



Influence of vine vigor on Pinot noir fruit composition, wine chemical analysis, and wine sensory attributes

By: J. Cortell, H. Sivertsen, J. Kennedy, and H. Heymann

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- There is a great interest in understanding the influence of vineyard factors on wine sensory characteristics. *Astringency*, in particular, has been very difficult to study because of its carryover effects. We know that monomeric flavanols are primarily bitter, and as molecular weight increases, astringency becomes predominant over bitterness. As a result, **large polymeric tannins from skins and seeds are the major contributors to wine astringency**. But the challenge to understanding astringency does not stop at knowing the tannin molecular weight, since a number of wine components and their interactions all have the ability to affect astringency. For instance, adding acid can increase astringency, whereas adding sugar, or increasing viscosity, tends to reduce it.
- In a previous study, these same authors had divided two Pinot noir vineyards into “vigor zones” based on three vigor parameters (trunk cross section, shoot length, and leaf chlorophyll). They found that **low-vigor zone vines had higher molecular weight proanthocyanidins and higher polymeric pigments in the fruit**. The same trend was found in the wines, along with a higher proportion of skin tannins, compared to the wines made from high-vigor zone vines. In the current study, the authors study how these different vigor zones affect sensory perception of the wines, with an emphasis on astringency.
- The study wines had been produced in the Willamette Valley of Oregon in 2003. There were 15 Pinot noir wines corresponding to 3 replications of each of 5 vigor zones: “high”, “medium”, and “low vigor” within Site A; and “medium” and “low vigor” within Site B. (“High vigor” of site B was similar to “low vigor” of Site A, meaning Site A was overall much more vigorous than Site B).
- The tasting panel of experienced tasters was composed of 9 students from the Department of Viticulture and Enology, University of California, Davis. The panel underwent training sessions for the purpose of this study, and to create a list of attributes to describe the wines. During the actual tasting, judges rated the wines, in groups of 15, using an unstructured scale. Data was collected with the sensory program FIZZ and analyzed with ANOVA (analysis of variance) and PCA (principal component analysis). Let’s see the main results.
- 1) **Effect of vigor on phenolic composition**. In the first part of this study, the authors had found 2 main phenolic differences in composition between the low and high-vigor wines: 1) the low vigor wines had much more *skin tannins* (twice as much), and 2) the low vigor wines had more *polymeric pigments*. Skin tannin has greater polymerization than seed tannin, and contains more epigallocatechin, which can modify the perception of astringency. Therefore, as the authors will point out later in their discussion, not only tannin “concentration”, but tannin “composition” and “degree of polymerization” may have been responsible for the higher astringency of the low vigor wines described in the next paragraph.

• 2) **Effect of vigor on sensory properties.** Astringency intensity increased from high-vigor zones to low-vigor zones, the latter showing significantly more astringency than the former. **Bitterness** intensity was higher in wines from the low- and medium-vigor zones compared to the high-vigor zone wines. Finally, there was a trend for higher **heat**, or ethanol, intensity in wines from medium- and low-vigor zones compared to those from high-vigor zones. The authors believe this increased heat could act to accentuate the bitterness sensation.

• 3) **Relationship between chemical composition and sensory properties.** In the fruit, there was a positive correlation between skin tannin levels and “earthy”, “sour”, “bitter” and “astringency” sensory attributes (“positive correlation” meaning that as those components increased in the fruit, the intensity of the attributes increased in the wines). As for the wine, both “wine tannin” and “pigmented polymers” were positively correlated with “earthy”, “chemical”, “sour”, “bitter” and “astringent”. On the other hand, “wine monomers” were negatively correlated with “earthy”, “chemical” and “sour” (that is, as wine monomers increased in the wine, the earthy, chemical, and sour attributes decreased). [But do remember that a “correlation” does not necessarily mean a cause-and-effect relationship].

• 4) **Grape composition predictors of perceived astringency.** If we know the chemical composition of the grapes, can we predict the resultant astringency in the wine? To explore that question, the authors used mathematical regressions to come up with a model that would relate perceived astringency data to fruit chemical data. The authors observed that this model had a very good fit ($R^2=0.93$). What they found was that the higher the parameters “number of seeds”, “fruit total tannin”, and “skin tannin”, the higher the model predicted the wine astringency would be. And the higher the parameters “berry weight”, fruit TA, and “total monomers”, the lower the predicted astringency.

In summary, the low vigor zone wines could be differentiated from the high vigor wines by their increased *astringency*, *bitterness*, *heat*, *sourness*, *earthiness*, and *chemical characters*. The fruit chemical composition parameters that correlated with these sensory attributes were the higher concentrations of *total tannin* and of *skin tannin*. And the wine chemical composition that correlated with these sensory attributes included *total tannin*, *skin tannin proportion*, *polymeric pigments*, and *monomer concentrations*. A study that followed this one suggested that many of the differences related to vigor are likely triggered by differences in light exposure. The relationship between grape composition and wine sensory perception is extremely complex due to the many compound interactions and the variability of the human perception. This work is a welcome step in the right direction.

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