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Reconstruction of vine hydraulic behaviour from tree-ring series up to must in Falanghina under different pedo-climatic conditions

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In the Mediterranean region, climate-change-driven increasing temperature and frequency of prolonged drought periods are affecting physiological behaviour and vine growth, with consequences on berry yield and quality. Assessing how plants have reacted to past environmental fluctuations can help understanding current plant behaviour and forecast possible responses to climate changes. The improvement of knowledge about the plasticity of morpho-functional traits in vines as response to climatic stress conditions can help the management of vineyards.

In this study, we applied a wood-sciences approach to reconstruct past vine hydraulic behaviour in four vineyards of *Vitis vinifera* L. subsp. *vinifera* 'Falanghina' located in southern Italy (La Guardiense farm, Benevento, Campania region), cultivated in different pedo-climatic conditions onto the same rootstock. Wood cores were extracted by the vine trunk and prepared for microscopy and stable isotope analyses to quantify functional wood anatomical traits and $\delta^{13}C$ to assess plant water use efficiency.

Vineyard performances were also monitored *in vivo* at the main phenological phases (flowering, fruit set, veraison, ripening), through the analysis of morphological, eco-physiological and production parameters. Stable isotopes were also traced in leaves and must. Soil profiles were characterised at the four sites that were also monitored for main climatic factors.

All parameters linked with vine hydraulics, resource use and growth efficiency showed a site-specific precise coordination linked with different water and resource availability as influenced by pedo-climatic conditions. The different vines hydraulic behaviour at the four sites, derived from the analysis of the tree-ring series and confirmed by *in vivo* plant monitoring, contributed to different vines productivity and quality of musts. The isotopic signal of wood and must showed a similar trend, suggesting that they both record the same ecophysiological information. These

innovative results suggest the possibility to use must as a good matrix to perform carbon isotope analysis and derive information on plant water use in response to pedo-climatic factors.

The overall information gained through the proposed methodological approach seem to be promising to better understand plant-environment relations in the *continuum* soil/plant/atmosphere, useful for the management of vineyard to achieve a more sustainable wine production.