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Physiological and transcriptomic responses of two grapevine rootstock genotypes to drought treatments

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Grapevines are relatively tolerant to water deficit, although severe drought can affect grape quality and yield. Plants responses to drought stress vary depending on the severity of stress and the stage of drought progression. The drought tolerance can be associated with water use efficiency, stomatal conductance, plant hydraulic conductance, embolism repair, rooting depth and leaf dehydration tolerance. Nevertheless, the molecular mechanisms underlying the adaptation of grapevine to water shortage remain less investigated. In this study, physiological and transcriptomic responses in leaf and root induced by water stress exposure of drought tolerant and susceptible rootstocks were compared.

The effect of progressive water stress exposure was studied under controlled environmental conditions on grafted (with Cabernet Sauvignon) and ungrafted plants of 101.14 and 1103 P rootstocks grown in pots. The sampling was performed at 3 different times: T_0, plants at soil water capacity (SWC) of 80%; T_1, plants at 50% SWC; T_2, plants at 20% SWC. The control plants were maintained at 80% SWC overall the experiment. Shoot growth, plant water status and leaf photosynthetic parameters were measured at each experimental time. For transcriptomic analysis, the leaf samples were collected from leaves that were fully expanded and the root samples were obtained by harvesting the whole root system.

Total RNA has been extracted from all samples and tagged mRNA stranded libraries for differential expression analysis have been produced. Each pooled library was sequenced on an Illumina HiSeq 2000 platform with paired end runs of 2 × 50 bps. Base calling and quality control were performed through the Illumina RTA sequence analysis pipeline.

Large differences between genotypes, in terms of phenotypic behavior and transcriptome regulation, were observable. The differences in gene expression among samples have been correlated to physiological responses.