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TanninAlert: A wine tannin management system for Niagara wineries

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- Tannin structures
- What is tannin management?
- Skin tannin variation
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- Tannin management options

Definition of ripeness



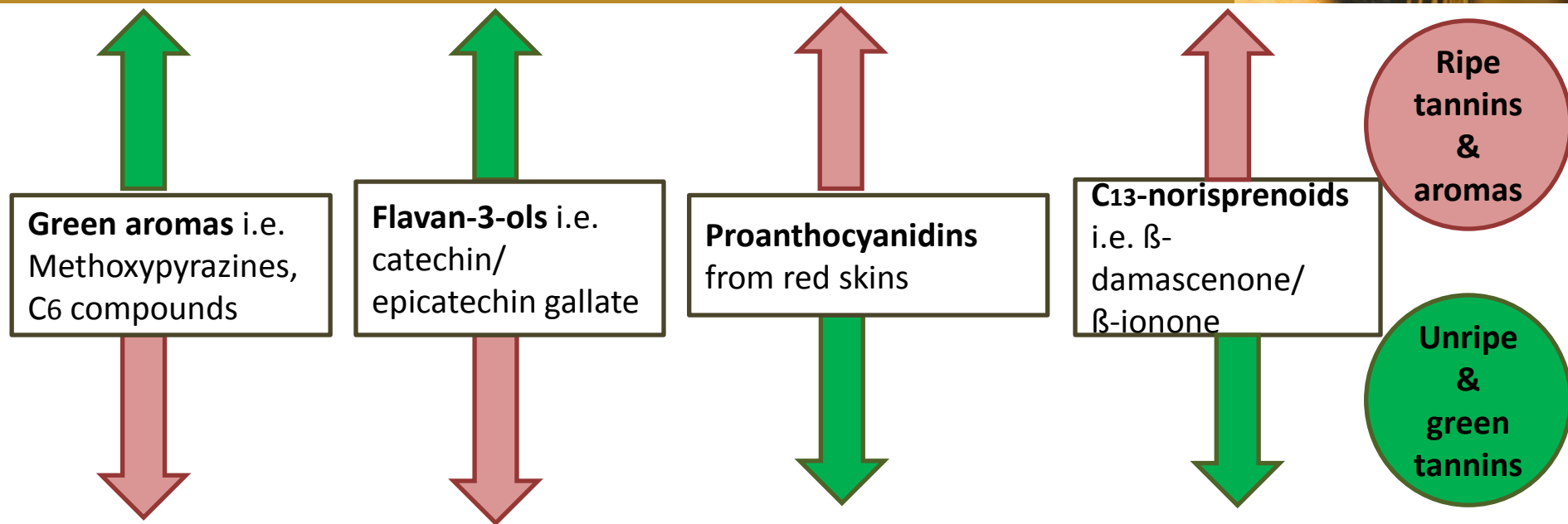
- ✓ Sugar, pH & acid.
- ✓ PLUS extractable phenolic compounds and aroma
- Influenced by: Light, temperature, **crop load**, **vine water status**, soil, vintage (*Reynolds 2014*)



Light,
temperature,
crop load



How does phenolic and aroma ripeness affect red wine?



Seeds = higher flavan-3-ols Skins = higher proanthocyanidins

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

What do we mean by “Tannin Management”?



Integrated tannin management;

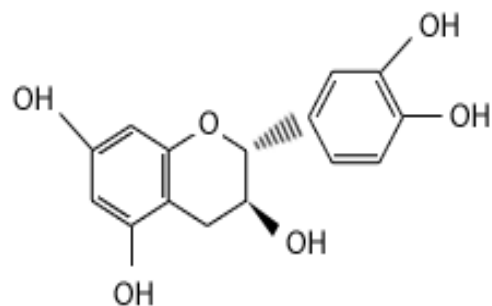
- Vineyard influence - including vintage, water, light, temp, yield, berry size, vine vigour....
 - Winemaking influence - aim: reduce “greenness” and harshness, ethanol level, temperature.....
 - Immature seeds (green seed) contain harsh phenols which may be extracted during fermentation
- Tactile skin tannins before over ripeness

Skin and seed tannins:

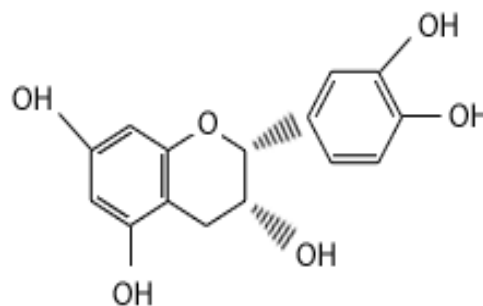
Structure of flavan-3-ols



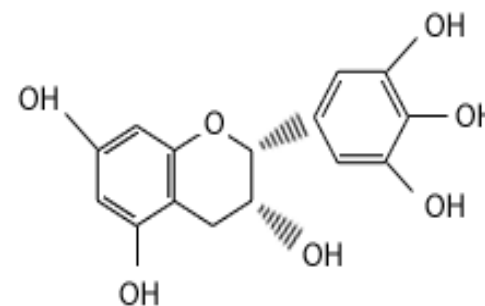
Different -H and -OH group substitutions on the B and C rings lead to different stereo-isomers i.e. (+)-gallocatechin, (-)-epigallocatechin, (+)-catechin and (-)-epicatechin.



(+)-Catechin



(-)-Epicatechin



(-)-Epigallocatechin

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!

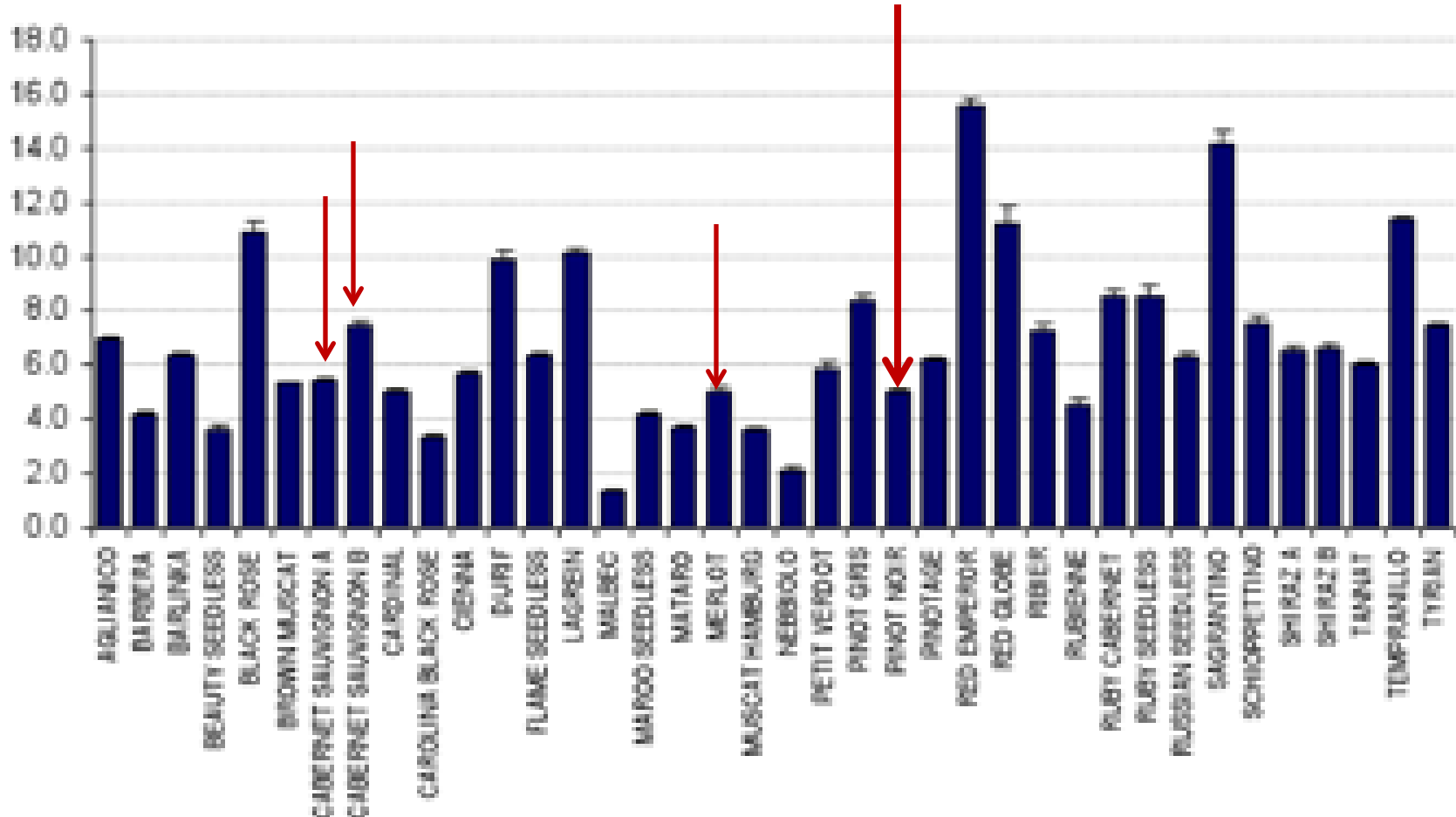
- **Study from Bruce Zoecklein’s lab found a relationship between maturity, total seed phenols and seed tannins in Virginia grown Cabernet Sauvignon**

Tannin



- 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



NEWS

Table

Comparison-Table

Chart

Comparison-Chart

Compare Years



Brix



Brix for Cab Franc at Site 1 - All Years



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Vintage variations in ripeness



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NEWS

Table

Comparison-Table

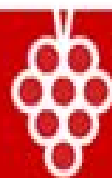
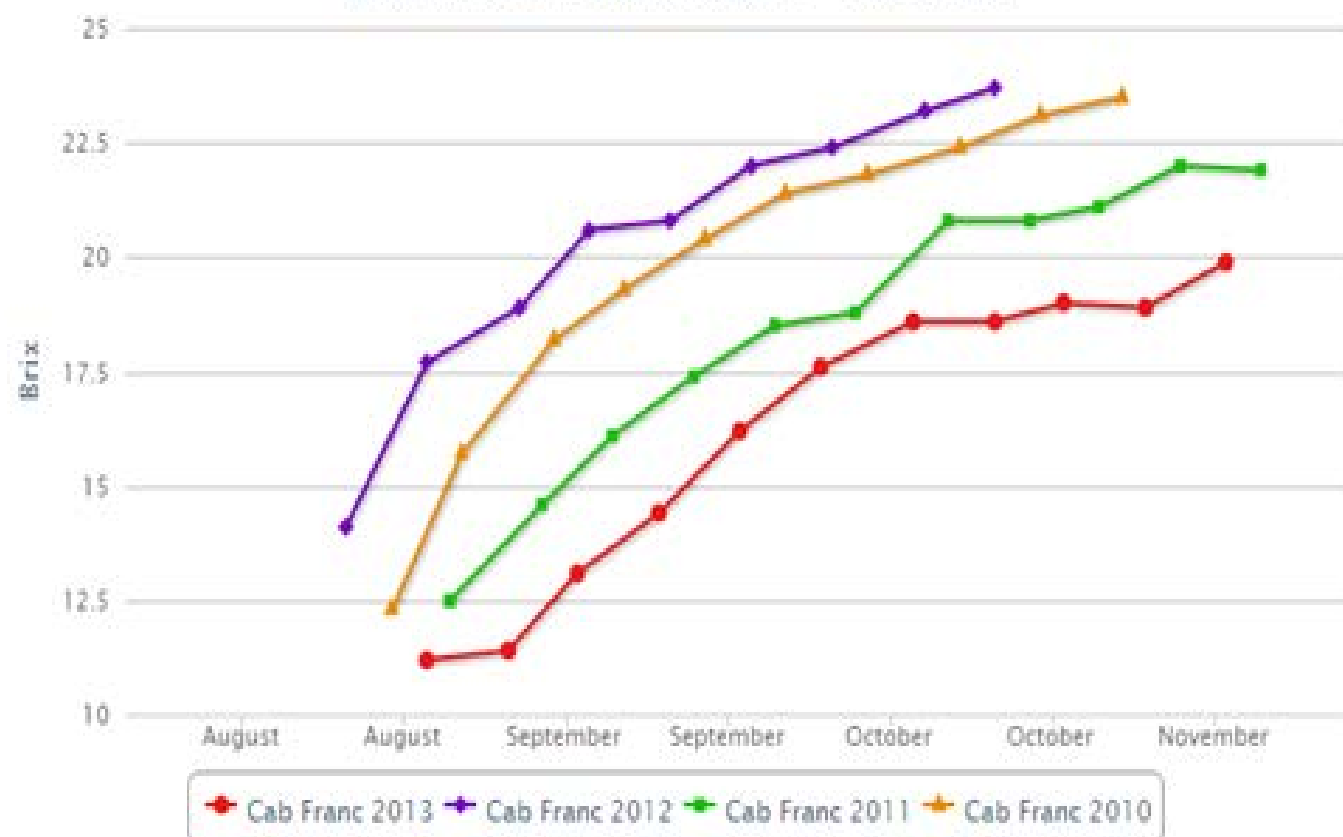
Chart

Comparison-Chart

Compare Years

Brix

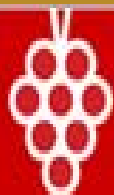
Brix for Cab Franc at Site 3 - All Years



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Vintage variations in ripeness

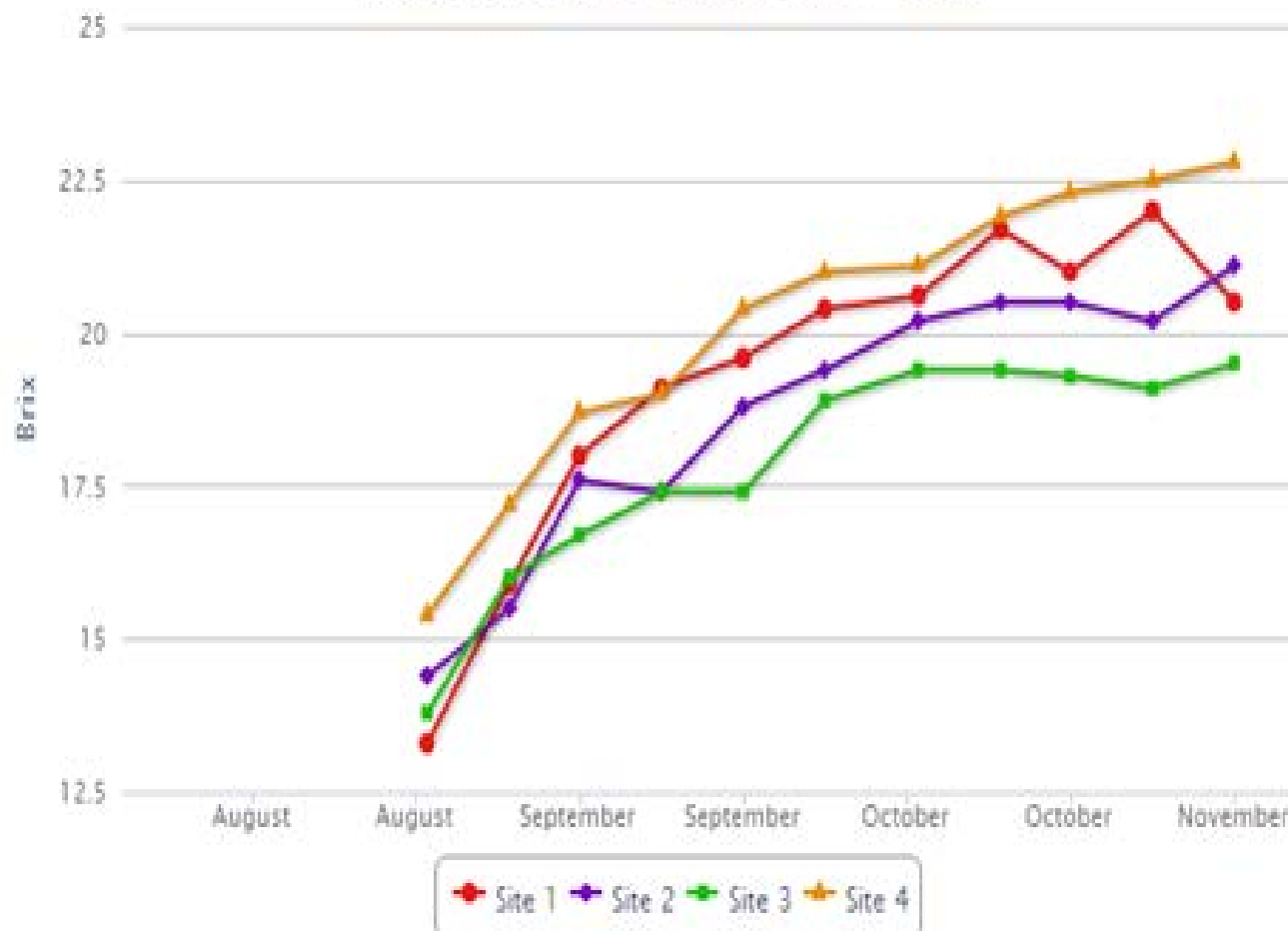


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Compare Sites Brix

Brix for Cab Sauv at All Sites - 2013



The ripening of Cabernet sauvignon grape seeds.



15.4° Brix
19.9 TA (g/L)
pH 2.74



17.2° Brix
13.9 TA (g/L)
pH 2.88



18.7° Brix
12.9 TA (g/L)
pH 2.90



19° Brix
12.3 TA (g/L)
pH 2.93



20.4° Brix
10.4 TA (g/L)
pH 3.06



21° Brix
9.9 TA (g/L)
pH 3.06



21.1° Brix
8.6 TA (g/L)
pH 3.16



21.9° Brix
8.7 TA (g/L)
pH 3.09



22.3° Brix
7.7 TA (g/L)
pH 3.18



22.5° Brix
7.1 TA (g/L)
pH 3.15

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



Microsoft Research AutoCollage 2008 - Trial version

Dorsal side

Grape Portal/Wine Portal - Tannin Portal – WineCloud™

AWRI, Australia



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

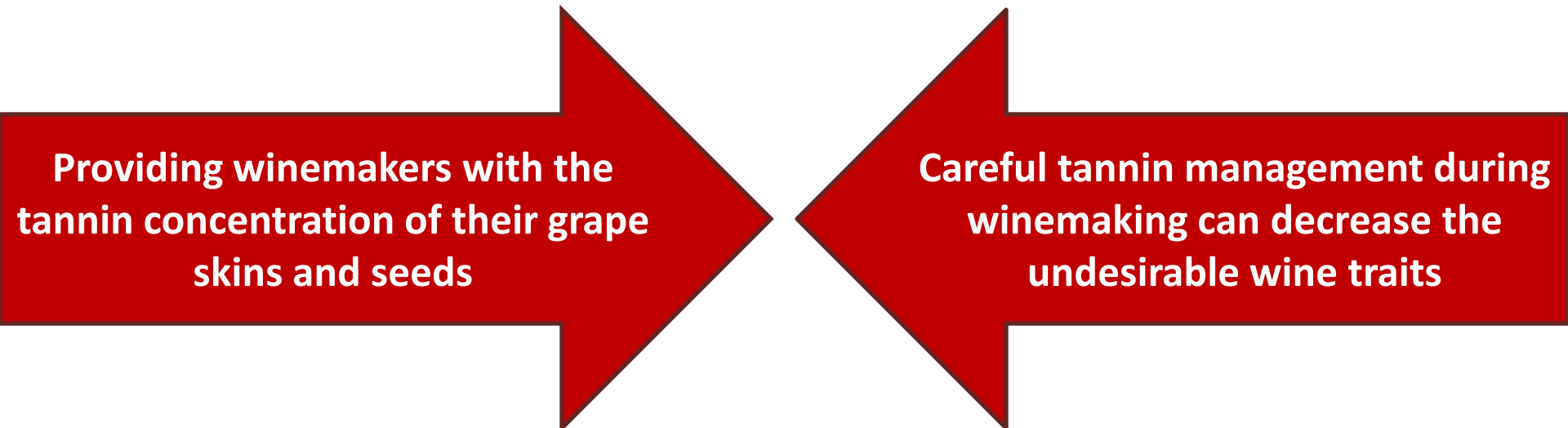
Web-based tool allows grape and wine producers to upload, analyse & benchmark data. (WineCloud™).

- 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



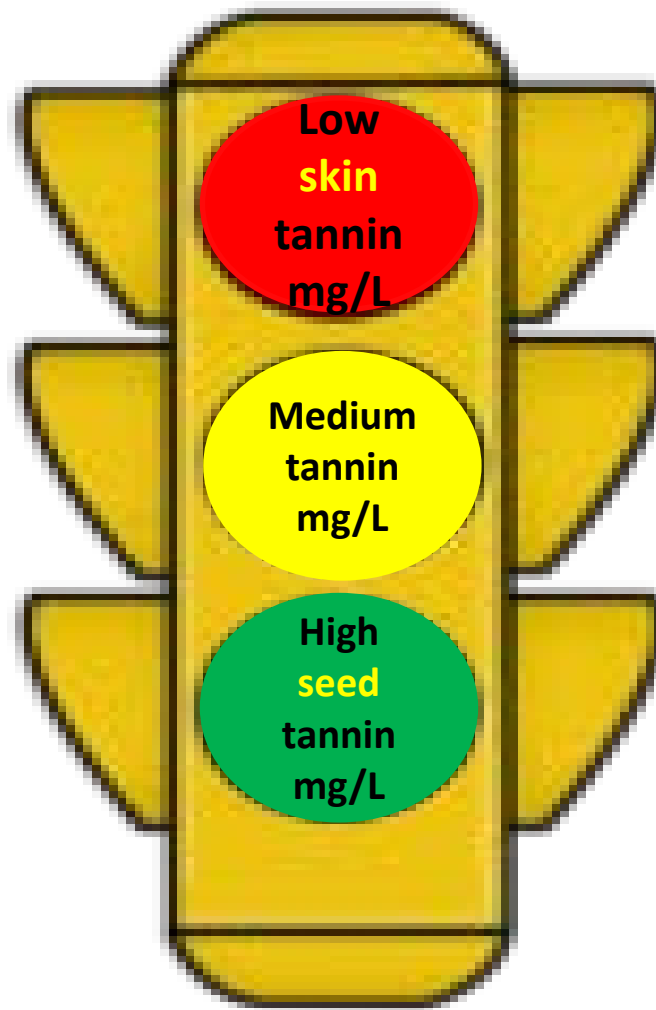
**Providing winemakers with the
tannin concentration of their grape
skins and seeds**

**Careful tannin management during
winemaking can decrease the
undesirable wine traits**

TanninAlert: Action



- 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



Variety	N	Low	Med	High	Mean
CAS	629	0.1 – 1.7 g/L	1.7 – 2.8 g/L	2.8 – 5.3 g/L	2.9 g/L
MER	188	0.3 - 1.4 g/L	1.4 – 2.2 g/L	2.2 – 3.3 g/L	1.8 g/L
PIN	112	0.4 – 0.8 g/L	0.8 – 1.4 g/L	1.4 – 3.5 g/L	1.2 g/L
SHZ	1107	0.4 – 1.7 g/L	1.7 – 2.7 g/L	2.7 – 4.9 g/L	2.2 g/L

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



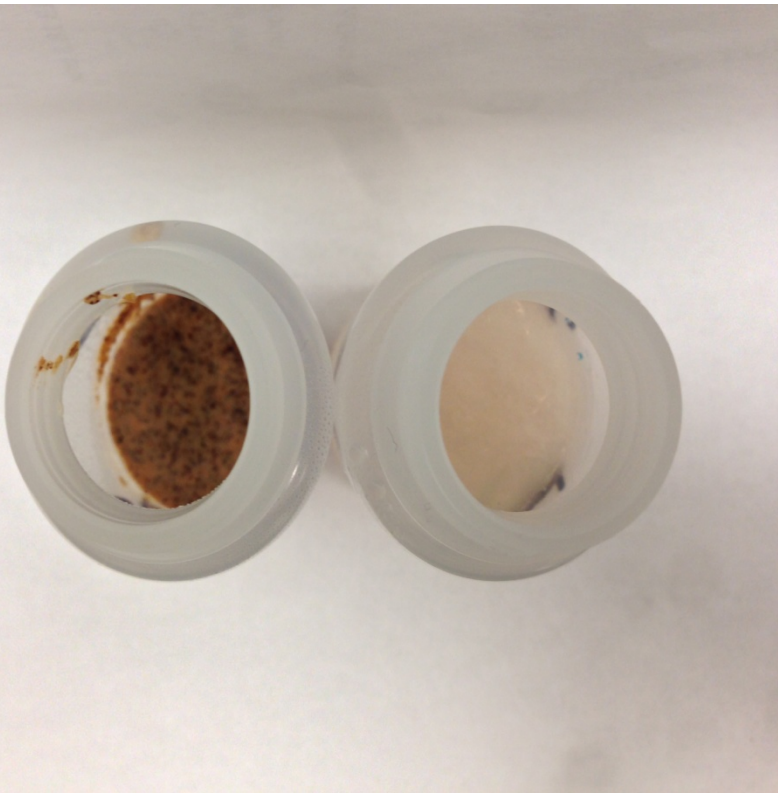
- Method of extraction; hydro alcoholic solution with acid and heating (Fragoso et al. 2011) instead of high ethanol or acetone concentrations



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

TanninAlert: Action



- 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

Thank you for your attention!
ANY QUESTIONS?



Acknowledgements

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University**



A cheerful bunch!



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