

Apple orchard

Irrigation strategy in apple orchards



The measurement of water content in the soil to increase productivity in agriculture

Experience

The Tres Land Improvement Consortium, in agreement with MACH foundation, during 2022 season collected soil moisture data on a large scale, in depth and in real time with two Finapp CRNS probes, using cosmic rays to measure the water content in the soil. A hillside cultivated with apple orchards, with drip irrigation, has been monitored.

The consortium manages the irrigation of the crop (apple orchard) mainly operating with drip systems. The irrigation's management of the valley, is divided by sectors depending on the slope and exposure to the sun. Trentino, together with Alto Adige, are among the areas most affected by the drought in the North East.

The purpose of this installation is to provide to the Consortium and its members, **relevant information to optimize the growth of the apple orchard, evaluating the behavior of soil moisture**. The hilly terrain, very stony, has always made the measurement of soil moisture complex and unreliable with traditional probes, for example TDR or similar. Our aim was to make field activities easier, reliable and more functional.

It was also intended to evaluate any differences between measurements obtained a few kilometers apart from each other.

The infographic is a light green rounded rectangle containing five circular icons with corresponding text below them. The icons are: a person (Name), a location pin (Location), a clipboard with a checkmark (Study validation), a water tap (Irrigation), and three wheat stalks (Crop).

- Name**
Consorzio Miglioramento Fondiario
- Location**
Tres (TN)
- Study validation**
Fondazione MACH
- Crop**
Apple orchard
- Irrigation**
Flood

Use

Soil moisture assessment is one of the pillars on which to build an appropriate irrigation strategy. Today, this measurement is achieved with point sensors or satellite measurements.

Both approaches have technological limitations, which is why irrigation is often based on professional experience rather than real measurements.

During the 2022 season, characterized by exceptional water stress, Finapp probes monitored two apple orchards in Trentino, a few kilometers away from each other.

The precipitation between May and early June (blue histogram), supported by a drip irrigation (blue histogram), allowed to keep the soil humidity within the optimal range, is between the field capacity (gravimetric humidity of 33% about) and the wilting point (gravimetric humidity close to 15%).

In July, the almost total absence of rainfall, combined with strong sunshine and temperatures well above seasonal average, brought humidity to values close to the wilting point.

Irrigation was not enough to compensate the evapotranspiration and only the return of rain in August, allowed optimal conditions to be restored, ensuring a more than satisfactory harvest.

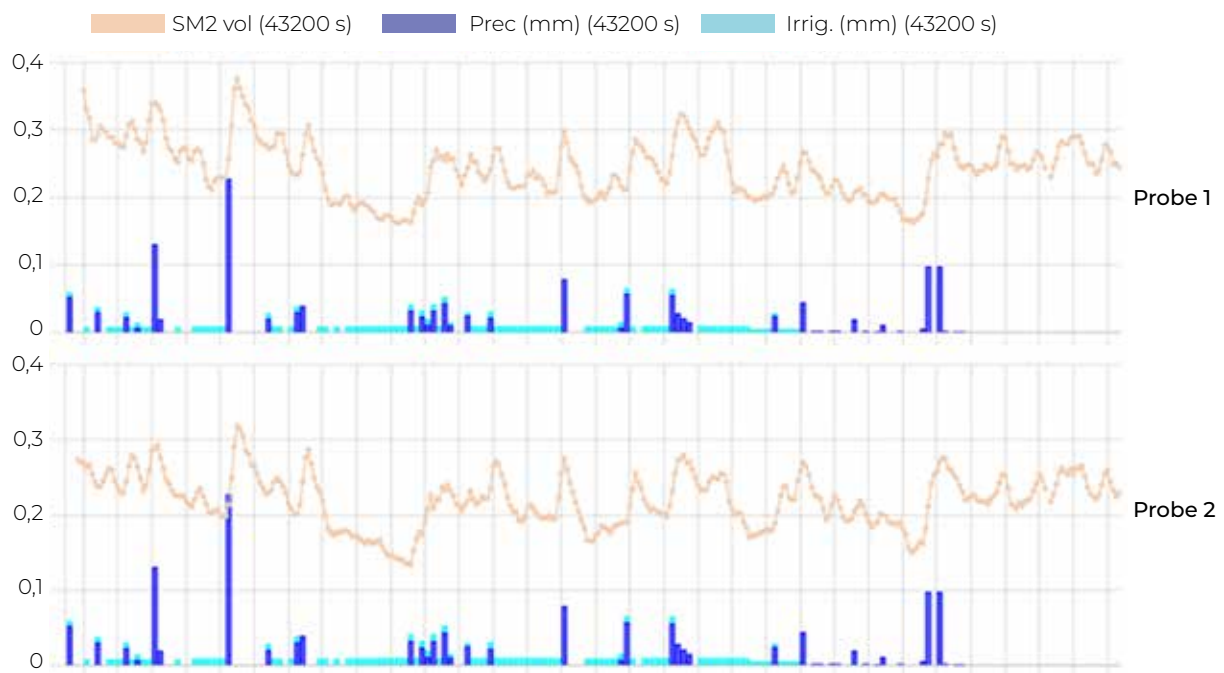
The test demonstrated the efficiency of CRNS probes compared to the limits of point probes.

Another information obtained was that one relating to the homogeneity of the soil. The correlation between the results obtained by the two probes in the two different plots, showed a very similar trend in the amount of water in the soil, even though we monitored two different areas a few kilometers away from each other.




This result is not surprising, since the measure of soil moisture of the Finapp probe, representative on about ten hectares at high hill altitudes, **is able to overcome the point inhomogeneities of the soil**, covering an area large enough to be representative of the whole area.

Soil moisture can then be monitored over large areas, even with a small number of probes, allowing the operator to make the water resource available when and where necessary. Evaluating the irrigation segments it was shown that with 6 or 7 sensors CRNS Finapp you would get the soil moisture data of the whole valley, allowing the ideal irrigation management on the side of the Consortium.

The test also highlighted the limits of traditional probes (for example TDR), in stony and mountainous terrain, where the measurement of soil moisture with traditional probes is complex and unreliable.



In figure:

-  Soil moisture
-  Precipitation
-  Irrigation during the 2022 season

Benefits

- Continuous quantitative measurement (kg/kg) and/or volume measurement (m³/m³).
- Large monitored area, also an entire slope. Spatial scale covering large medium areas, 5/20 ha.
- Non-invasive and no-contact measures.
- Insensitivity to soil salinity, density bulk, texture and surface roughness.
- Indicates when is the best time to irrigate crops according to agronomic and operational parameters
- Optimize water resources by allowing you to irrigate in the right place, at the right time and saving water
- Decreases product losses
- Reduces water and energy consumption by avoiding waste

"We installed the two Finapp probes in about an hour, without any difficulty. The data is easy to access, even from a smartphone, and this is a great advantage for who spend most of the day on the field. In terms of irrigation strategy, we have relied on the Edmund Mach Foundation for several years. The fact that we were advised to install Finapp probes is a guarantee for us"

- These are the words of Alessandro Zadra, President of the Tres Land Improvement Consortium.

Consorzio Miglioramento Fondiario di Tres

The Tres Land Improvement Consortium is part of the Federation of Irrigation and Land Improvement Consortia (COMIFO) which is the service company that supports the activities of over 230 Consortia of the Autonomous Province of Trento. In total, the consortia currently manage more than a quarter of the provincial territory and over 78% of the irrigated area of the province, with constant investments in infrastructure and maintenance. In this way, the Autonomous Province of Trento can currently boast one of the most modern irrigation systems in Italy, namely localized drip irrigation, managed through automation and control systems.

Fondazione EDMUND MACH

For more than 150 years, FEM has been an international research centre, also composed of a technical and professional agricultural school and a technology transfer centre that provides service and advice in the area. It also has an experimental farm with plots located in various locations of the province, which expands the possibilities for research, experimentation and teaching.



The CRNS Finapp technology

Finapp's CRNS technology relates the neutron count of cosmic rays striking the soil, to the hydrogen atoms and thus to the water content in the soil itself. Finapp provides the measurement of soil moisture in a unique way:

- **No-contact: no need for sensors installed in the soil**
- **Area measurement: approx. 5 hectares, a radius of approx. 125 meters**
- **In depth: approx. 30-50 cm in the soil**
- **Continuous: 24/24h, 7/7 days**
- **Not influenced by structures or artefacts**
- **The type of soil does not influence the measurement**
- **Does not interfere with agricultural daily working routine**
- **Less energy consumption thanks to solar panels and no connection to the grid**
- **Data is just a click away on PC, smartphone, tablet, offering an intuitive user interface, clear graphics and the possibility of downloading all numerical values.**
- **Optional information such as DSS (irrigation decision support) is available or can be integrated, as well as meteorological data, data from other sensors, etc.**



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