Decline of Rootstock-Mediated Physiological Responses in Tempranillo Grapevines by Prolonged Extreme Conditions

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Abstract (250 words)

Agriculture faces many global warming challenges especially in the Mediterranean region. Many strategies have been proposed in viticulture to manage global warming. Rootstocks are among them since they may affect water uptake and the scion's performance.

The study conducted in La Rioja, Spain, aimed to investigate the impact of different rootstocks (1103P and 161-49C) on the performance of the Tempranillo grapevine scion over a three-day cycles under drought and extreme conditions, specifically during a heatwave in July 2022, with maximum air temperatures up to 40ºC and average daily temperatures of 29.1ºC. The physiological parameters measured included stomatal conductance (g_s), photosynthesis (A_N), transpiration (E), mid-day (Ψ_{MD}), intrinsic water use efficiency (WUE_i) and abscisic acid (ABA) concentrations.

The results indicated that water stress treatment significantly affected all physiological parameters throughout the three-day cycle. Interestingly, the rootstocks did not show a significant impact on A_N or g_s, except for water potential. The rootstock effect on A_N and g_s was observed during the initial hours of the day on specific days, particularly coinciding with the lowest daytime temperature.

Notably, ABA levels were affected by water stress only on the first day of measurement, at the beginning of the heatwave. However, this effect disappeared on subsequent days (195 and 200) when ABA concentrations reached their highest levels. Surprisingly, the rootstocks did not influence ABA levels.

Our data suggest that, the physiological effects triggered by the rootstocks in grapevine tend to diminish under prolonged extreme events such as heat waves, high temperatures and water scarcity.

Keywords: Global warming, drought, plant physiology, phytohormones, vineyard.