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Coupling soil and canopy proximal sensing in vineyards to assess short range variability of grape quality

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Selective grape harvest, based on short distance variability of soil and vine features, can be an important tool to optimize and increase wine quality. This precision viticulture approach needs suitable maps of functional homogeneous zones (fHZs), discriminated by their potential functionality (eg. soil water retention, grapevine vigour, etc.).
Objective of this work was coupling methods of proximal sensing for soil (ECa, apparent electrical conductivity measured by electromagnetic induction) and crop (NDRE, Normalized Difference Red Edge) mapping to delineate fHZs within the vineyards. Study vineyards were situated in 4 different terroir of Brunello di Montalcino DOCG district, southern Tuscany, and they shared the same grape cultivar (Sangiovese) and similar age and management. Each vineyard was split into two fHZs after k-means clustering, using the maps obtained by proximal sensing as input data. For each fHZs, a soil profile was described and analyzed, as well as 10 grapevines were selected to analyze grape at harvest (berries weight, sugar content, pH, total acidity, polyphenols and anthocyanins).
The results showed that grapevine vigour, mapped through NDRE, generally followed the ECa soil spatial variability. Indeed, soil limitations, namely shallow rooting depth, low chemical fertility and available water content, moderately restrained grapevine vigour. This moderate stress induced a decrease of grape berries dimensions and weight (from -16% to 49%), as well as increase of polyphenols and anthocyanins. Sugar content and acidity were similar between the grapes of the two fHZs, although differences were individuated in some cases. This proximal sensing approach can be suitable to discriminate two, or more, homogeneous areas within a vineyard, allowing to obtain different grape quality by selective harvests.