SOILS FOR FUTURE UNDER GLOBAL CHALLENGES

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APPLICATION OF MULTISENSOR CAPACITANCE PROBES (MCAP) FOR SPATIAL AND TEMPORAL MONITORING SOIL MOISTURE, SALINITY, AND TEMPERATURE DYNAMICS IN IRRIGATED ORCHARDS

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1 INTRODUCTION

- Efficient management of water resources is of utmost importance for the sustainability of irrigated agriculture, particularly in Mediterranean, a dynamic region, which is highly dependent on irrigated agriculture.
- Soil salinity and moisture are important factors affecting agricultural production in arid regions. Additionally, the measurement of soil temperature is often needed in understanding its impact on these various processes and in turn the plant growth and crop yields. Soil temperature affects soil water retention, transmission, and availability to plants. The knowledge of these parameters is an important practical consideration to improve irrigation decisions.
- A field experiment was established on an apricot orchard growing in a Mediterranean environment to investigate the effects of freshwater groundwater (GW) and treated wastewater (TWW) on irrigated soils including soil temperature (ST), soil salinity (SS), and soil water content (SWC).

2 MATERIAL AND METHODS

A total of eight (8) Sentek Drill & Drop sensors equipped with data loggers were installed at an apricot tree field (Fig. 1) in Acquaviva delle Fonti (BA), in Southern Italy. Measurement probes provided a complete picture of what's happening in the soil profile by combining soil Water Content (SWC), Volumetric Ion Content (VIC), and soil temperature (ST) readings at several depths in the soil profile (5, 15, 25, 35, 45, 55 cm). The probes were situated 5-12 m apart in different orchard rows. Three sensors were installed at freshwater plots and three at the TWW plots. Two sources of irrigation water were tested: GW (ECGW = 0.5 dS m-1) and RW (ECTWW = 1.5 dS m-1). The monitoring period of the in-situ observational system was from 01 April 2020 to 15 September 2020, and data were recorded over 10-minute intervals on a data logger. The data was assessed in real-time and processed using the IrriMAX software, a web-based platform where one can access the output data measured by the Sentek Multi system.

Fig. 1. Drill&Drop automated sensors installed in an Apricot farm , Southern Italy.

3 RESULTS

CUMMULATIVE VALUES

GW: 113,2 mm

TWW: 154 mm

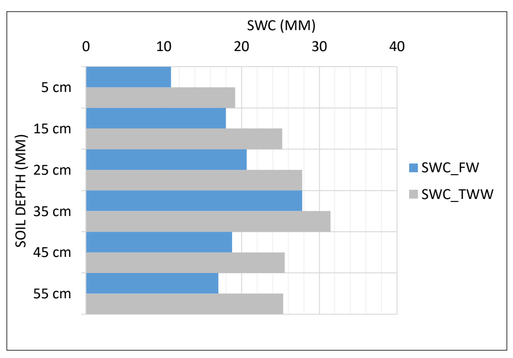
1526 VIC

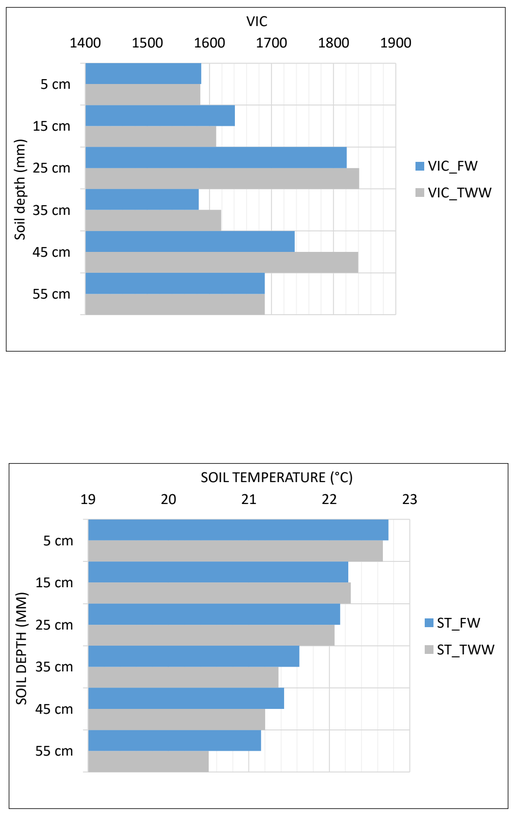
1585 VIC

22,7 °C

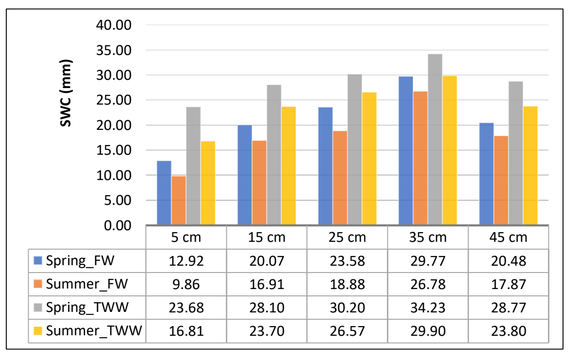
22,7 °C

SPATIAL MONITORING

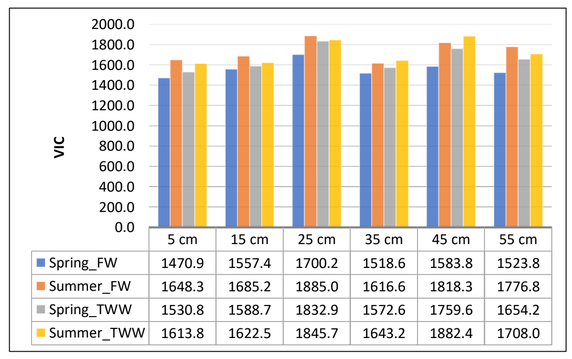




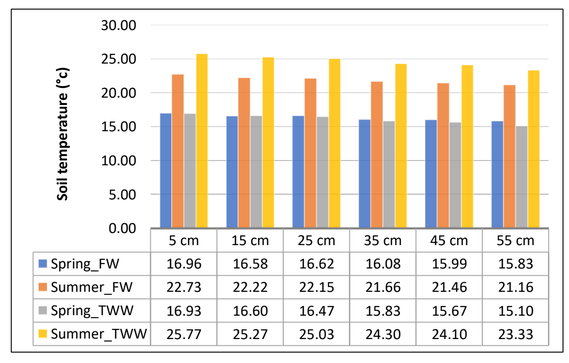
TEMPORAL MONITORING



	5 cm	15 cm	25 cm	35 cm	45 cm
Spring_FW	12.92	20.07	23.58	29.77	20.48
Summer_FW	9.86	16.91	18.88	26.78	17.87
Spring_TWW	23.68	28.10	30.20	34.23	28.77
Summer_TWW	16.81	23.70	26.57	29.90	23.80



	5 cm	15 cm	25 cm	35 cm	45 cm	55 cm
Spring_FW	1470.9	1557.4	1700.2	1518.6	1583.8	1523.8
Summer_FW	1648.3	1685.2	1885.0	1616.6	1818.3	1776.8
Spring_TWW	1530.8	1588.7	1832.9	1572.6	1759.6	1654.2
Summer_TWW	1613.8	1622.5	1845.7	1643.2	1882.4	1708.0



	5 cm	15 cm	25 cm	35 cm	45 cm	55 cm
Spring_FW	16.96	16.58	16.62	16.08	15.99	15.83
Summer_FW	22.73	22.22	22.15	21.66	21.46	21.16
Spring_TWW	16.93	16.60	16.47	15.83	15.67	15.10
Summer_TWW	25.77	25.27	25.03	24.30	24.10	23.33

CONCLUSIONS

Soil Water Content (SWC)

SWC in the TWW plots was higher than in FW plots. Ranges of SWC increase in T1, T2, and T3 (0-35 cm) and decrease in soil depth above 35 cm.
On the seasonal scale, SWC shows a decreasing trend from spring to summer.

Volumetric Ion Content (VIC)

Soil salinity in the wastewater-irrigated area is a little more (<10%) than freshwater irrigated land.

Salinity is not dangerous. Values above 5000 VIC are generally considered to be causing significant plant stress and loss of yield, but this degree of risk is dependent upon soil type.

Soil Temperature (ST)

Soil temperature was similar at both monitoring irrigated plots.
ST for FW ranged from 7.8 to 36 ° C.
ST for TWW ranged from 8.6 to 35.5 ° C.
Increase in ST followed a T1 < T2 < T3 < T4 < T5 pattern (decreases with an increase in depth).

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