BIOCHEMICAL RESPONSES OF CRIMSON SEEDLESS (*VITIS VINIFERA*) GRAPEVINES TO ALTERED MICRO CLIMATIC CONDITIONS AND DIFFERENT WATER TREATMENTS IN THE BREEDE RIVER VALLEY OF SOUTH AFRICA

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Abstract:

Context and purpose of the study – The South African Table grape industry has to expand to new markets with high quality niche products, but limited water availability threatens sustainable production. To overcome this challenge and to obtain high-quality products for the new markets, require constant technological advancement. Currently, limited available scientific information about growth balances and physiology and especially grape quality parameters, hinders technological advancement and thus efficient regulatory management of the morphological, chemical, and pathological status of table grapes, especially in response to abiotic factors. To enable a deeper understanding of the reaction of grapevines to water supply and climatic conditions, this study partially aimed to determine the impact of different amounts of water and an altered micro-climate (complete covering of vineyards with plastic) on primary and secondary grape quality compounds. The objectives of the study were to deepen the understanding of table grape composition parallel to external factors affecting the value chain and to provide producers with sustainable tools to improve the management of quality variables.

Material and Methods - Two trials, an open field (OF) trial and a trial underneath overhead plastic covering (OPC), were conducted on Crimson Seedless / Ramsey in the Breede River Valley of South Africa. The plastic covers to alter micro climatic conditions were installed after budbreak (in other words for what is generally known as protection), and the sides of the vineyard remained open. Vines were trained onto a Pergola trellis system, micro-irrigated (32 L/h) and spaced 1.75 m x 3.0 m on a stony loam-sand soil. The trial layout design was a randomised complete block with water regime as main factor and ripeness as split strip-plot factor. Four water treatments were applied from after budbreak until the end of harvest. The treatments included a control treatment (100% water application, calculated using evapotranspiration and crop factor), 80% less than the control; 70% less than the control and 55% less than the control. The water treatments were replicated six times under OF conditions and four times under OPC conditions. Grapes were harvested at three ripeness levels. Ripeness levels were indicated by total soluble solids (TSS) where ripeness level 1 = TSS recommended by the Department of Agriculture, Forestry and Fisheries, ripeness level 2 = 10% less than the recommended TSS and ripeness level 3 = 10% higher than the recommended TSS. At each harvest, two 4.5 kg cartons per treatment per replicate were packed, of which one carton was stored for five weeks (four weeks at -0.1°C plus one week at 7.5°C) and another for nine weeks (8 weeks at -0.1°C plus one week at 7.5°C). After storage, the grapes were evaluated for cold storage defects. Biochemical variables, such as total soluble solids (TSS) and total titratable acidity (TTA) were measured from berry set until harvest (three harvest dates). Phenolic compounds, sugars and acids were measured.

Results – Under OF and OPC conditions, the application of less water (55% and 70%) lowered the TSS and TTA at harvest. Acidity breakdown of all the treatments underneath OPC was slower and grapes had a higher acidity. Underneath OPC, colour development was slower, and ripening was delayed. HPLC analyses of grape skins from the OF trial showed that the 55% water application increased total anthocyanins, total 3-glucoside anthocyanin compounds, total acetyl-glucoside anthocyanin compounds, as well as total p-coumaryl-glucoside anthocyanin compounds. The 55% water treatment produced grapes with the highest anthocyanin concentration and phenolic content in the grape skins compared to the 100% water treatment. For the OF and OPC trials, grapes had more decay after a storage period of nine weeks compared to a storage period of five weeks. Correlations between the secondary quality compounds and the occurrence of defects such as loose berries, botrytis, split berries and SO_2 damage of Crimson Seedless will be shown.

Keywords - grapevine, table grape quality, micro-climate, overhead plastic covering, post harvest, storage ability