



Unravel the underlying mechanisms of delaying ripening techniques in grapevine

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Abstract

In a scenario of changing climate conditions, grapevine is significantly affected at multiple levels. Advancements in phenology and berry ripening, however, are the major dynamics of the generalized increase in average temperature and evaporative demand, negatively affecting berry quality and productivity. The aim of this work was to unravel the underlying mechanisms of bunch-zone auxin application (NAA; 1-Naphthaleneacetic acid) and source-limiting canopy management approaches in delaying berry ripening. In randomized block design experiments, control vines were compared to vines treated with NAA, subjected to apical-to-bunch defoliation or antitranspirant application (n=10-to-42 plants per treatment). Juice chemical analysis, berry ripening kinetics and physiological traits were monitored every week from pre-veraison over multiple vineyards, years (2021, 2022, 2023) and varieties (Chardonnay, Pinot gris, Syrah, Merlot). Overall, all the treatments delayed berry ripening, and in particular °Brix build up, by 7 to up 15 days. Opposite trends were observed for total acidity, particularly malic acid concentration that displayed a slower degradation kinetic post-veraison. Time course expression profile of ripening-associated transcription factors revealed a significant and consistent repression for *VviNAC60*, *VviNAC33*, *VviBHLH75*, *VviWRKY19*, *VviERF45* following the application of delaying ripening techniques. Similarly, abscisic acid and Indole-3-acetic acid concentration in the berry were modulated by treatments, with specific variation for their free and conjugated forms. This work enlightens, for the first time, the mechanistic framework of berry ripening dynamics following specific treatments with different mechanisms of action and provides novel avenues to harmonize management approaches in grapevine in the context of climate change.

Keywords: Delaying ripening, Climate change, Auxin, Juice quality, transcription factors