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Eco-Physiological Response of *Vitis vinifera* L. to the Foliar Application of Basalt Flour® under Extreme Environmental Conditions

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ABSTRACT

The need to identify strategies to mitigate extreme abiotic conditions has become urgent, as these factors directly influence the yield and quality of viticultural production. This study aims to evaluate the physiological and productive effects of applying a biological leaf corroborant - Basalt Flour® (FB) on autochthonous grapevine varieties and international ones under different sensitive areas for climate conditions: a peri-urban Rome (Velletri) and a minor Mediterranean island (Ventotene). During three consecutive seasons (2023-2025) micro-environmental parameters of the vineyard were monitored, and historical climate data were analysed to assess the climatic vulnerability. Peri-urban vineyards are integrated within the urban fabric, making them vulnerable and more exposed to likely, intense, and frequent climatic fluctuations. On the other hand, vineyards of minor Mediterranean islands are affected by abiotic stressors (climate, soil salinity, water deficit) combined with socio-economic processes such as land abandonment and require a multifaceted approach combining climate resilience, land management, and community engagement, to preserve cultural heritage, biodiversity and local economies. The health status of the vine was monitored using non-destructive tools capable of measuring leaf chlorophyll content, chlorophyll fluorescence efficiency, and vegetative indices to evaluate the plant's water and nutritional status. The results highlight a genotype-dependent response. Overall, foliar application of FB delays leaf senescence, reduces abiotic stress, improves gas exchange, enhances the photosynthetic performance of the vine, and improves the hydraulic status of the canopy. The effect of FB is more pronounced in seasons with more limiting climatic conditions. In conclusion, foliar application of FB proves to be a promising strategy to enhance the resilience of the vine to climatic adversities, thus ensuring the sustainability of viticulture under semi-arid conditions. These findings offer valuable insights for future agronomic practices aimed at maintaining quality and productivity in vulnerable viticultural contexts such as urban, peri-urban and coastal ones.

Keywords: climate emergency, cropping strategies, ecosystem services, native grape varieties, photo-chemical performance

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