



## **The Carotenoid Profile in Ripening Berries of *Vitis vinifera* L. cv. Merlot: the Interactive Effect of Grapevine Vigour and Water Status**

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An HPLC method was developed to characterize the profile of carotenoids in green and colouring grape berries, and was determined in Merlot grapes sampled at four different stages pre-véraison and post-véraison. The samples were taken from plots within a single vineyard, from vines characterized into three vigour categories: low (L), medium (M) and high (H) as defined by remote sensing images and vine characteristics. Within these vigour categories, one additional level of irrigation was imposed in order to explore the interactive effect of vigour and irrigation on the carotenoid profile during berry ripening. The growth of dry matter as determined by pruning mass was significantly different between vigour categories but was not significantly affected by the irrigation treatment. Plant water status as measured by pre-dawn leaf water potential ( $\psi_L$ ) was determined immediately after véraison, and at four different stages up to harvest. The  $\psi_L$  of irrigated vines was significantly higher than unirrigated vines in all of the vigour categories. No significant relationship was found between vigour category and  $\psi_L$ . However, an interactive effect between vigour categories and irrigation was observed, where differences between the  $\psi_L$  of irrigated and unirrigated vines increased as vigour increased from L to M and H. The reason for this is unclear, since soil type within the vineyard was homogeneous. This could indicate that physiologically, the L vines were better able to 'resist' soil water deficit than the higher-vigour vines, maintaining consistently higher  $\psi_L$  values throughout the developmental period. The carotenoids were found to degrade as ripening progressed, with higher levels being present in green unripe fruit, and the lowest levels detected at harvest (24°B). In green berries, pre-véraison, the carotenoid profile was characterized in order of abundance: lutein,  $\beta$ -carotene, zeaxanthin and neoxanthin. After véraison, the presence of the less abundant xanthophylls was no longer detected, except where differences between treatments showed a large increase in carotenoids. The carotenoids lutein and  $\beta$ -carotene responded most significantly to the applied treatments. The application of irrigation caused a decrease in carotenoid content which was independent of berry weight, when expressed per g dry weight or per berry. This was evident pre-véraison and immediately after véraison, but these differences were negligible in ripe fruit where carotenoid content was low. Significant differences in the content lutein and  $\beta$ -carotene and some of the less abundant xanthophylls were observed between vigour categories but this was not correlated with vigour per sé. Rather, where a vigour category was characterized by decreased  $\psi_L$ , this was found to have increased carotenoid levels. The implications of this study show that carotenoid content in grape berries of Merlot can be manipulated by altered plant water status, i.e. irrigation, but that natural within-vineyard variation in plant water status drives this more strongly. Since the breakdown products of carotenoids are considered to be important precursors to norisoprenoid (aroma) compounds in grape berries, this result provides keys to observed sensory differences in wines produced under altered grapevine water status.