Apoplastic pH influences *Vitis vinifera* Barbera recovery responses to short and prolonged drought

Cristina Morabito[1*], Jessica Orozco[2], Maciej Zwieniecki[2], Francesca Secchi[1]

[1] *Department of Agriculture, Forest and Food Sciences, University of Turin, Largo Paolo Braccini 2, 10095 Grugliasco (Italy)*
[2] *Department of Plant Sciences, University of California Davis, One Shields Avenue, 95616 Davis (CA), USA[3] Affliliation*

[*]*Corresponding author: cristina.morabito@unito.it**

Abstract (250 words)

Alteration of sap pH is one of the first chemical changes that occurs within the xylem vessels of plants exposed to drought. Xylem sap acidification accompanied by the accumulation of soluble sugars has been recently documented in several species (Sharp and Davis, 2009; Secchi and Zwieniecki, 2016). Here, *Vitis vinifera* plants of the anysohydric cultivar Barbera were exposed to either short (no irrigation; SD) or to prolonged drought (continual reduction of 10% water; PD). When comparable severe stress was reached, the potted grapes were re-watered. SD was characterized by fast (2–3 days) stomatal closure and high abscisic acid (ABA) accumulation in xylem sap (>400 µg L−1) and in leaf. In PD plants, the rise in ABA levels was considerably diminished. We observed a pronounced acidification of the xylem sap pH, coupled with a rise in the concentration of soluble sugars, during the recovery phases following both types of water stress. Nevertheless, in plants subjected to PD, pH acidification initiated as early as the more severe stages of stress. The reduction in Non-Structural Carbohydrates (NSC) observed in both leaf and wood tissues during the recovery phase suggests that sugar reserves were likely utilized to facilitate recovery fulfilment. In plants exposed to SD, the intense and abrupt increase in ABA was likely the primary response strategy to stress. The plants favored a protective strategy aimed at minimizing damage caused by sudden stress. Conversely, under PD conditions, the plants exhibited greater acclimatization, implementing an alternative response strategy that encompassed osmoregulation mechanisms triggered by pH acidification.

Keywords: pH, xylem sap, drought, recovery, soluble sugar.