P27 – High-throughput phenotyping of water functioning and carbon metabolism in grapevine

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Abstract

Grapevine production and wine quality are affected by climate change, and identifying varieties adapted to climate change becomes an urgent necessity. Searching for genotypes that are more water-efficient and able to maintain high photosynthesis in drought condition seems to be the key to maintain production while preserving vineyards on the long term. In order to evaluate the genetic variability for these traits, it is a key requirement to phenotype hundreds of genotypes in the vineyard. However, this is often hampered because conventional methods for measuring water and carbon related traits are typically expensive, destructive, and not usable at high-throughput. In this project, we aimed at developing and testing new high-throughput phenotyping methods, based on the use of NIRS (Near InfraRed Spectroscopy) and leaf chlorophyll fluorescence, for studying the genetic variability and determinism of functional traits in grapevine. We used two populations, one resulting from a semi-diallel cross (600 genotypes), the other corresponding to a diversity panel of *279 Vitis vinifera* varieties. In this "calibration" phase, we combined, on a subset of genotypes, conventional low-throughput measurements of photosynthesis, stomatal conductance, leaf water potential, nitrogen and carbohydrates content, with fast leaf measurements using porometry/fluorimetry and NIRS. We used these datasets to calibrate models to predict the traits of interest from NIRS and porometry/fluorimetry, based on PLS (Partial Least Squares) regressions. In the next phase of the project, we are deploying the high-throughput methods alone on the whole populations, in order to predict the traits of interest using models established in the calibration phase, and to further analyse the genetic determinants of these traits with Genome Wide Association Study (GWAS).

Keywords: Phenotyping, high-throughput, near infrared spectroscopy, wineyard, drought, photosynthesis, transpiration