XXVI National Conference Of Agrometeorology
L'Aquila 2024, June 5th-7th
Innovative approaches to support agricultural production in an evolving climate context

COUPLING STEM WATER POTENTIAL AND SOIL WATER POTENTIAL ON IRRIGATED AND NOT IRRIGATED VINES. PRELIMINARY RESULTS FOR *Vitis vinifera L. cv. Teroldego*

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INTRODUCTION

- Wine quality can be improved by moderate plant water stress during maturation (Van Leeuwen et al.,), that can be regulated optimizing irrigation timing and quantity.
- The coupled measurements of plant water potential and soil water tension allow a more complete overview of the water status of the plant and of the soil respectively.
- Microtensiometers are a viable method to assess the water status of grapevine (Choné, 2001; Lakso et al., 2022). They perform remote and less demanding monitoring of Stem Water Potential with respect to pressure chambers (Deloire et al., 2020).
- The high sampling rate of these sensors allows the continuous measurement of the plant parameters (Lakso et al., 2022) to understand the plant behaviour in response to soil water status.
- The primary objectives of this study are to investigate the effects of irrigated and non-irrigated conditions on the dynamics of plant water status, as well as on grape quality and yield.

MATERIALS AND METHODS

EXPERIMENTAL SITE

- Mezzolombardo (Trentino-Alto Adige) at about 215 m a.s.l.. (Fig.1)
- Teroldego cultivation grafted onto Teleki 5C rootstock and managed using the "pergola doppia" training system. The vineyard is oriented from North-East to South-West and vine spacing are 5 m x 0.5 m. (Fig.3)
- Irrigation was scheduled following Tab.1.

STEM WATER POTENTIAL (Ψ_{stem})

- 4 microtensiometer probes (FloraPulse Co., Davis, CA (95616), USA) installed: 2 on an irrigated vine and 2 on a not irrigated vine (2023, May 25th) (Fig.2).

SOIL MOISTURE (Ψ_{soil})

- 2 tensiometers installed (2023, June 20th): one next to the irrigated vine and one next to the not irrigated vine.
- positioned under the drip line at a depth of about 30 cm into the soil.
- Values of Ψ_{soil} were recorded every 15 minutes.

GRAPE QUALITY AND VINE BALANCE

- For each vine the Ravaz Index was calculated (Ravaz and Sicard, 1903):

$$I_{rav} = W_g \, W_b^{-1}$$

W_g = weight of the harvested grapes;

W_b = weight of the 2023-grown biomass (no canopy regulation, Fig.4).

- Oenological properties of the must were analysed (Tab.2).

PRELIMINARY RESULTS AND CONCLUSIONS

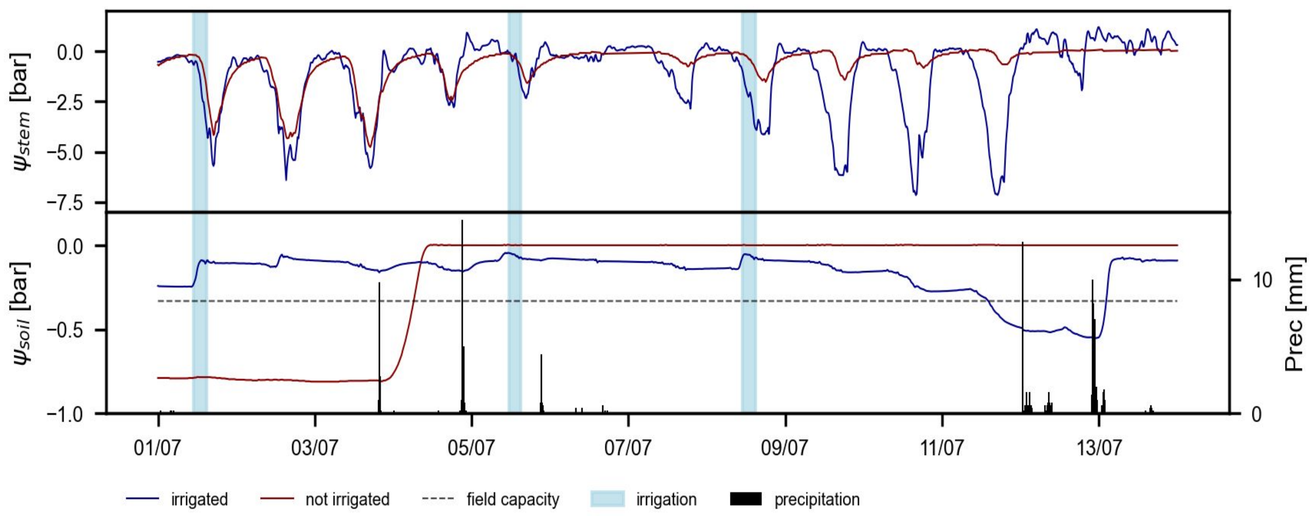

Fig.5: Time series of Ψ_{stem}, and Ψ_{soil} of irrigated and not irrigated vines.

DATE	START	END	AMOUNT
01/07	11:30	15:00	7.7 L d^{-1}
05/07	11:00	15:00	8.8 L d^{-1}
08/07	11:00	15:00	8.8 L d^{-1}

Tab.1 2023 irrigation calendar

	IRRIGATED	NON IRRIGATED
SUGAR CONTENT	230.82 ± 12.61 g l^{-1}	240.44 ± 3.93 g l^{-1}
pH	3.22 ± 0.01	3.37 ± 0.15
TOTAL ACIDITY	8.11 ± 0.61g l^{-1}	9.80 ± 1.53 g l^{-1}
MALIC ACID	3.28 ± 0.37 g l^{-1}	4.46 ± 0.10 g l^{-1}
TARTARIC ACID	6.08 ± 0.15 g l^{-1}	6.43 ± 0,37 g l^{-1}
YAN	115.67 ± 7.23 mg l^{-1}	188.33 ± 20.21 mg l^{-1}
K	2.15 ± 0.05 g l^{-1}	2.95 ± 0.17 g l^{-1}
RAVAZ INDEX	6.5	5.7

Tab.2 Oenological characterization of the grapes in both irrigated and not irrigated musts. YAN stands for Yeast Assimilable Nitrogen.

Fig.6 Stem Water Potential probe by FloraPulse Co. (Lakso et. al. 2002)

- In our settings microtensiometer probes have proven to be a promising technology: Coupled with soil moisture measurements and meteorological data, they widened our perspective on the interaction between plant, soil and atmosphere.
- The vines never reached values of Ψ_{stem} associated to water stress levels (Fig.5).
- The soil below the irrigated vine was above field capacity even before being irrigated (July 1st, July 5th, July 8th). This could enhance loss of water through deep percolation.
- Oenological analysis (Tab.2) of the harvested grapes of the non-irrigated vine show a yield reduction and an increase in both total acidity and Yeast Assimilable Nitrogen,
- Both vines were in optimal productive-vegetative balance (Ravaz index, Tab.2).
- For some hours during the day $\Psi_{stem,irr} > \Psi_{stem,not\ irr}$ and vice versa. One hypothesis is that an environmental threshold exists to activate this switching behavior (mainly driven by Vapor Pressure Deficit, air temperature and global solar radiation)
- **These are preliminary results, and are not generalizable due to the lack of experimental replicates.**

Fig.1 Localization of experimental and meteorological sites.

Fig.2 Microtensiometers on the vines.

Fig.3 Experimental site in summer 2023.

Fig.4 No canopy regulation of vines during the season.

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ACKNOWLEDGMENTS

We extend our deepest gratitude to Danilo Caset who generously provided the grapevines for our experiment, adapting agricultural practices to accommodate our research needs. His contributions have been invaluable in constructing the tensiometers, executing the wiring and also helping us in installing the microtensiometers. His dedication to monitoring the development throughout the growing season and his insights into data interpretation have been pivotal to the success of our study. We also thank Michael Santiago, Terrence Jones and Maryrose Lund of the Florapulse Co. staff for all their technical support.