RIUBSAL: opportunities for expanding the use of reclaimed water for olive tree irrigation

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Abstract

Water scarcity, combined with the increased food demand, requires a more efficient use of resources as well as recourse to unconventional sources [1]. The main goal of the RIUBSAL project is to develop innovative technologies for monitoring and reusing urban wastewater, evaluating their sustainability, efficiency, and nutrient recovery capacity. The study was conducted in an olive orchard in Gallipoli (*Olea europaea* L. cv. 'Leccino') involving two field treatments: 1) irrigation with treated municipal wastewater, and the use of 'RIUBSAL' Decision Support System for smart fertigation and nutrients recovery; 2) irrigation with treated municipal wastewater and conventional fertigation. This system monitors various water quality parameters continuously (NH_4^+, NO_3^-, K, P_2O_5 concentration, water EC, pH and temperature). RIUBSAL integrates data from soil moisture, temperature, and EC field probes, facilitating irrigation and fertigation management. From May 2021, monthly surveys of physiological parameters (stem water potential, gas exchange, leaf chlorophyll content, Normalized Difference Vegetation Index, and Photochemical Reflectance Index) were conducted. The absence of statistically significant differences in both yield and measured parameters shows that the smart nutrient reduction in the RIUBSAL model (-17% for N and -33% for K) did not cause alterations in the physiological state. Furthermore, a predictive model using Random Forest has been developed to estimate the Chlorophyll Content Index (CCI). Using 8-band multispectral images from PlanetScope, with a spatial resolution of 3 meters, the model achieved an R^2 of 0.85 during training and 0.65 during testing. According to bibliography, these results demonstrate that applying multispectral bands and indices may provide a faster, cheaper, and simpler alternative to traditional field measurement methods [2].
In conclusion, RIUBSAL project aims to reduce pressure on conventional water use and ensure sustainable nutrient management. Reusing reclaimed water in agriculture decreases marine discharges and groundwater extractions, reducing seawater infiltration and energy costs. Efficient nutrient management prevents eutrophication and lowers the environmental impact of fertilizer production. 'RIUBSAL' offers a data-driven approach for efficient, sustainable orchard management.

References

[1] Pedrero, F., Grattan, S. R., Ben-Gal, A., & Vivaldi, G. A. (2020). Opportunities for expanding the use of wastewaters for irrigation of olives. Agricultural Water Management, 241, 106333. https://doi.org/10.1016/j.agwat.2020.106333

[2] Garofalo, S. P., Giannico, V., Costanza, L., Alhajj Ali, S., Camposeo, S., Lopriore, G., ... & Vivaldi, G. A. (2023). Prediction of stem water potential in olive orchards using high-resolution planet satellite images and machine learning techniques. Agronomy, 14(1), 1. https://doi.org/10.3390/agronomy14010001