UNRAVELING VINEYARD SITE FROM VINTAGE CONTRIBUTIONS: ELEMENTAL COMPOSITION OF SITE-SPECIFIC PINOT NOIR WINES ACROSS MULTIPLE VINTAGES

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Abstract

Understanding vineyard site contribution to elemental composition of wines has, historically, been limited due to lack of continuity across multiple vintages, as well as lack of uniformity in scion clone and lack of controlled pilot-scale winemaking conditions. We recently completed our fifth vintage, and have elemental composition characterizing wines from four vintages (2015–2018). The experimental design minimizes sources of potential variation by using a single scion clone of Pinot noir and by using automated 200 L fermentation vessels at the UC Davis Teaching and Research Winery, in which fermentations are highly controlled across vineyard replicates, vineyards, and vintages. The work aims to begin to unravel vineyard site from vintage contributions in elemental composition of wines.

Grape clusters were hand-harvested from vineyards which span a distance of more than 1400 km. Eight American Viticultural Areas (AVAs) are represented in this work: Santa Rita Hills, Santa Maria Valley, Arroyo Seco, Carneros, Sonoma Coast, Russian River Valley, Anderson Valley and Willamette Valley. Fruit was destemmed only and inoculated with Saccharomyces cerevisiae yeast. Upon completion of inoculated MLF, wines were stored in stainless steel vessels until sampling for characterization. Forty-seven elements were profiled in a mass range of 7 to 238 m/z by using inductively coupled plasma–mass spectrometry (ICP-MS).

Thirty elements have been quantified in the wines from at least half of the sites by ICP-MS. Principal component analysis (PCA) was used to characterize vineyards using only significant elements identified by an analysis of variance (ANOVA) measuring effects of vineyard. Across multiple vintages, wines from some AVAs were consistently clustered by elemental composition profile, such as those within Santa Maria Valley and Arroyo Seco. Other vineyard locations, however, were reproducibly more similar in elemental composition to sites in other AVAs than those within their AVA. Differences in profiles within an AVA suggest that factors such as distinctive soil composition or conditions, or microclimate have an effect. Overall, separation and clustering of wines by elemental composition appears consistent across vintages in this experiment. These results quantitatively demonstrate reproducibility and differentiation of chemical composition of wines across multiple vintages, which is an important component of terroir. Details continue to be unravelled in future work to elucidate consistency of elemental profile from sites across vintages, such as correlations with soil composition and site microclimate.

Keywords: Wine elemental composition, Pinot noir, American Viticultural Areas, terroir