



## **Development of a soil-crop water status Wireless Sensor Network to support the agrohydrological approach in the drought audit processes: first setups in Chianti terroir**

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Vineyards registered under Controlled Designation of Origin (CDO), such as Chianti (Tuscany, Italy), are subjected to a certification aimed to verify that the product quality, dependent on natural and human factors, meets the conditions requested from the respective regulations. Despite dry farming is usually practiced in Chianti region, supplemental irrigation could be necessary after prolonged drought periods to support the functioning of the vineyard. Supplemental irrigation and other agronomic practices connected with soil water status (e.g. cover crops) are in fact suggested from the disciplinary of production. Monitoring of the soil and crop water status in Chianti region can therefore represent an innovative practice to support the audits of drought characterizing the wine terroir of Central Italy.

A Wireless Sensor Network (WSN) is an environment-embedded tool composed by sensors installed in the analyzed agroecosystem. The WSN is controlled by computer-based applications and integrated in web-cloud platforms. Agrohydrological WSNs, based on the combination of soil-crop water status sensing technologies, represent robust systems to monitor, in real time, environmental forcing useful for the decision making processes related to smart and eco-friendly water management, as well as to detect the functioning status of the crop system.

In this work we present a robust and reliable WSN developed to monitor and quantify the soil-crop water status in Chianti vineyards in order to: i) provide the farmers with a management tool to support supplemental irrigation practice and to define the time and amount of watering, and also ii) offer to the policy makers a tool for environmental analysis aimed at objectively assessing the occurrence of drought periods.

Two pilot areas were chosen in the commercial farms "Monteverdine" and "San Giusto a Rentennano" of "Chianti Classico" wine district, where the agro-ecological approach, as regulated by the disciplinary of production, was followed to identify indicators that can be associated to the wine terroir. The experimental layout of WSN includes 10-nodes in which downhole "Drill and Drop" soil moisture sensors (Sentek, Stepney, Australia) and "Thermal Dissipation Probes" (Granier, 1985) were installed. All the sensors are interfaced with a communications board using the 3G communication protocol to send the collected data to a TCP/IP server, that decodes the packet transmission and saves the data into a MySQL database operated by AgriNET/Tuctronics ([www.grovision.com](http://www.grovision.com)). The system allows to download in real time the soil water content in the root zone at intervals of 10 cm depth, as well as the daily crop transpiration flux.

The initial setups developed during in 2018 allowed to define the topology of the WSN and to identify the position of the nodes based on the soil (clay content, CC) and crop (Leaf area index, LAI) physical properties. At this aim drone-based multispectral LAI-images and CC-maps were integrated in GIS environment allowed to identify homogeneous areas (zone) that were defined according to the spatial variability observed in the fields. The number of nodes, which constitute the WSN, was then defined based on a compromise between the requested estimation accuracy and the cost of equipment.