TanninAlert: A wine tannin management system for Niagara wineries

Belinda Kemp
Email: bkemp@brocku.ca
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Definition of ripeness

✓ Sugar, pH & acid.
✓ PLUS extractable phenolic compounds and aroma

• Influenced by: Light, temperature, crop load, vine water status, soil, vintage (Reynolds 2014)
How does phenolic and aroma ripeness affect red wine?

- **Seeds = higher flavan-3-ols**  
  - Over-extraction of seed tannins from underripe seeds = green flavors, high levels of rough & drying tannins, low color & lack of fruit flavors *(green tannin descriptor)*.

- **Skins = higher proanthocyanidins**  
  - Higher skin tannins from ripe grapes = fruit flavor, smooth and soft tannins, darker color stability & ageing ability.

**Key Compounds:***
- Flavan-3-ols: *catechin/epicatechin gallate*
- Proanthocyanidins: from red skins
- C13-norisoprenoids: i.e. β-damascenone/β-ionone
- **Green aromas**: i.e. Methoxypyrazines, C6 compounds
- **Unripe & green tannins**
What do we mean by “Tannin Management”?

Integrated tannin management;

• Vineyard influence - including vintage, water, light, temp, yield, berry size, vine vigour....

• Winemaking influence - aim: reduce “greenness” and harshness, ethanol level, temperature.....

• Immature seeds (green seed) contain harsh phenols which may be extracted during fermentation

➢ Tactile skin tannins before over ripeness
Skin and seed tannins: 

*Structure of flavan-3-ols*

Different -H and -OH group substitutions on the B and C rings lead to different stereo-isomers i.e. (+)-galallocatechin, (-)-epigallocatechin, (+)-catechin and (-)-epicatechin.

![Diagram of (+)-Catechin, (-)-Epicatechin, and (-)-Epigallocatechin](image-url)
Skin and seed tannins: 
*Proanthocyanidins*

Grape-based proanthocyanidins two subclasses exist:

- Procyanidins found in skins and seeds, consisting of (epi) catechin and epicatechin gallate *(seeds only)* units.

- Prodelphinidins found only in the skins deriving from (epi) gallocatechin

- Polymerised longer chain tannins *(condensed tannins)*
Tannin synthesis

- UV light
- Difference in seasons & regions

- Studies conducted in McLaren Vale, South Australia on Shiraz skin showed high tannin level at flowering - high tannin synthesis towards veraison - tannin levels declined until harvest.

- Shiraz & Cabernet Sauvignon skins from Sunraysia, NW Victoria, tannin levels peaked at fruit-set - declined from then on over several seasons

What do we know about tannin synthesis and accumulation or decline in varieties grown in Niagara?
Tannin

Tannin “quality”:
- degree of polymerization
- association of tannins with other molecules

(Virginia Tech 2014)

Whatever winemaking techniques are used some tannins will always remain in the skins and seeds!

- Study from Bruce Zoecklein’s lab found a relationship between maturity, total seed phenols and seed tannins in Virginia grown Cabernet Sauvignon
• We do not know the ideal grape tannin content & composition for any given wine (Downey 2010).

• Factors that affect tannin perception: Glycerol, acidity, manoproteins, source/structure, anthocyanins, pectin, ethanol, sugar and individual taste

• The amount of tannin in grapes is significantly higher than the resulting amount of tannin extracted into wine.
Skin tannin variation

Variation in total skin tannins (mg/g FWT skin) between varieties grown in Australia. (Downey 2010). Seed tannin does not vary as much as skin tannin.
Vintage variations in ripeness

• Variation: on a vine, in a bunch, in a block, in a vineyard.....

• Significant variation in skin tannin content can occur within the same vineyard, commonly associated with vine vigour (Downey 2010)

• It is important to note that the total phenol concentration of the grape may double from one season to the next

• Skin tannins extracted early in fermentation - seed tannins at the end
Vintage variations in ripeness
Vintage variations in ripeness
Vintage variations in ripeness

Brix for Cab Sauv at All Sites - 2013

Brix

August August September September October October November

Site 1 Site 2 Site 3 Site 4
The ripening of Cabernet sauvignon grape seeds.

<table>
<thead>
<tr>
<th>Brix</th>
<th>TA (g/L)</th>
<th>pH</th>
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<td>2.74</td>
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<tr>
<td>22.5°</td>
<td>7.1</td>
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Calculating grape seed colour as a sign of ripeness: Ristic, R. & Iland, P. 2005.

Seed colour as a sign of ripeness
*Ristic, R. & Iland, P. (2005).*

*Figure 2. A colour chart indicating changes in grape seed coat colour during seed development and maturation.*

*Calculating Grape Seed Colour*
Take a random sample of at least 20 seeds from a representative sample of berries.
High % of green seeds = unripe grapes

Ventral side

Dorsal side
• Australian Wine Research Institute’s (AWRI) system allows comparisons of tannin concentrations in different grapes and wines, from different vintages and regions.

Web-based tool allows grape and wine producers to upload, analyse & benchmark data. (WineCloud™).

• used to monitor grape maturity
• track active ferments
• Follow wines as they age
• helps winemakers understand the impact of different processes & make informed decisions
TanninAlert: Aims and objectives

1. To develop a Niagara-specific regional database for future benchmarking & grouping of tannin concentration of 3 main red grape varieties

2. Provide winemakers with skin and seed tannin concentrations at harvest to assist with the management of tannins in the winery that nature has given us in the vineyard each year

Providing winemakers with the tannin concentration of their grape skins and seeds

Careful tannin management during winemaking can decrease the undesirable wine traits
Varieties per site will be placed into low, medium or high seed and skin tannin group according to their tannin level (mg/L).

Suggestions for winemaking techniques by variety and tannin group will be provided to winemakers.
Tannin classification

The classification of low, medium and high tannin concentration categories for Cabernet Sauvignon (CAS), Shiraz (SHZ), Pinot Noir (PIN) and Merlot (MER) wines from the AWRI tannin survey of Australian wines (Smith et al. 2007).
Skins & seeds - extraction and tannin analysis

• Cabernet franc all 4 ripeness monitoring sites
• Cabernet sauvignon all 4 preharvest ripeness monitoring sites
• Pinot noir 2 sites from preharvest monitoring sites analyzed
Tannin Extraction

- Method of extraction; hydro alcoholic solution with acid and heating (Fragoso et al. 2011) instead of high ethanol or acetone concentrations
Tannin Analysis

- Tannin analysis method; AWRI Methylcellulose assay precipitation assay - 96 well plate reader for quick analysis (Mercurio et al. 2007)
TanninAlert: Action

• First year of database of Niagara tannin concentrations in 3 varieties (skins & seeds not whole berry)

• Cool climate peer reviewed data from global wine regions will be used to decide low, medium & high levels per grape variety in 2014 season until at least a 3 year tannin database is available

• Need at least 3-5 growing seasons for strong database of tannin concentrations
• Following tannin analysis at commercial harvest in 2014 red still wines from the 3 grape varieties will be using the same winemaking technique.

• A second set of wines will be produced in 2014 using a range of winemaking techniques for each tannin group which can then be compared to the base level wines using sensory and chemical analysis.

• Sensory analysis with Niagara winemakers
TANNIN MANAGEMENT OPTIONS
Fining can be a last resort!

- Equipment required for:
  - Thermovinification
  - Flash Détente
  - Micro-oxygenation

- Délestage - eliminates high tannins early in winemaking

- Saignee - reduce skin to pulp ratio
TANNIN MANAGEMENT OPTIONS

Fining can be a last resort!

» Cold soaking - studies show it extracts colour & aroma more than tannins = macerating enzymes required

» Cap management - Increased punch downs / Punch overs

» Extended maceration - unripe fruit/'immature' tannins unlikely to benefit from extended skin-contact
TANNIN MANAGEMENT OPTIONS
Fining can be a last resort!

✓ Early blending of high tannin wines with low tannin wines

✓ 30% - 50% whole berry ferments? whole cluster? stems/destem? Whole bunch press? Combination of all?

✓ Tannin addition? - depends on type of tannin and timing and wine style

✓ Fermentation temperature, speed and alcohol level
Tannin management: Pressing

• Early pressing
High press pressures = more harsh tannin
Low press pressures = less of the harsh tannins
• Hold the press wine back - blend it back into the main wine if more astringency is needed.
• Remove free run juice?

A high concentration of extractable seed tannins has been shown to negatively impact wine quality
Young red wines consider restricting tannins and increasing pH
This time next year......

• We will have wines made from 2014 vintage

• Plus the tannin concentrations from skins and seeds from 3 varieties from 4 sites from 2 years to start our Niagara tannin database

• Compare to brix, TA g/L and pH levels during ripening and at harvest
Acknowledgements

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A cheerful bunch!
References


References


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