THE EFFECT OF WATER STRESS DEFICIT ON 'XYNISTERI' GRAPES THROUGH SYSTEMS BIOLOGY APPROACHES

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Abstract:

Context and purpose of the study - Cyprus is one of the very few phyloxera-free areas worldwide where the vast majority of vines are own-rooted and non-irrigated. 'Xynisteri' is a predominant indigenous cultivar, particularly amenable to extreme conditions such as drought and hot climate, thus rendering it appropriate for marginal soils and adverse climatic conditions. In the current work, a comparative study between irrigated (irrigation initiated at BBCH 71) and non-irrigated vines was conducted. An array of physiological (water potential, leaf water content, stomatal conductance, chlorophyll content), biochemical and qualitative indices were monitored during successive developmental stages (BBCH-75, 85, 87, 89). Harvested grapes were additionally monitored for their aroma profile with the employment of GC-MS, while must was analyzed using FT-NIR and E-nose techniques.

Material and methods - Field experiments were carried out during 2020 in a 6-year old commercial cordon-trained, spur-pruned vineyard of own-rooted 'Xynisteri' grapevines in Agios Ioannis (34°53'56.5"N 33°00'48.4"E) (Limassol district, Cyprus). Grapevine developmental stages were determined based on the Biologische Bundesanstalt, Bundessortenamt, Chemische Industrie (BBCH) scale. Leaf and berry samples were collected at BBCH 75, 85, 87 and 89. Leaves were additionally harvested prior to irrigation. For biochemical analysis, leaves and berries were flash frozen in liquid nitrogen in the vineyard, ground into powder in the lab, and stored at -80°C until needed.

Results - Physiological parameters of leaves were severely affected from drought stress; stomatal conductance registered exceptionally low values at non-irrigated vines. Non-irrigated berries were characterized by higher total soluble content and ripening Index (TSS/TA), while titratable acidity (TA) and pH registered lower values. The concentration of glycosylated aromatic compounds on irrigated grapes was lower, mainly due to their bigger size that led to a dilution effect. Thus, non-irrigated berries can be destined for production of fresh wines. On the other hand, the concentration per g of berry was lower on irrigated berries but the concentration per berry was higher. Hence, the irrigated berries are better suited for dessert wines production upon sun-drying. Finally, molecular signatures were mapped in grapes using RNA-sequencing, which lead to the identification of a number of key transcripts involved in the response.

Keywords: volatile organic compounds; abiotic stress; drought; indigenous cultivars; aroma profile.