COULD INTERMITTENT SHADING, AS PRODUCED IN AGRIVOLTAICS, MITIGATE GLOBAL WARMING EFFECTS ON GRAPEVINE?

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Abstract:

Context and purpose of the study - Global warning increases evaporative demand and accelerates grapevine phenology. As a consequence, the ripening phase shifts to warmer and drier periods. This results in lower acidity and higher sugar levels in berries, yielding too alcoholic wines with altered organoleptic properties. Agrivoltaics, which combines crop and renewable energy production on the same land using photovoltaic panels, emerged as a promising innovation to counteract these impacts by partially shading the plants. Orientable panels (trackers) further offer the possibility to shade during specific periods. This study aimed at identifying the conditions and periods of shading that are most profitable to vine development and production, by studying the effects of different types of intermittent shading (shade and sun alternations) such as those created by agrivoltaics.

Material and methods - Three types of experiment were carried out in South France: (i) a 2-year experiment, conducted on young potted plants (cv. Syrah) that were placed at different phenological stages under strong intermittent shading provided by fixed panels, and two field trials, conducted with moderate intermittent shading, (ii) the first one with 12 year-old cv. Merlot covered by fixed panels and (iii) the second one with 19 year-old cv. Grenache covered with solar trackers installed by Sun'Agri®. A wide range of responses were characterized: phenology, leaf area and radiation interception, carbon assimilation and allocation, yield components and primary quality characteristics of berries.

Results – In well-watered pots, two years of strong intermittent shading delayed veraison, but with a decrease in berry diameter and sugar content per berry at harvest. The delay was much less important when shading was limited to the post-veraison period or combined with a water deficit. In the field, where plant water status was close to that observed in pots under water deficit, much smaller delays were observed from veraison onwards in response to shading and sugar loading slowed down. In all cases, the shade avoidance syndrome was observed with carbon re-allocation from roots to aerial parts in pots. Photosynthetic capacity was reduced in pots, whereas the photosynthesis decrease induced by moderate shading in fields was partially compensated during intermittent sun exposures thanks to a better water status. Despite these physiological compensations, intermittent shading tended to limit yield, especially when applied during berry formation and repeated over years, mainly due to reduced fertility. Consequences for shading strategies in vineyards are discussed.

Keywords: Grapevine, intermittent shading, water-deficit, growth, yield, berry quality