



INFLUENCE OF DEFICIT IRRIGATION ON GRAPEVINE CV. “TOURIGA NACIONAL” IN DOURO REGION: A METABOLOMIC APPROACH

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Abstract

Aim: This study aimed to evaluate whether irrigation of Touriga Nacional in Douro Demarcated Region (DDR) can partly mitigate the negative impacts of ongoing climate change on grapevine yield and quality and its impact on plant metabolism.

Methods and results: Water status was determined by performing pre-dawn leaf water potential (Ψ_{Pd}) using a pressure chamber throughout the growing season. Although from the end of July till the end of August of 2018 both R30 and R70 significantly prevented a decay of Ψ_{Pd} under extreme drought conditions, R30 promoted only a relatively small increase of yield at harvest, but this increase was not observed at R70. In 2019, drought conditions were not so harsh than in 2018 and differences in cluster weights were not observed among irrigation treatments at harvest. A UPLC-MS-based targeted metabolomic analysis from the vintage 2018 identified 44 compounds in grapes from non-irrigated (R0), irrigated at 30% of evapotranspiration (ETc; R30) and 70% ETc (R70), corresponding to eight classes: amino acids; phenolic acids; stilbenoid DP1; stilbenoid DP2; flavonols; flavan-3-ols; di-OH anthocyanins and tri-OH anthocyanins. PCA analysis showed that irrigation influenced the composition of the different classes of grape berry compounds e.g. amino acids, phenolic acids, stilbenoids, flavonols, flavan-3-ols, and anthocyanins.

Conclusions: In the two consecutive seasons of 2018 and 2019 in DDR irrigation at R30 and R70 failed to bring Touriga Nacional vines to hydric comfort at veraison, when drought stress was more pronounced, and did not substantially affect yield and berry quality traits at harvest. However, UPLC-MS-base metabolomics analyses highlighted that berry metabolism was tuned under different irrigation regimes, but more water did not traduce in higher contents of key metabolites like anthocyanins.

Significance and Impact of the Study: Douro Demarcated Region (DDR) has a Mediterranean climate with low rainfall values during summer, high temperatures and high levels of radiation. The introduction of irrigation in this region is still a matter of debate due to the limited number of available studies.

Keywords: Deficit irrigation, metabolomics, leaf water potential, grape quality