



Enology Notes #146

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To: Winemakers and Prospective Winemakers

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Subjects Discussed in *Enology Notes* #146:

- 1. White Wine Integration**
- 2. Macromolecules – Mannoproteins**
- 3. Winery Sustainability Program Online**
- 4. Winery Planning, Design, and Expansion Workshop**
- 5. Winery Establishment Conference, 2009**

1. White Wine Integration. In today's highly competitive marketplace, wine consumers expect well-balanced wines, often possessing a symphony of integrated aromas and flavors. To produce such wines requires an understanding of the grape and how each processing variable influences the balance of fruit, wood, bacterial, and yeast-derived aromas and flavors.

Structural and textural balance and harmony have been discussed in previous editions of *Enology Notes* (# 84, 87, 90, 94, 108). Lack of balance and harmony can result in unpleasant coarseness or aftertaste, involving bitter taste and/or the tactile sensations of astringency, hotness, or metallic character, which can negatively impact wine perception.

Structure/texture coarseness in red wines is outlined in the online publication *Red Wine Mouthfeel* at www.vtwines.info. White wine coarseness was reviewed by Gawel et al. (2008). Some factors influencing coarseness include:

Phenols

- Hydroxycinnamic acids
- Flavonols
- Flavanols
- Tyrosol

Oxidative products

Glycosides

Wine alcohol and acidity

Low concentration of macromolecules

Winemakers frequently attribute coarseness to phenolic elements, and attempt to resolve the perceived harmony imbalance by fining. Protein fining agents can impact mouthfeel by binding with phenols. However, the difference in the phenol concentration before and after fining is often not large. This suggests that the sensory impact may be due, at least in part, to changes in components other than phenols.

When wines are fined prior to aging, macromolecules such as mannoproteins are removed. Feuillat et al. (1987) showed that wine clarification can exert a negative influence upon sensory properties when the rate of eliminated macromolecules reaches approximately 30%. This may help to explain why different wines react differently to the same type and concentration of fining agent. (See section titled: Macromolecules – Mannoproteins.)

In white wines, coarseness can be a result of the phenols listed above, but the tannin intensity does not always strongly correlate with the total phenol concentration. Tyrosol (a phenol alcohol) has been estimated to comprise 10% of the total phenolic content of white wines (Myers and Singleton, 1978), in addition, it was found to be the dominant profile in some white wines of Spain as outlined by Gawel et al. (2008). Tyrosol is thought to be formed from tyrosine by yeast during fermentation. Concentration depends on yeast strain and on the initial concentration of sugars and tyrosine in the must. Winemaking practices, such as oxidative must handling, may affect tyrosol levels in wine.

Many terpene-rich varieties, such as Muscats, Gewürztraminer, etc., can have palate coarseness. A correlation between bitterness and terpene glycoside concentration has been reported (Nobel et al., 1988). The use of so-called flavor-enhancing enzymes which contain glycosidic activity can contribute to the problem. Glycoside hydrolysis releases volatile terpenes, possibly increasing aroma intensity, but also reacts with phenols, possibly increasing coarseness.

Alcohol impacts wine mouthfeel, and is known to be bitter-sweet and to produce palate hotness. A high alcohol level may enhance negative textural characteristics such as hotness, roughness, bitterness, and metallic character. Acids can magnify the impact of phenols as outlined in *Red Wine Mouthfeel* at www.vtwine.info.

2. Macromolecules – Mannoproteins. During aging *sur lie*, yeast components are released into the wine. These macromolecules can positively influence structural integration, phenols (including tannins), body, aroma, oxygen buffering, and wine stability.

Macromolecules can provide a sense of sweetness as a result of bridging the sensory sensations between the phenolic elements, acidity, and alcohol, aiding harmony and integration. An excellent review of wine macromolecules was provided by Feuillat (2003).

There are three general sources of macromolecules in wine (Feuillat, 2003).

- Grape – polysaccharides and proteins
- *Botrytis* – glucans
- Yeast – mannoproteins

Mannoproteins in the yeast cell wall are bound to glucans and exist in wines as polysaccharide and protein moieties (Feuillat, 2003). They are released from the yeast cell wall by the action of an enzyme, β -1,3-glucanase. β -1,3-glucanase is active during yeast growth (fermentation) and during aging in the presence of non-multiplying yeast cells. Stirring increases the concentration (Feuillat, 1998).

Mannoproteins can impact the following:

- Integration of mouthfeel elements by interaction between structural/textural features

- Reduction in the perception of astringency and bitterness (Escot and Feuillat, 2001, Saucier, 1997)
- Increasing wine body
- Encouraging the growth of malolactic bacteria, possibly yeasts
- Preventing bitartrate instability (Lubbers and Leger, 1993, Moine-Ledoux, 1996, Moine-Ledoux, 2002, Waters et al., 2004)
- Interacting with wine aroma (Lubbers and Voilley, 1994)

The amount of mannoprotein released during fermentation is dependent on several factors including:

- Yeast strain. Large differences are noted among yeasts in the amount produced during fermentation and released during autolysis.
- Must turbidity. Generally, the more turbid the must, the lower the concentration (Guilloux-Benatier et al., 1995). Mannoproteins released during the fermentation are more reactive than those released during the yeast autolysis process in modifying astringency. This helps provide additional justification for measuring the non-soluble solids of juice pre-fermentation.

The protein component of the mannoprotein fraction is important for overall aroma stabilization. Interactions between macromolecules and aromatic compounds can lead to modifications of volatility and aromatic intensity of wines.

Wines aged on lees with no fining have mannoproteins present, while those fined prior to aging have a large percentage of mannoproteins removed. Periodic stirring *sur lie* increases the mannoprotein concentration, and increases the rate of β -1,3-glucanase activity.

Generally, yeast autolysis is relatively slow and may require months or years to occur, limiting the mannoprotein concentration (Charpentier and Feuillat, 1993). Alternative methods of increasing mannoprotein levels have been suggested (Feuillat, 2003) and include:

- Selection and use of yeast which produce high levels of mannoproteins during the alcoholic fermentation
- Yeast which autolyse rapidly upon completion of the alcoholic fermentation
- Addition of β -1,3-glucanase to wines stored on lees
- Addition of exogenous mannoproteins (proprietary products) prepared from yeast cell walls to wines stored on lees.

Some of the many practical winemaking issues regarding lees management are listed below and discussed in *Enology Notes* #106.

- Specific nature of the wine
- Primary vs. secondary lees
- Non-soluble solids level
- Method of stirring
- Frequency and duration of stirring
- Type and size of vessel, barrel parameters
- Duration of lees contact
- MLF and timing
- Timing and type of racking
- SO₂ timing and level of addition
- Frequency of barrel topping

3. Winery Sustainability Program Online. In early 2008, we organized a very successful Winery Sustainability and Design program covering many winery sustainability issues. Because of the success of this event and the importance of the subject, I have posted an Adobe Presenter version of this online. The subjects included in these audio and PowerPoint slide presentations are as follows:

- Sustainability in Winery Design
- Sustainable Winery Architecture
- Why Solar, Why Now
- Gravity Flow Design, Principles and Practices
- Cellars, Caves and Earth-Sheltered Design
- Winery Construction and Sustainable Building Materials

Each presentation is approximately 45 minutes long. Topics listed are discussed by some of the most respected winery architects, engineers, and winery planners from California and the Pacific Northwest.

This password-protected program is available for a donation of \$45 to the Enology-Grape Chemistry Group at Virginia Tech. These funds will be used to support graduate student education.

To gain unlimited access:

- Mail a check for \$45, payable to Virginia Tech Foundation.
- Send to Terry Rakestraw, Department of Food Science and Technology (0418), Virginia Tech, Blacksburg, VA 24061.
- Provide your full name and email address.

A password will be emailed to allow full access to all Adobe Presenter programs listed above.

4. Winery Planning, Design and Expansion Workshop. A one-day program titled: "Winery Planning, Design and Expansion" is scheduled for March 13, 2009 in King of Prussia, PA, just outside of Philadelphia. This event is associated with Wineries Unlimited 2009.

The following topic areas will be reviewed and discussed by leading architects and planners from throughout the country.

Winery Design

- Winery Facility Design Concepts
- Winery Design Considerations
- Winery Layout

Examples of Winery Designs

- Winery Architecture
- Winery Designs and Case Studies

Integration of Winery Process Equipment, Layout and Design

- Stylistic Winemaking and Winery Design
- Equipment Considerations Overview
- Equipping Small vs. Large Wineries
- Fermentation and Storage Vessel Considerations

Sustainable Winery Design Considerations

- Winery Sustainability Options
- Saving Energy and Water
- Wine Caves
- Gravity Flow Winery Designs

Winery Business Planning

Winery Economics

Expansion Economics

Registration information is available at www.wineriesunlimited.com.

5. Winery Establishment Conference 2009. A Winery Establishment Conference is planned for February 17-19 at the Jordan Tatter Conference Center, Southwest Michigan Research and Extension Center, Benton Harbor, MI. This event, organized by myself and Dr. Tom Zabadal of MSU, will feature a number of industry leaders, and highlight issues relevant to winery regulation, winery business planning, equipment, etc. More information is available at <http://grapes.msu.edu/pdf/wineryEstablish09.pdf> or contact Diane Miner at (269) 944-1477 ext 210.

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All past *Enology Notes* technical review are posted on the Wine/Enology – Grape Chemistry Group's website at: <http://www.vtwines.info>

To be added to (or removed from) the *Enology Notes* listserv, send an email message to rakestra@vt.edu with the word ADD or REMOVE in the subject line.

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