Wine Mouthfeel and Texture

Seth Cohen
Appalachian State University
Director of Enology / Fermentation Sciences
Wine Texture

From a quality / character perspective
Wines primarily characterized by *varietal typicity*: Color, Aroma, Balance (Age)
Consumer has an expectation of what that wine will be based on the label

Wine texture comes into play immediately, differentiating quality (90 pt vs. 80 pt)

*Achieving exceptional textural properties of wine can be inherently difficult*

Stems from *fruit composition* and *wine production techniques* once off the vine
Wine texture – *mouthfeel, body, palette, balance, finish* ...

**Ideal descriptors:** *Full, Rich, Supple, Smooth, Round, Balanced*

**Not so ideal:** *Thin, Limp, Watery, Angular, Harsh, Aggressive, Rough*

Like aroma profiles, not all wines are expected to be *big, full* wines. However, they should **present a pleasing entry into the palette and finish**. Wine texture should **follow the expectations** set by the eyes and nose.

I like to break this aspect into **3 basic categories** in my own mind:

- Balance
- Body
- Astringency

(\[Finish\])

There is **interplay between areas** (e.g. influence of acidity on astringency or perceived bitterness, influence of alcohol on palette and finish).
Balance

Quite literally- the balance between sweet and sour / sugar and acid

Sweet and Sour are 2 of the 5 tastes most of us are capable of perceiving. *Sweet, Salty, Sour, Bitter, Umami*

This response is dictated by the activity of our taste buds, or papillae on the tongue. *Density of papillae on the tongue has been correlated to ones sensitivity to taste perception.*
Balance

- A form of chemoreception, chemicals interact with the receptor proteins at the papillae and a signal is transmitted through neurons to the brain.
  - Sweet perception: 0.5 - 5 g/L (Sucrose)
  - Sour perception: 0.05 - 0.2 g/L (Tartaric Acid)
- Dry wine:< 5.0 g/L Sugar (< 0.5 %), 4-6.0 g/L Tartaric Acid
Balance

The importance of balance in a wine (red or white) is to *compliment the aroma or character*.

Highly acidic wines tend to deliver a *thin, watery, dry* perception.

The contribution of *sugars*, even *very low concentrations* (< 0.5%), can *counteract the acidity* and *build volume* or body to a wine.

Wines out of balance towards *low acidity* tend to be *flat, flabby, soft*.

*Glycerol* is also found to balance acidity through the *perceived sweetness*.

Not generally thought to provide *viscosity* at concentrations typically found in wine.
The *Body* of wine refers more to *the perception of weight, volume, or viscosity in the mouth.*

There is an obvious *interplay* between *balance and body.*

An acidic wine can display considerable body or weight.

**Sweet wines** often exemplify the definition of a *thick or full* wine—*Tokay, Sauternes, Trockenbeerenauslese, Ice-wine, Sweet Muscadine...*

Aside from sugar, common *contributions to body* come from *polysaccharides* - *Grape, Yeast, Exogenous -*

*Polysaccharides* (colloids) are generally held in solution or suspension. *Setting jelly* is a visual and textural example of the influence of polysaccharides. Increase the *viscosity* and *perceived thickness* of wine. *Stabilize macromolecules* in wine during aging (haze, texture, color, acidity).
Polysaccharides are long-chained sugar polymers (glucose, mannose, arabinose, xylose etc.)

Many of the soluble polysaccharides are not digestible by humans / microbes

Remain in solution / suspension, are relatively large, and open to various molecular interactions (ionic bonding, H+ bonding, hydrophobic interactions).

Interact with phenolics, proteins, and other polysaccharides

Can form ‘protective’ colloid stability; can also form precipitates (haze potential)
Grape-based polysaccharides come from the skin and mesocarp

May precipitate due to the ethanol content of wine. Issues with filtration and haze formation (Botrytis infected grapes)

Yeast Polysaccharides – **Mannoproteins** or mannans (mannose polymers)

Liberated from **yeast cell walls** (autolysis)

Lees aging (Sur Lies) via Batonage / Stirring

Thought to provide **colloid stability** during aging and a richness in texture (Chablis).
*Pectolitic enzymes* can influence the size and solubility of polysaccharides
Typically added at crush pad to liberate juice, aid in maceration, pressing
and clarification.

Skin contact, phenolics, and fining agents can also influence final content

**Lees aging** (Sur Lies) via Batonage / Stirring
Common method to enhance texture
and body of white and red wines

Requires time and attention (*and good lees*)
Avoid H$_2$S formation
Rhamnogalacturonan II dimers
The more RGII-d’s, the greater the aggregation.
(0.05 – 0.5 g/L)

Yeast Mannoproteins
Inhibit aggregation
(0.05 g/L – 1.0 g/L)
**Exogenous Polysaccharides or Gums**
Colloid stability (color, aroma, tannins), volume enhancement, balance

**Commercial yeast and grape-based preparations**
*Biolees, Opti-red, Surli products, Claristar*
Intended to be *added at different times* based on desired outcome
(fermentation aid vs. cellaring / aging / finishing)

**Commercial Gum-based preparations**
Typically gum arabic (Acacia tree), guar gum (guar bean), fruit pectin
Intended to be soluble, odorless, and stable
Numerous products available depending on desired outcome
Tannins

*Tannins provide astringency,* contributing to the perception of wine texture and mouthfeel

*Astringent, Rough, Chalky, Silky, Creamy, Abrasive, Drying*

Principle activity stems from the ability to **bind proteins**

- Tanning leather / hide
- Proteins in salivary excretion are precipitated (*Proline-Rich-Proteins, PRPs*)
- Loss of lubrication; drying or astringent sensation

For **some reason** – people respond positively to this attack on the tongue!

- Provides depth, texture, and a wine to chew on

Ideally tannins provide a **round or full texture**; not **angular** or a ‘**donut**’ wine
Tannins

- Found in all tissue.
- Di- and Tri-OH in skin.
- Di-OH and gallate-ester in seed.
- Ellagitannins from Oak
- Sensory properties related to substitution and polymer size.

- Seed tannins are generally smaller polymers (mDP); thought to contribute bitterness

- Skin Tannins tend to be larger (mDP); providing more astringent quality and less perceived bitterness.

- In the vineyard, light exposure before véraison is probably the most influential factor relating to tannin content.
Tannin extraction is dictated by *maceration, time, ethanol content, interaction with other components* (proteins and polysaccharides).

*Saignee* is an effective method to increase tannin content of wines (juice : pulp). Balance ethanol content with effect on tannin content.

**Crushing** berries *does not appear to have the impact often assumed* (Merlot).
Tannin Extraction

Tannin extraction is dictated by maceration, time, ethanol content, interaction with other components (proteins and polysaccharides).

Saignee is an effective method to increase tannin content of wines (juice : pulp). Balance ethanol content with effect on tannin content.

Crushing berries does not appear to have the impact often assumed (Merlot).
Tannin Extraction

Tannin extraction is dictated by maceration, time, ethanol content, interaction with other components (proteins and polysaccharides).

Saignee is an effective method to increase tannin content of wines (juice : pulp). Balance ethanol content with effect on tannin content.

Crushing berries does not appear to have the impact often assumed (Merlot).

Cerpa-Calderon and Kennedy (2008) JAFC. 56, 9006-9014
Tannins

In addition, *seed tannins do not appear to negatively effect wine quality*

Studies show a *preference for the contribution of seed tannins* in red wine. Seed removal and seed additions during fermentation *(Lee at al. (2008) Food Chemistry. 1270-1273; Kovac et al. (1995) AJEV. 363-367)*

**During aging** – tannins aggregate, form associations with other molecules, and oxidize (reactive). Alters overall perception, intensity, and quality of astringency.

The “Softening” of red wine occurs over time due to oxidation This process involves *oxidative polymerization, intermolecular associations, and precipitation* (development of mature wine color evident).

The presence of polysaccharides / proteins / fining agents will also influence tannin content / perception

Fining trials with *Gelatin, Isinglass, PVPP* – Dial in perception of tannins but critical to *consider the intention of aging wine.*
Fermentation tannins (white wines, red wines)
Added at the crush pad, to must, pressed juice.
Typically in a range from **50-200 ppm**
Help develop color (stabilize anthocyanins), protect against oxidation (flavor/aroma, browning), increase overall tannin concentration and encourage tanning development.

Aging and cellaring tannins
Added at tank or at barreling, again from **50-200 ppm**
Help protect against oxidation (*reduce SO₂*?)
Generally, a “rougher tannin”, something that also benefits from modifications during the aging process.

Still developing long-term color stability and focus on development / maintenance of aroma profile.

Exogenous tannins:
*Grape-based* and *wood based* (oak)
Do you want to incorporate aroma / flavor?
Finishing tannins
   Added pre-bottling, typically *weeks or months* before wine is packaged
   Should provide *desired effect within 1-2 days of trial* (maybe a slight overshoot in intensity)
   Important to be aware of *potential instabilities* in wine (precipitates)
   Can be effective anywhere from *10- 200 ppm*; hopefully the low range of addition at this point (and they are typically more costly!)
Tannin Additions

*Strategy of tannin additions* is typically to *start rough and dial in* as the wine ages.

**Assess** the condition of the grapes / juice / must at harvest (can be difficult)

Make additions and allow time (1-2 weeks) to determine incorporation

By the time you hit the finishing tannins, that should be aimed at filling the palette in and providing a slight boost that will carry the wine through bottling to desired age.

**Keep records** for following years (*including additions + tasting notes*)

**The best tannin for the job?!**

You really have to **determine that for yourself**, but don’t be accepting of the first product that seems to do the job
Tasting Wines – 3 Whites (W1-W3) and 4 Reds (R1-R4)

Starting from LEFT to RIGHT (W1 > W2 > W3)
Assess visual and aroma
Assess **Balance, Body, Astringency, Finish**
  - Do you perceive differences between samples?
  - Describe how they differ most.
  - Preferences?

**Red Wines (R1 > R2 > R3 > R4)**
Same process, this time **Astringency** and **Tactile sensations** are more pronounced
  - Try to identify attributes that differentiate the samples from each other
R1
Base Red
Barbera, Piedmonte
(Italy, in a box)

W3
Sucrose 0.5%
Addition of 5.0 g / Liter

R2
Tannin Riche
(Scott Labs)
Addition of 150 mg/ Liter

W2
Flash Gum
(Scott labs)
Addition of 1 ml / Liter

R3
Tanenol Fruitan
(Enartis)
Addition of 150 mg/ Liter

W1
Base Wine
Cortese, Piedmonte
(Italy, in a box)

R4
MaxiGum
(Enartis)
Addition of 1 ml / Liter
Prove to yourself that what you think you need is worthwhile.
Get input via blind tastings whenever possible.
Take advantage of sample products and determine what is right for you.

**Use of gums in white and red wines**
Increase volume, viscosity, stabilize color, aroma, tannins, colloids

**Use of tannins in white and red wines**
Protect against oxidation, stabilize color / aroma, provide astringency, fill holes in palette, increase aging potential (all of above), impart flavor (oak)

Consider ranges of gums: 0.05 – 1.0 ml /L
Tannins: 50-300 mg / L

Start by comparing various products for overall impact
- Consider variable additions of product to dial in
- Give wines time to acclimate (1-2 days)
- Get a consensus
- KEEP GOOD RECORDS