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Rootstock-scion contributions to seasonal water and light use diversity under field conditions

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Cultivar and rootstock selection are two well-known strategies for adapting vine production in challenging environments. Despite the vast diversity of rootstocks and cultivars, their effective contribution to grapevine sustainable development and acclimation to changing growing conditions remains an open question. The use of robust and prompt monitoring tools can allow a powerful screening of the water status of the vineyard before considering a further detailed characterization. This study leveraged new tools to monitor the stomatal conductance (g_s), transpiration rate (E), and quantum efficiency of photosystem II (ϕPSII) throughout a season, from pre-veraison to after-harvest. The resulting dataset represent one of the largest and most comprehensive rootstock gas exchange studies to date, encompassing a broad range of rootstock-scion combinations: Grenache, Syrah and Cabernet Sauvignon cv. grafted onto the rootstocks 110R, 1103P, SO4, 5BB, 140Ru, and Fercal. A total of 45 measurements, distributed by three blocks, were undertaken per combination throughout eleven dates. Overall, the results show that water use diversity is driven primarily by the cultivar and to a much lesser extent the rootstocks, whose contribution is greatly influenced by environmental parameters (e.g. VPD, light, temperature, and precipitation) and vine development. Grenache cv. showed the lowest g_s values during the experiment, displaying the most conservative water use strategy. On the other hand, light stress responses were more homogeneous across rootstock-scion combinations. Finally, the contribution of most rootstock-scion combinations was revealed to be complex and to vary greatly across the season.

Keywords: gas exchange, grapevine, stomatal conductance, stress responses, water status.