SOLUBLE SOLIDS AND FIRMNESS RESPONSES OF A VERY SLOW RIPENING MUTANT TO RIPENING ACCELERATION TREATMENTS

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Abstract:

Context and purpose of the study – Wine grapes have the ability to accumulate high amounts of hexoses (glucose and fructose), which is considered one of the main processes occurring during the ripening stage. Sugar accumulation dynamics respond to genetic, environmental and vineyard management factors, with a changing climate leading to advanced and faster sugar accumulation worldwide. Research on mitigation techniques to this phenomenon is ongoing, with the largest focus being vineyard techniques to delay sugar accumulation. Breeding represents another powerful tool to address the issue of high sugar concentration at harvest, since historical trends of selecting best sugar-accumulators may be inverted to breed varieties that accumulate diminished concentrations of hexoses while maintaining optimal acidity, color, mouthfeel and aroma compounds. Our study closely evaluated sugar accumulation in germplasm that was previously observed to have low total soluble solids (TSS) levels around commercial harvest. Physiological measurements were taken on the slow-ripener candidate and exogenous hormones applied to investigate the reasons underlying such ripening failure.

Material and methods – The study was conducted on a white-fruited wine grape selection of the Viticulture research program at E. & J. Gallo Winery that historically displayed low sugar levels (TSS < 10 °Brix) compared to its wild-type, normal-ripening siblings. Hormonal treatments were applied to single vines on 20 clusters by dipping the clusters five times in the solution for 10 seconds. Abscisic acid (S-ABA, ProTone, Valent Biosciences) was applied at two concentrations: 400 mg/L (ABA400) and 2000 mg/L (ABA2000). Tween20 was used as a surfactant at 0.1 % v/v for ABA treatments and applied as standalone treatment to account for the effect of submergence. The same treatments were applied to own-rooted vines of the cv. Muscat of Alexandria grown in close proximity to the slow-ripening selection. Berry samples were collected at least twice a week for TSS and fresh weight mesaurements. Berry firmness and diameter were measured *in vivo* on treated and control clusters on the same dates.

Results – TSS accumulation in the control vines showed that the slow-ripening selection remained in a pre-veraison stage (TSS < 9 °Brix) until mid Septemper, while the corresponding wild-type ripener from the same population and Muscat of Alexandria had reached 30 and 20 °Brix respectively. Firmness readings highlighted that ripening initiation (i.e. softening) was strongly delayed (~45 days) and occurred at a much slower pace compared to the wild-type counterpart and Muscat of Alexandria, taking over 30 days to reach firmness levels commonly observed in post-veraison berries. ABA2000 was able to readily release grapes from their pre-veraison stage, however sugar accumulation reached a platueau at 13 °Brix, while with ABA400, ripening was unchanged from the control. These findings suggest a possible failure in the hormonal signals triggering ripening, an important first step towards understanding mechanisms of slow ripening in grapes.