

P31 – Real-time high-throughput monitoring of grapevine berry ripening and development with near-infrared spectroscopy

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Abstract

It becomes particularly urgent to decipher the physiological mechanisms underlying the impact of climate change on berry ripening and to select new genotypes keeping an adequate balance between sugars and acids despite the increase in summer temperature. Classical genetic studies consist in studying the diversity of traits of interest, possibly in response to constraints, in order to identify alleles of interest. This type of study is particularly complex to implement regarding grape composition, which displays marked developmental changes during berry ripening, this phenological variation being itself genetically controlled. It is therefore essential to analyze berries from various varieties at the same developmental stage, so that the differences observed are not due only to differences in maturity level. This is further complicated by the noticeably asynchronous development of berries. In this context, it is crucial to develop non-destructive tools for monitoring ripening and berry development at high-throughput. Here, we report the use of near-infrared spectroscopy (NIRS), using a portable device in the field, to study the accumulation of sugar and acids in berries of four grapevine varieties. We sequentially acquired spectra on single berries from 50 clusters all along ripening, from the green stage to over-maturity, collecting a subset of these berries weekly, for quantifying sugar and acid concentrations with HPLC. We used the resulting data to train calibration models between spectra and sugar or acid concentrations, which proved to be quite accurate within cross-validation settings. These models were further applied to predict sugar and acid concentration on the berries that were followed with NIRS but not collected for HPLC measurements. This enabled the reconstruction of developmental trajectories of individual berries during the whole ripening period. These results pave avenues for genetic and physiological studies of berry ripening which are critical for selecting and developing new varieties in the context of climate change.

Keywords: Phenotyping, near infrared spectroscopy, single berry, ripening, sugar, acids