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Inquiring Winemaker

Finding Balance in Viognier

Today's consumers expect Viognier to be well balanced with a symphony of integrated aromas and flavors. Balance and harmony are two descriptors often used to denote quality, while unpleasant coarseness, aftertaste involving bitterness and/or excessive astringency or hotness can negatively impact this important varietal wine. To attain structural and textural balance requires an understanding of the grape, impact of vineyard management and how winemaking variables influence the integration of fruit, wood, yeast and bacteria-derived aromas and flavors.

A significant volume of research has advanced our understanding of how various viticultural practices such as crop level,[1] crop exposure,[2,3] leaf area to crop ratio,[4] shoot density, training systems[5] and *terroir*[6] affect grape and wine components. However, few studies have been directed to Viognier. The paper "Effect of Vertical Shoot-Positioned, Smart-Dyson and Geneva Double-Curtain Training Systems on Viognier Grape and Wine Composition"[7] reported that Viognier training impacted grape and wine volatiles and wine aroma, flavor and mouthfeel.

With most varieties, grape aroma and flavor development is relatively linear, increasing at a relatively even pace near the end of the ripening period. Viognier, however, undergoes an engustment (a rapid respiratory change) late in the season that creates the aroma and flavor characteristics associated with the variety including lychee, musk, rose, pear, apricot, peach, nectar, ginger and citrus.

Engustment occurs late in the season, often with a relatively high potential alcohol (above 14%), linking aroma and flavor to mouthfeel. Viognier varietal character is largely the result of C13-norisoprenoïds and terpenes. Yeast-derived aromas are mainly from esters produced as a result of the metabolism of fatty acids and amino acids. Generally, these are less stable than grape-derived aromas. The relatively high alcohol in most Viognier can impact both varietal and fermentation aroma and flavors as well as mouthfeel.

Structural and textural components that impact mouthfeel interact in a palate balance relationship depicted in "Palate Structure and Texture Balance Components" on page 67. This somewhat over-simplified association suggests that an increase in the perception on one side of this relationship decreases the perception of components on the other side. The converse is also true. With this in mind, it is easy to understand how perception of structural and texture components interrelate.

The sweet elements impact not simply sweet taste but also, in a dry wine, the perception of body or volume. These sensory features are derived mainly from carbohydrates, polysaccharides, mannoproteins, gums and alcohol. The acid elements are the result of grape-derived organic acids or acid addition. The phenolics include sensations derived from the skins, seeds and stems, and they may also result from winemaker intrusions such as barrel and enological tannins. Phenolic compounds in Viognier can provide a range of sensory features including what is described as tannin intensity, astringency, bitterness and dry tannins.

Integration of structure and texture components is important because perceptions occur in different parts of the palate and, therefore, at different time

Highlights

- While researchers have examined the correlation between viticultural practices and wine properties, few of their studies have included the winegrape Viognier.
- In this column Bruce Zoecklein analyzes how viticulture and winemaking affect the components of wine balance.
- In high-quality Viognier, we expect to experience sweetness, acidity and phenolic elements as a harmonious whole.

Palate Structure and Texture Balance Components

Volume, Body, Sweetness <——> Acid + Phenolics (tannin intensity, astringency, dry tannins, bitterness)

Volume, Body, Sweetness	Acid	Phenolics
• Carbohydrates	• Organic acids	• Skin, seed and stem phenols
• Polysaccharides		• Barrel phenols
• Mannoproteins		• Enological tannins
• Gums		• Volatile phenols
• Alcohol		

intervals. For example, we initially taste sweetness at the front of the palate, followed by acidity, and finally the taste of bitterness and tactile sensation of astringency near the back of the palate. Yet we expect in a high-quality, well-integrated and balanced Viognier not to perceive these as separate sensations, but as a harmonious whole.

Palate balance is impacted by the quantitative and qualitative nature of components in the above relationship and wine temperature. For example, a low temperature can increase the perception of acidity while reducing the perception of sweet elements. Warming wine a few degrees often reverses this by increasing the sweet perception, thus lowering the sense of acidity and the discernment of phenols. This highlights the inverse nature of the palate-balance relationship. It also serves as a reminder of the importance of specific serving temperature recommendations predicated on style and essential for optimum wine enjoyment.

The relative interaction of the structure and texture components of Viognier are outlined in the following gray boxes. The plus signs (**+**) indicate a positive correlation; negative signs (**-**) a negative correlation, and zero (**0**) no association. These generalizations follow winemaker's empirical observations.

Correlations with Volume, Body, Sweetness

+ Alcohol
+ Polysaccharides and mannoproteins
+ Gums, like Gum Arabic

Alcohol, an important component to Viognier, impacts wine mouthfeel being bittersweet and producing palate hotness.[8] A high (above 14.5%) alcohol level may enhance negative textural characteristics including tannin roughness and bitterness. This highlights the importance of understanding the potential alcohol level (sugar-to-ethanol conversion) specific to each vineyard site.

Mannoproteins in the yeast cell wall are bound to glucans and exist in wines as polysaccharides and proteins. They are released from the cell wall by the action of an enzyme *(ß-1,3-glucanase)* and can impact aroma, oxygen buffering and wine stability.[9,10] These so-called macromolecules provide a sense of sweetness as a result of increasing the perception of volume or body, thereby lowering the perception of acidity and the phenol elements.[11] This is one reason for the addition of glucanase enzymes and/or storage *sur lie*.

Attaining balance with Viognier requires an understanding of the grape, impact of vineyard management and how winemaking variables influence the integration of aromas and flavors.

Newly fermented Viognier is frequently settled for 24 hours to remove gross lees. Subsequent racking may remove a large percentage of these macromolecules, countering the optimal integration of the structural and textural components.[12] This may be very important in Viognier produced with skin contact and, therefore, with an enhanced phenolic load. Additionally, if Viognier is fined prior to aging, some macromolecules are removed. This can exert a negative influence on structure and texture integration.

Correlations with Acidity

- \- Sugar
- \+ Tannins
- \- Polysaccharides and mannoproteins
- +/- Body/volume
- \+ Tannin intensity
- \+ Dry tannins
- \+ Bitterness
- \+ Carbon dioxide

Increasing the perception of acidity usually increases the perception of the phenolic components as a result of lowering the perception of the sweet elements. Viognier fruit is generally fairly low in acidity. Wine pH may be relatively high—particularly if the vine was over-cropped, moisture stressed, and if skin contact is used that may impact mouthfeel components.[13] On occasion winemakers bottle with elevated levels of carbon dioxide to both increase the perception of acidity or freshness and to increase the aromatic intensity.

Phenolic elements

The qualitative and quantitative nature of phenols impacts their sensory characteristics and wine balance. Winemakers frequently attribute Viognier coarseness to phenolic elements. Causes of structure and texture coarseness have been reviewed by Richard Gawel[14] and include:

- Phenols including hydroxycinnamic acids, flavonols, flavanols and tyrosol
- Oxidation products
- Glycosides
- Alcohol
- Acidity.

Viognier fruit-processing methods (whole-cluster press, destemming, crush with or without skin contact, contact time and temperature) impact phenol extraction from this relatively high-phenol grape. Modification of the phenol concentration may be achieved through oxygen management, including limiting pre-fermentation sulfur dioxide (which will enhance phenol polymerization and precipitations) and by cold settling and/or pre- or post-fermentation fining. The lower the nephelometer turbidity units level of the juice pre-fermentation, the lower the soluble tannin load in the juice. As such, juice clarity can be an important stylistic tool. Protein-fining agents generally remove higher molecular weight tannins. However, the difference in the phenol concentration before and after fining is not often large. This suggests that the sensory impact may be due, in part, to changes in the colloidal complexes, not simply a change in phenol concentration. This may explain why different wines react differently to the same type and concentration of the same fining agent. Mouthfeel may also be impacted by filtration, which can remove colloidal macromolecules.

A universal problem ... is that elevated levels of alcohol can increase the perception of bitterness.

Correlations with Tannin Intensity

+ Acidity
+ Volume/body/sweet
+ Yeast in suspension
+ Non-soluble solids
- Polysaccharides

In Viognier, tannin intensity does not always strongly correlate with the total phenol concentration. For example, tyrosol has been estimated to comprise 10% of the total phenolic content of white wines,[15] and tannin taste has been correlated to tyrosol. It is thought to be formed from the amino acid tyrosine by yeast during fermentation.[16] The concentration is believed to depend primarily on yeast strain, initial concentration of sugars and tyrosine in the must. Winemaking practices such as oxidative must handling may lower the tyrosol concentrations.

Correlations with Astringency

+ Grape and oak tannins
+ Acidity
0 Sugar
- Alcohol up to about 14%, + above 14%
+ Non-soluble solids

Qualitative change in phenols due to oxidative polymerization and protein precipitation can result in *softer* astringency, which can lower the perception of the acidity and increase the perception of the sweet elements.

Correlations with Dry Tannins

- Alcohol up to about 13%, + above 13%
0 Sugar
+ Grape and oak tannins, including seed tannins
+ Acid, mainly malic and acetic
+ Yeast in suspension
+ Non soluble solids
- Polysaccharides

Some attempt to provide sweetness and/or body or volume with the addition of a small concentration of sugar, juice, etc. The fact that dry tannins are not well masked by sugar suggests this approach is not always effective in Viognier if the phenol elements have not been properly managed.

Correlations with Bitterness

+ Ethanol
+ Grape and oak tannins, including immature seed tannins
+ Acid, specifically malic acid
+ Yeast in suspension
- Polysaccharides

A universal problem in Viognier production is that elevated levels (above 14.5%) of alcohol can increase the perception of bitterness. The negative correlation between polysaccharides and bitterness is a reason for the use of high polysaccharide-producing yeast and the use of addition agents such as gums like Gum Arabic and yeast fining.

Viognier fruit contains terpenes, and a correlation between bitterness and terpene glycoside concentration has been reported.[17] The use of so-called flavor-enhancing enzymes, which contain glycosidic activity,

may contribute to the problem. Glycoside hydrolysis releases volatile terpenes, possibly increasing aroma intensity, but also phenols, possibly increasing coarseness or bitterness.

The kaleidoscope of viticultural and enological considerations reminds us of the complexity of our industry and how practices and philosophy can change as new information is acquired. Premium Viognier winecrafters continue to strive to understand how to best reflect the expression of this important grape variety from each vineyard site. W&V

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