P55 – Molecular responses to sunburn in grapevine and preventive measures for viticulture

Waber, Jonas[1, 2, 3*]; Winterhagen, Patrick[2, 3, 4]; Bogs, Jochen[1, 2, 5**]

[1]State Education and Research Center of Viticulture, Horticulture and Rural Development, Institute of Viticulture and Oenology, Neustadt/Weinstraße, Germany
[2]Weincampus Neustadt, Neustadt/Weinstraße, Germany
[3]University of Hohenheim, Institute of Crop Science, Department of Crop Physiology of Specialty Crops, Stuttgart, Germany
[4]State Education and Research Center of Viticulture, Horticulture and Rural Development, Institute of Plant Protection, Neustadt/Weinstraße, Germany
[5]Bingen Technical University of Applied Sciences, Bingen am Rhein, Germany
*Jonas.Waber@dlr.rlp.de; **Jochen.Bogs@dlr.rlp.de

Abstract

Climate change has a significant impact on viticulture. Particular phenological growth stages such as flowering and berry development, the challenge of certain grape varieties to adapt to higher temperatures and drought stress, as well as the occurrence of undesirable off-flavours in wine represent a wide range of impairments. The growing conditions of many autochthonous varieties become poorer as they are adapted to cooler climate due to the longstanding selection process. In addition, sunburn damages to grapes have frequently occurred in Germany since the 1990s, which is associated with an increase of global radiation exposures as well.

In ‘Riesling’ wines, sensory impairments known as "petrol off-flavour" have also occurred in this context in recent years. According to previous studies, the causes of this off-flavour are attributed to rising temperatures and an overall increase in radiation exposure whereby carotenoids in grape berries are degraded into C_{13} norisoprenoids. Further chemical reactions ultimately result in the compound 1,1,6-trimethyl-1,2-dihydronaphthalene (TDN) which gives a dull and petrol-like odour as well as a bitter and astringent taste to the wines. Therefore, sunburn damages significantly reduce both, yield quantity and wine quality.

One research objective of the project is to develop a prevention strategy in which optimized canopy management in combination with application of various compounds or shading reduces sunburn susceptibility of ‘Riesling’ grapes. First results suggest an early defoliation of the bunch zone and application of china clay or lime to significantly decrease the risk of sunburn. Alternatively, different nets could improve grape health. Sunburn avoidance needs to be as effective, economically affordable and sustainable as possible, but also without impairing wine quality.

Moreover, grape varietal differences in sunburn susceptibility could be observed. The fungus-resistant grape variety ‘Calardis Blanc’ visually showed a significantly higher tolerance compared to the genetically distantly related ‘Riesling’. To get further insights regarding sunburn tolerance, experiments in the field as well as in the climate chamber are conducted. Berry skins are investigated on a transcriptional and metabolic level to identify the underlying molecular mechanisms and evaluate their temporal regulation. For this purpose, a deeper understanding of the sunburn-inducing factors is essential as well.

Keywords: ‘Calardis Blanc’, climate change, drought stress, global radiation, grapevine, heat, prevention strategy, ‘Riesling’, sunburn, *Vitis vinifera*