EGU24-15927, updated on 15 May 2024
https://doi.org/10.5194/egusphere-egu24-15927
EGU General Assembly 2024

Ecohydrological investigation of a karstic vineyard in Ceroglie (Italy)

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Due to climate change, southern European viticulture will experience lower and more variable yields and an use of irrigation will be necessary. In the cross-border area between Italy and Slovenia, grapevines are also grown in karst environments on shallow soils developed over limestone bedrock. In this environment the use of irrigation is very limited due to the scarcity of water sources and the ruggedness of the terrain.

In the framework of the Interreg Ita-Slo Acquavitis project we conducted an ecohydrological investigation over two consecutive growing seasons on a *Vitis vinifera* cv. Refošk vineyard on a shallow (50 ÷ 100 cm) karstic red soil in Ceroglie (Friuli Venezia-Giulia, Italy) to: (I) understand the water dynamics in the soil, (II) monitor the vines water status and (III) assess the depth of root water uptake. We also investigated the possibility of vines to exploit water reserves in caves, fractures, and matrix of the karstic system. Monthly precipitations were sampled from July 2020 to December 2021, and single precipitation events from February 2021 to June 2022. A first sampling campaign for soil, xylem sap and water potentials was conducted in 2020, with three sampling dates during the summer. In the following season 2021, the second campaign was conducted with a sampling frequency of ca 15 days from March to October for soil and from June to September for xylem sap . Sampling of dripping water and cave-soil were carried out in a nearby cave up to a depth of approximately 7 m.

Oxygen and hydrogen stable water isotope composition was analysed in precipitation and dripping waters from the cave using an IRMS; an IRIS-IM technique was used to extract and analyse soil water and to analyse xylem sap extracted with a vacuum system in the field. We also measured soil water content, soil water potential,

Summer 2020 was particularly rainy while 2021 showed heavier rainfall in spring followed by a

drier summer. Results from the soil water and xylem sap isotopic values suggested that in this vineyard the vines relied mainly on shallow (above 50 cm) water and precipitation of late spring and summer. Soil water isotopic data showed a high variability in the upper soil while below 40 cm the δ^2H values varied by only 10‰, while xylem saps showed an even slighter variability. Cave-soil water isotopic values were within the variability range of the vineyard ones, as such we could not discriminate whether the vines used also this water resource matrices.

Based on the water potential data of the two growing seasons, the availability of water in the vineyard soil was sufficient for the vines and it seems unlikely that under similar conditions, water resources from the karstic system would be utilised. In the event of severe drought conditions, as occurred in 2022, however, these additional water resources could be exploited by the vines, contributing to a better resilience of the karstic vineyards.