EGU25-10812, updated on 09 Jul 2025
https://doi.org/10.5194/egusphere-egu25-10812
EGU General Assembly 2025

Effects of deficit irrigation practices on the Soil-Plant-Atmosphere system: a case study on *Vitis vinifera L.* (*Teroldego* cv.) from Trentino Alto Adige, Italy

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Viticulture in Trentino Alto Adige (northern Italy) mainly focuses on wine quality rather than quantity, and it is well known that wine quality can be improved by applying moderate water stress during fruit ripening. But with climate change extreme drought periods are becoming more and more frequent, and longer often coupled with high air temperatures. This is challenging for farmers, since prolonged periods of water scarcity negatively affect the physiological activity of the vines, the yield and the increase of water demand from irrigation reservoirs. On the other hand, summer extreme precipitations cause, as well, crop loss, plant diseases, nutrient leaching and soil erosion.

With appropriate precision irrigation practices the timing and the amount of water can be controlled to guarantee the optimal amount of water to the crops and ensure the best quality of the products, also avoiding water loss by runoff or deep percolation resulting from an excess of irrigation. In this perspective it is essential to accurately monitor the water status of the SPAC, which is the Soil-Plant-Atmosphere Continuum.

This study focuses on the comparison of two different irrigation regimes on a vineyard located in Mezzolombardo (Trentino Alto Adige, Italy), with the analysis of the water status of the field during the 2024 growing season and the comparison of the musts after harvest.

Four vines (*Vitis vinifera L.*, *Teroldego* cv.) on the same vine row were chosen: two of them were kept without irrigation, and the others were treated as usual with irrigation scheduled by the irrigation consortia. The water state of the plant was monitored with microtensiometers (FloraPulse Co., Davis, USA) embedded in the trunk and measuring the stem water potential (Ψ_{stem}) allowing a continuous, non-invasive and remote monitoring of Ψ_{stem}. The amount of water in the soil was measured with tensiometers, located near each plant, and atmospheric parameters were given by a meteorological station nearby.

The start of the 2024 growing season has been extremely wet and limited the initial development of the vegetation, but August was characterized by almost no water income and particularly high temperatures. Despite the lack of water, the non irrigated plants never reached Ψ_{stem} values associated to water stress, whereas the irrigated plants were kept regularly irrigated even when the water in the soil was above field capacity, leading to a potential loss of water by deep

percolation. The comparison of the musts between the two thesis highlighted no significant differences in the organoleptic properties and the Ravaz Index showed that the non irrigated vines were in a better vegetative-productive equilibrium with respect to the irrigated plants.

In order to adapt the agricultural production to the water imbalance given by the changing climate, it is more effective to provide irrigation only when needed, and not to rely on a scheduled calendar. It is confirmed that precision irrigation practices accurately support the crop needs and it should be one common practice to be developed and enhanced in the near future.