13:00	Lunch at BF Educational restaurant

Afternoon

14:30 > 17:30	**Field exercises: from water balance to irrigation requirements** *(M. Mastrorilli, G. Pagnani)*

> **Compilation of the soil water balance**
> - of soil
> - of cropped plot
>
> **Agronomic techniques modulating the terms of the water balance equation**

17:30 > 19:00	**Report results**
20:00	Dinner at BF Educational restaurant

Wednesday, 25th September

Morning

07:30	**Departure to DISTAL, V.le Fanin 44 Bologna (BO)**
09:00 > 10:15	**Why do we worry about water? Uptake, transport and utilization in the Soil-Plant-Atmosphere continuum** *(L. Corelli Grappadelli)*
10:15 > 11:00	**Assessment of fruit traits variability in orchards: sensors & analysis** *(L. Manfrini - DISTAL UNIBO)*
11:00 > 11:30	Coffee break

11:30 > 12:00   **The bioristor in-vivo sensor**
(M. Janni - IMEM-CNR)

12:00 > 12:30   **Case study fruit growing: image analysis
for crop load estimation, fruit skin blemishes**
(G. Bortolotti; A. Bonora - DISTAL UNIBO)

12:30 > 13:00   **Case study autonomous, electric vehicles: the Dedalus Rover**
(D. Mengoli - UNIBO)

13:30 > 14:30   Lunch, Cadriano Experiment Farm Dining Hall

Afternoon

14:30 > 15:00   **Sensors for assessing soil moisture and related sensors** *(E. Tavelli - WINET s.r.l.)*

15:00 > 15:30   **Setting up ad hoc sensor networks for agriculture
with available, off-the-shelf technology**
(E. Tavelli - WINET s.r.l.)

15:30 > 16:30   **Orchard irrigation design for digital water management**
(L. Franco, Irritec)

16:30 > 17:00   **Demonstration of an autonomos electric orchard vehicle:
Hammerhead by Fieldrobotics**
(D. Mengoli - UNIBO)

17:30   Departure to Jolanda di Savoia (FE)

20:00   Dinner at BF Educational restaurant

Thursday, 26th September

Morning

09:00 > 10:00 **Integration of heterogeneous data flows
for impactful irrigation advisory services**
(M. Amoretti, S. Caselli - UNIPR)

10:00 > 10:30 **Optimisation of crop management with advanced
estimation of biophysical parameters**
(S. Amaducci, M. Croci - CRAST, UNICATT)

11:00 > 12:00 **ARPAE climate services and open data supporting
climate change monitoring, mitigation and adaptation**
(C. Alessandrini, E. Chatzidaki - Osservatorio Clima, ARPAE Emilia-Romagna)

12:00 > 13:00 **Smart data representation and big data platform for Precision Agriculture**
(M. Golfarelli - UNIBO)

13:15 Lunch at BF Educational restaurant

Afternoon

14:30 > 15:30 **Leveraging Earth Observation and DSS
for Precision Soil Moisture Monitoring and Irrigation Estimation**
(R. Dainelli e P. Toscano CNR-IBE)

15:30 > 16:30 **Earth Observation for precise irrigation management:
from research to real-world applications in the context of Agritech**
(G. D'Urso - UNINA)

16:30 Coffee break

17:00 > 17:20 **Soil moisture modeling and assessment: a case study**
(M. Francia - UNIBO)

17:20 > 17:45 **Scalable protocols and general purpose open edge nodes
for sensor data acquisition in agriculture**
(G. Penzotti, F. Saccani - UNIPR)

17:45 > 18:05 **Cosmic-ray neutron sensing
for soil moisture monitoring and precision agriculture**
(G. Baroni - UNIBO, TBC)

18:05 > 18:30 **From sensor technology to true olfactory systems for agriculture**
(B. Fabbri - UNIFE)

18:30 Aperitif at BF Educational restaurant

Friday, 27th September

Morning

7:30 — Departure to Budrio (BO), Acqua Campus Via Ronchi 4

09:00 > 09:30 — **Introduction** *(R. Zucaro)*

09:30 — **Greetings** *(A. Rocchi – CREA)*

09:30 > 10:30 — **Precision Irrigation: new water saving approaches** *(P. Campi - CREA-AA)*

10:30 > 11:00 — Coffee break

11:00 > 11:30 — **Satellite and sensors: new tools for in-farm irrigation management** *(T. Letterio - Consorzio CER)*

11:30 > 12:00 — **The use of big data to improve decisions for sustainable water management at the territorial level** *(F. Cavazza - Consorzio CER)*

12:00 > 13:00 — **Digital water management: examples from reclamation and irrigation boards**

> **Automated water gates and remote control: how precision irrigation management can help water savings at the district level**
> (A. Mambelli – Consorzio di Bonifica della Romagna)
>
> **New paradigms for reaching out farmers, save water and provide ecosystem services**
> (M. Solmi – Consorzio della Bonifica Renana)

Afternoon

14:00 > 15:00 — **In vivo biosensing: applications of bioristor in precision farming** *(M. Bettelli, F. Vurro - IMEM-CNR)*

15:00 > 17:00 — **Field demonstration** *(S. Gentile, G. Chiari - Consorzio CER)*

> - **Variable Rate Irrigation and Ultra Low Drip Irrigation**
> - **New tools and sensors for the assessment of water demand**
> - **Water retention and water phytoremediation systems**

Contacts:

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