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AUTOMATED WATER STATUS MONITORING IN GRAPEVINES

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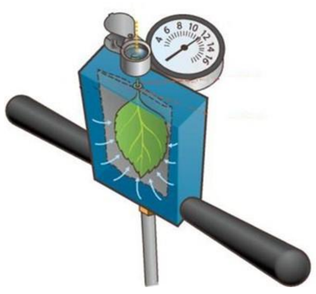
Climate change scenarios, together with the increasing request of sustainable products, push the irrigation sector towards always more efficient use of natural resources. This is particularly evident for the wine sector of the Mediterranean areas, where there is a growing interest in new technologies and knowledge for improving irrigation management. In particular, reliable and immediate data related to water status of grapes is needed to improve irrigation management and for a sustainable use of water resources. In this work, a set of plant water status related variables have been continuously monitored by the use of an automated platform and compared with the stem water potential using pressure chambers. The continuous water status monitoring information represents a useful and user-friendly information for a better irrigation management and scheduling at farm level.

Study site:
Sardinia, Italy (40°50'10'' N, 8°37'36'' E); 120 m asl
Grape variety: Vermentino
Pruning system: Guyot
Space: 1.15 m within the row; 2.3 m between rows
Two thesis:
a) irrigated (allowing a mild to moderate water stress)
b) stressed (no irrigation)
Irrigation: drip line, emitters 2.2 l h^{-1}, spaced 0.75 m

Monitoring activities (June-September 2019)



Stem water potential by a pump-up pressure chamber (PMS Instruments, USA)

Leaf turgor by Leaf Sensor REV3 (Agrihouse).

Xylem sap flow rate by a methodology based on T-Max method
(TT-Wine, TreeTalker Wine, Nature 4.0 SB srl, IT)

Weather station
(Meter environment, ATMOS41)

Preliminary results

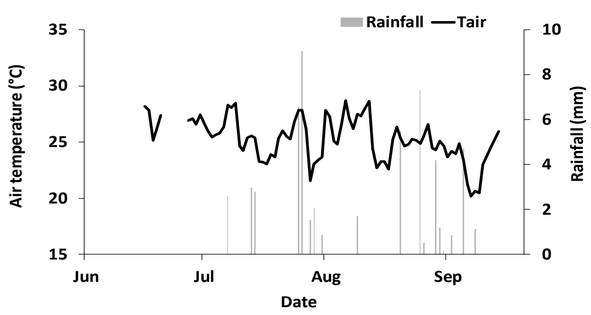


Fig. 1. Weather during the experimental trial

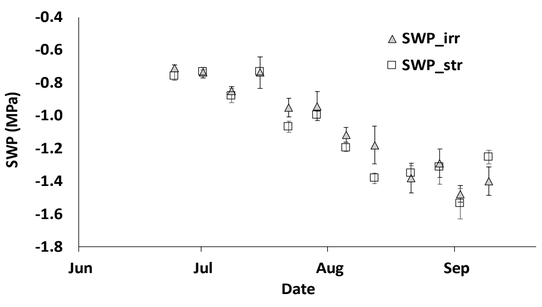


Fig. 2. Stem water potential (SWP) values recorded in the stressed (str) and irrigated (irr) grapes (error bars indicate the standard error).

Figures 1-2. The weather pattern and irrigation strategies caused slight differences in the stem water potential (SWP) values among treatments. Irrigated (irr) and stressed (str) vines SWP value ranged from -0.71 to -1.54 MPa. The lowest values were recorded at harvest while light to moderate water stress was observed during cluster development (-0.8 to -1.1 MPa) (July). SWP values from -1.1 to -1.4 MPa were recorded in August. After the last irrigation (August 21st) supplied to the whole vineyard, the plants of both treatments were able to recover and maintain SWP at -1.3 MPa, an optimal water status for the ripening period for producing high quality wine grape berries.

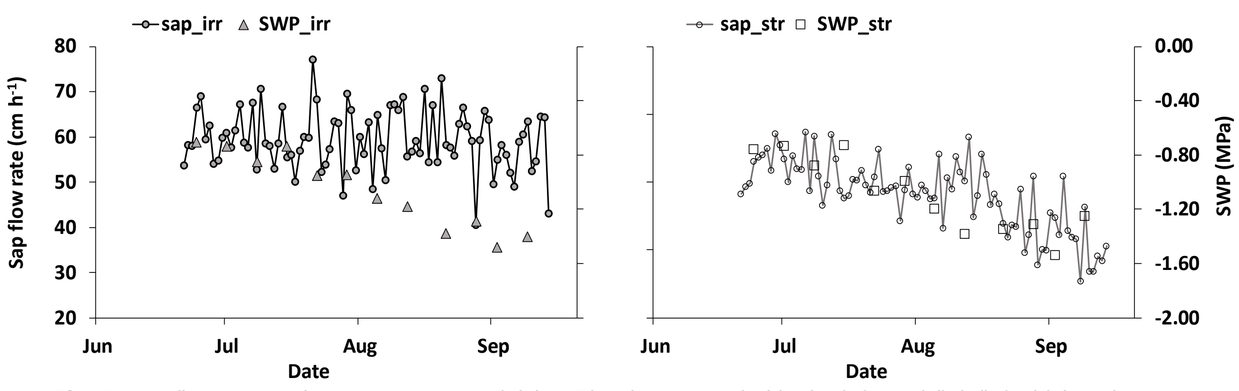


Fig. 3. Sap flow rate and stem water potential (SWP) values recorded in the irrigated (irr) (left side) and stressed (str) (right side) grapes.

Figure 3. The sap flow values trend does not fit well with the SWP pattern in the irrigated thesis (left side). On the opposite, a relatively good fit between the sap flow rate and SWP values for the stressed grapes was observed (right side). It is also interesting to notice that the sap flow rates of the irrigated grapes, on average, were clearly higher than the stressed ones. The visual analysis of the sap flow rates trend shows a high day by day variability of these values.

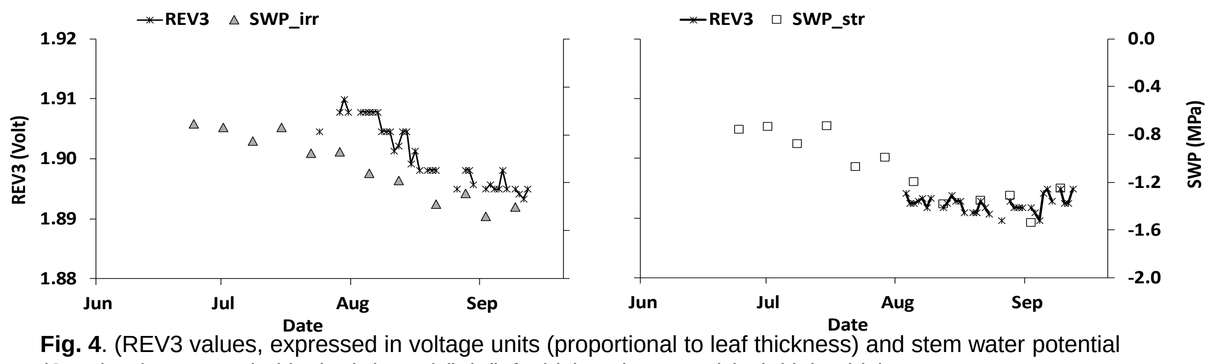


Fig. 4. (REV3 values, expressed in voltage units (proportional to leaf thickness) and stem water potential (SWP) values recorded in the irrigated (irr) (left side) and stressed (str) (right side) grapes.

Figure 4. Interesting results were also observed for the Leaf sensors REV3. In this case, higher leaf thickness values for the irrigated grapes (left side) than the stressed ones (right side) were recorded and, both for the irrigated and stressed grapes, a good fit of data has also been observed.

Continuosly monitoring the water status of the grapes is still not standardized, and it represents a limitation for an optimal irrigation management. This work showed that there are promising techniques potentially capable to monitor continuously proxies of the grapes water status. The preliminary results described in this paper give the basis for future analysis on the most suitable variables and sensors today available

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