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Characterizing Vineyard Water Status Variability in a Premium Winegrape Vineyard

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One of the biggest challenges in viticulture and winemaking is managing and optimizing yield and quality across vineyard blocks that show high spatial variability. Studies have shown that zonal management of vine water status can contribute significantly to improving overall fruit quality and improving uniformity. Vine water status is a major parameter for vine management because it affects both wine quality and yield. In order to optimize vineyard management and harvesting practices, it is necessary to characterize vineyard variability in terms of water status. Establishing a targeted irrigation program first requires spatially characterizing the variability in vine water status of a vineyard.
In California, due to the low or no rainfall during the active growing season, the majority of vineyards implement some type of irrigation management program. As water supplies continue to decrease as a consequence of persistent drought, establishing efficient and targeted water use programs is of growing importance in California. The aim of this work was to characterize the spatial variability of plant-water relations across a non-uniform 4 ha block in Napa Valley with the primary objective of establishing vineyard irrigation management zones.
The study plot was divided into three sections, designated the North, Middle and South sections, each at about 1.3 hectares. Stem (Ψstem) and midday (Ψl) leaf water potential and predawn (ΨPD) water potential were measured at 36 locations within the block at 14 (Ψl), 10 (ΨPD) and 2 (Ψstem) points in time throughout the growing season. Of the three techniques utilized to evaluate water status, ΨPD and Ψstem were the most sensitive indicators of water stress conditions.
An integrated overview of water use efficiency over the growing season was assessed by measuring the leaf carbon isotope ratio of δ13C. Fully mature leaves were sampled from 280 vines and results show, similarly to ΨPD and Ψstem, that the North section (-28.05%) was significantly different than the South (at -28.31) and Middle (at -28.33) sections.
Interblock variability can be reduced by managing water supply to the North section independently of the South and Middle sections. For Napa due to foggy mornings and overcast skies, Ψl provided the least discriminatory water status measurements.