

Optimizing the Quality of Canadian Wine

TanninAlert: the launch of a new program to assess skin and seed tannin during grape maturation and at harvest to assist in winemaking decisions

CGCN seminar series

June 23, 2022

Debra Inglis, CCOVI



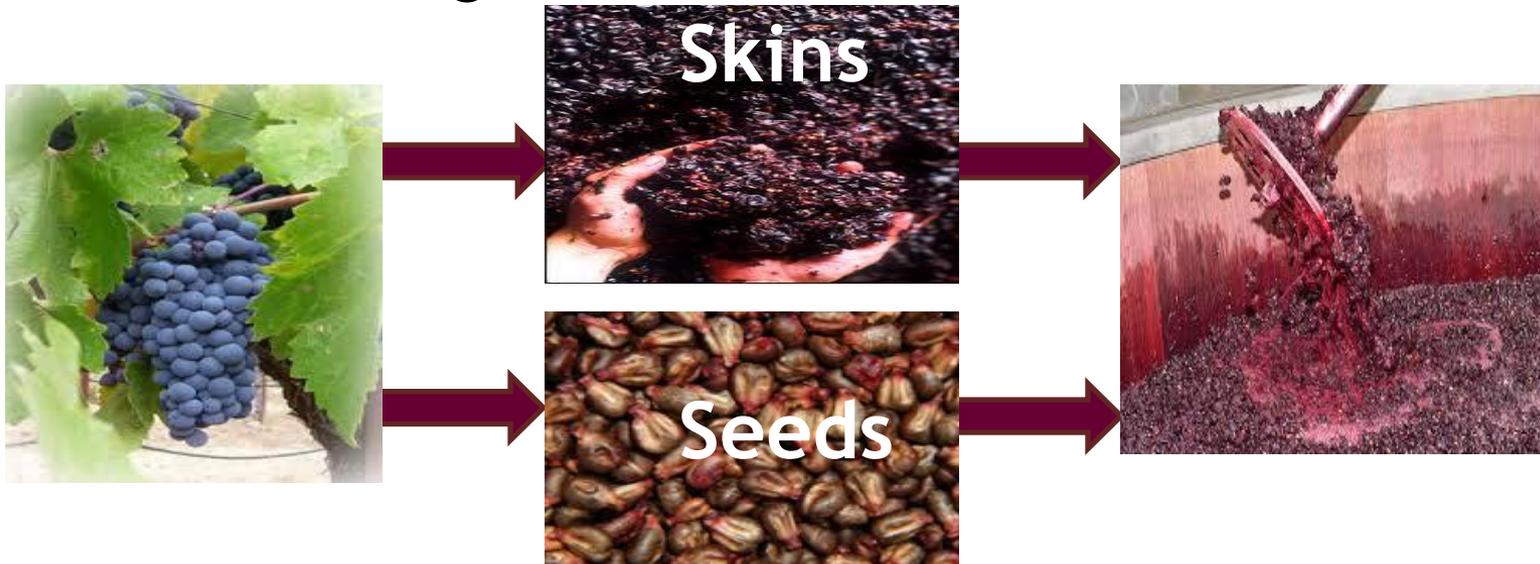
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The industry challenge



- Producing high **quality** red wines, **consistently**, year after year in a changing climate
- In making red wine, you need skin contact for colour
- Challenge: extracting colour and tannin from skin but not extracting bitter tannins from seeds; amplified in cool climate regions



The industry challenge



- Fruit does not always reach optimal ripeness each year
- For red grapes, “tannin ripeness” may not be achieved, leading to wines of lower quality
 - Skin colour is not developed + skin tannin too low
 - Extractable seed tannin too high - bitter and astringent wines



Realistic

Brix ✓
pH ✓
Tannin ?



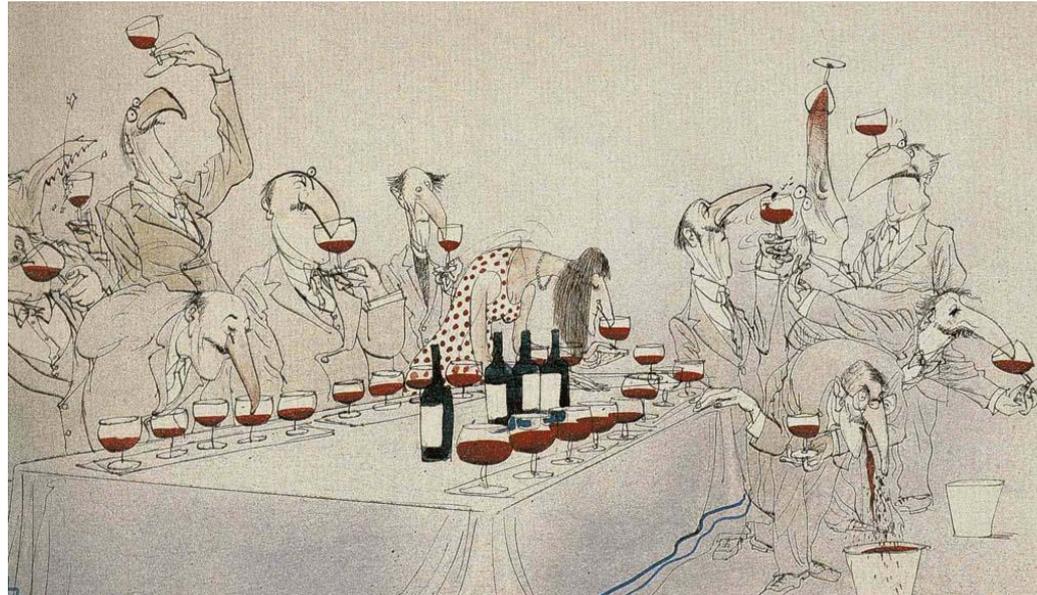
Ideal

Brix ✓
pH ✓
Tannin ✓

The industry challenge



- Consumers demand a **high quality, consistent** product despite annual weather/vintage variation
- LCBO requires red wines that are “**ripe, rich and rounded**”
- In some years, this requires greater intervention
- We can be at a disadvantage in tannin development in cool climates



What are Tannins

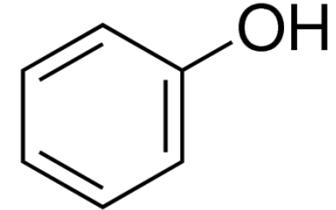


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<https://www.medicalnewstoday.com/articles/324771>
<https://www.greenmatters.com/p/dark-chocolate-health-benefits>
<https://www.goodhousekeeping.com/health/diet-nutrition/a47266/health-benefits-of-grapes/>



- Phenolic compounds
- They are found in various food products such as : Tea, dark chocolate, grapes, red wine
- Responsible for the astringent mouthfeel (sensation of dryness) (Rousserie et al, 2020; Hanlin et al, 2009)
- Greatly impact the perceived quality of food products (taste and color) (Rousserie et al, 2020; Hanlin et al, 2009; Lopez-Miranda et al, 2016)
- There are two classes of tannins : condensed and hydrolysable

Flavonoids: The basic unit of condensed tannins

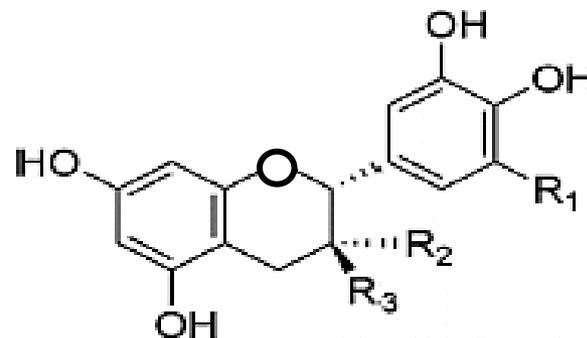


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Flavan-3-ol monomers

- Present in skins and seeds (Cheynier et al, 2006; Gil et al, 2012; Hanlin et al, 2009; Lorrain et al., 2013; Smith et al., 2015; Vignault et al., 2019; Rousserie et al., 2019; Gouot et al, 2019;).
- Catechin and Epicatechin are responsible for bitterness in wines (Markoski et al., 2016; Kemp et al, 2011).



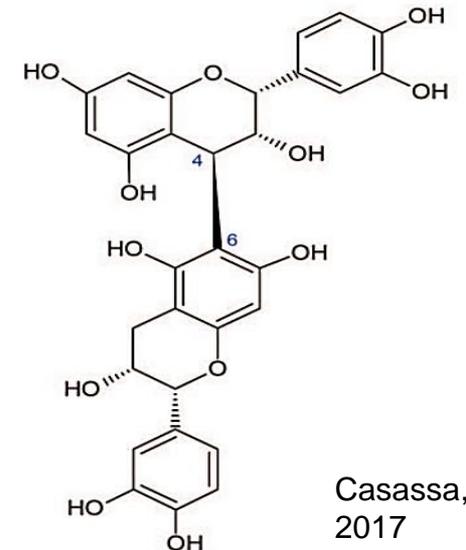
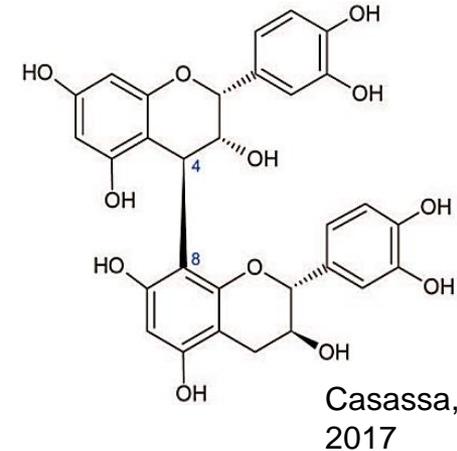
Adapted from Rousserie et al, 2019

monomer	R1	R2	R3
Catechin	H	OH	H
Epicatechin	H	H	OH
Gallocatechin	OH	OH	H
Epigallocatechin	OH	H	OH
Epicatechin-3-gallate	H	H	Gallate
Epigallocatechin-3-gallate	OH	H	Gallate

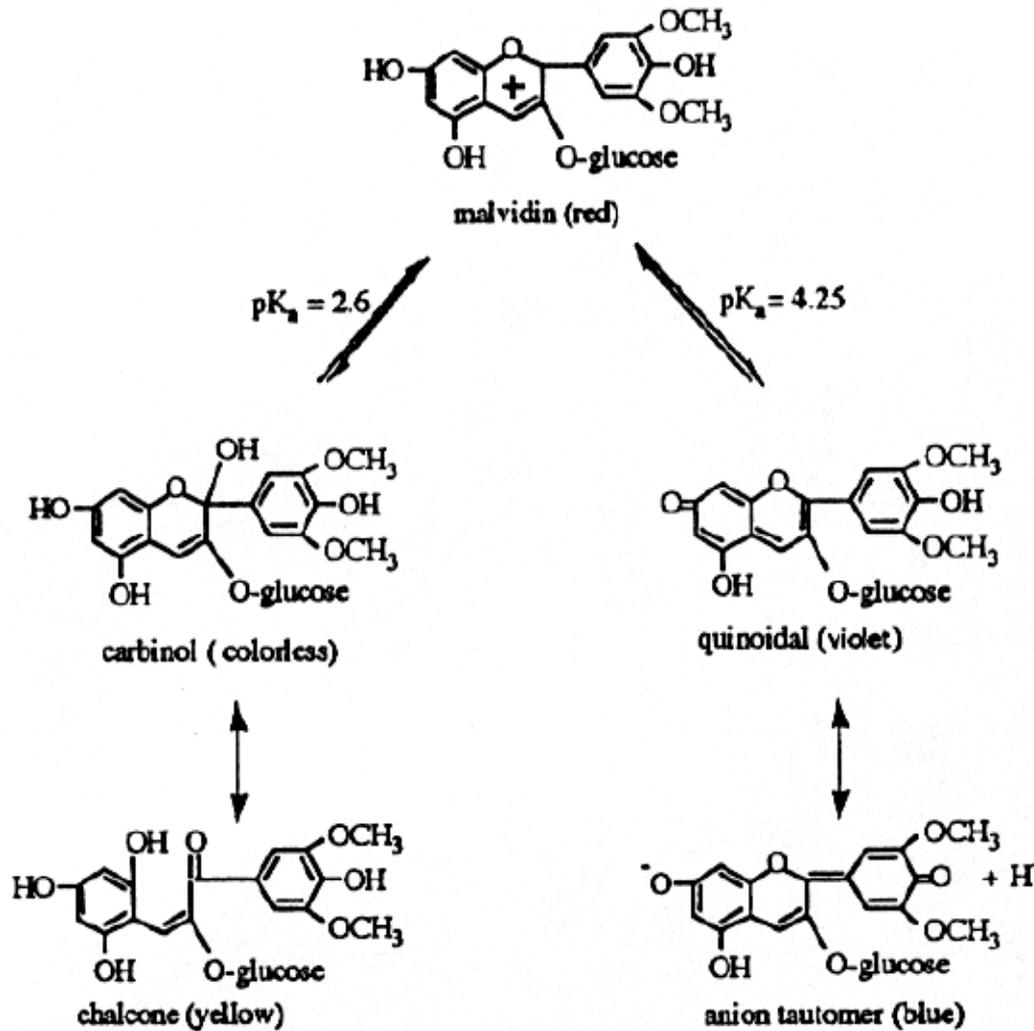
Condensed Tannins (Proanthocyanidins (PAs))



- Found in the skins and seeds of grapes and in wine (Hanlin et al, 2010)
- Oligomers and polymers (Casassa et al, 2017)
- Known to be highly reactive with proteins and polysaccharides which affect the extraction during winemaking and the taste of the final wine (Casassa, 2017; Cheynier et al., 2006; Li et al., 2019; Smith et al., 2015; Vignault et al., 2019)
- Known to bind to pigments (anthocyanins) to create polymeric pigments (Casassa et al., 2019; Casassa, 2017; Fulcrand et al., 2006; He et al., 2012).
 - Leads to color stabilisation during aging and tannin retention



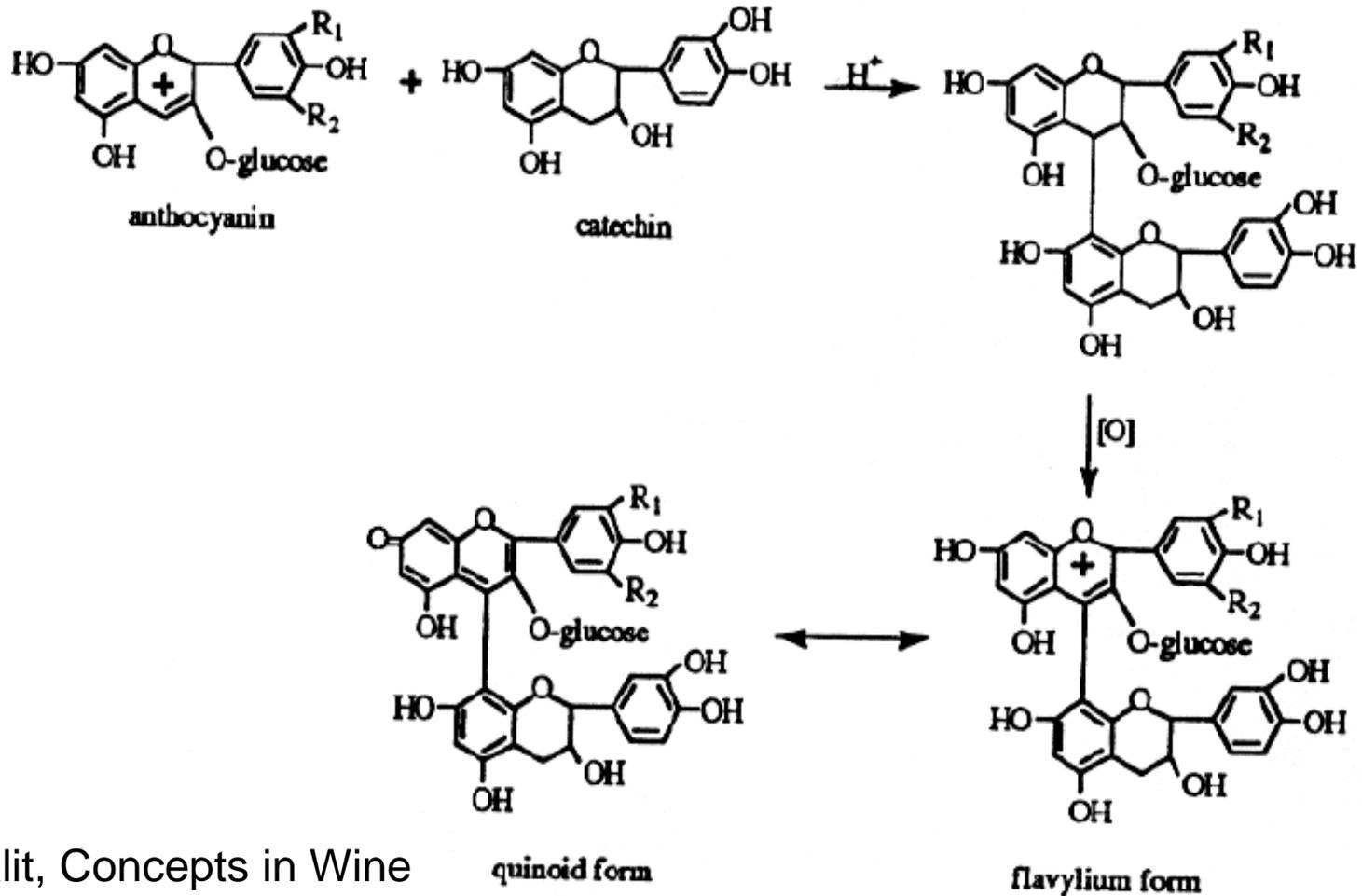
pH dependency of colour



Margalit,
Concepts in
Wine Chemistry

Tannins, a good thing

Stabilization of colour



Margalit, Concepts in Wine Chemistry

Industry Challenge



Current winemaker toolkit:

Brix



pH/TA



Tannins



Winemakers are lacking predictive analytics to measure tannins

What is the **solution**?

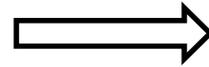
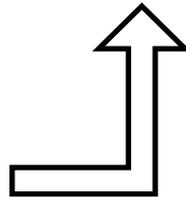
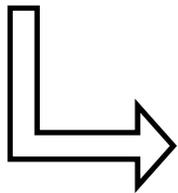
- Belinda Kemp – separate and measure skin and seed tannin separately



Measuring skin and seed tannin from veraison to harvest



PRE-HARVEST MONITORING



Tannin
Extraction



Methylcellulose
precipitation
assay (MCP)

“TanninAlert” -easy to follow tannin measurement program for red grapes -benchmark skin and seed tannin



1

- Follow tannin ripeness of red grapes for 6 red varieties – version to harvest

2

- Measure skin and seed tannins separately for each variety

3

- Develop Ontario skin and seed database for red grape varieties at harvest to benchmark tannin

4

- Categorize skin & seed tannin by variety into low, medium and high based on database

5

- **Optimize red wine quality by accounting for tannin level in grapes and using winemaking protocols to optimize tannin extraction**



Followed skin and seed tannin development for six red grape varieties



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- Cabernet Sauvignon, Cabernet franc, Pinot noir
 - 2015-2021
- Merlot, Gamay, Syrah
 - 2017-2021
- variety, site and vintage differences
- winemakers would need to measure tannin in their grapes at harvest to document the profile, compare their numbers to the database and make management decisions

Tannin from veraison to harvest -Cabernet Sauvignon site 3 2020

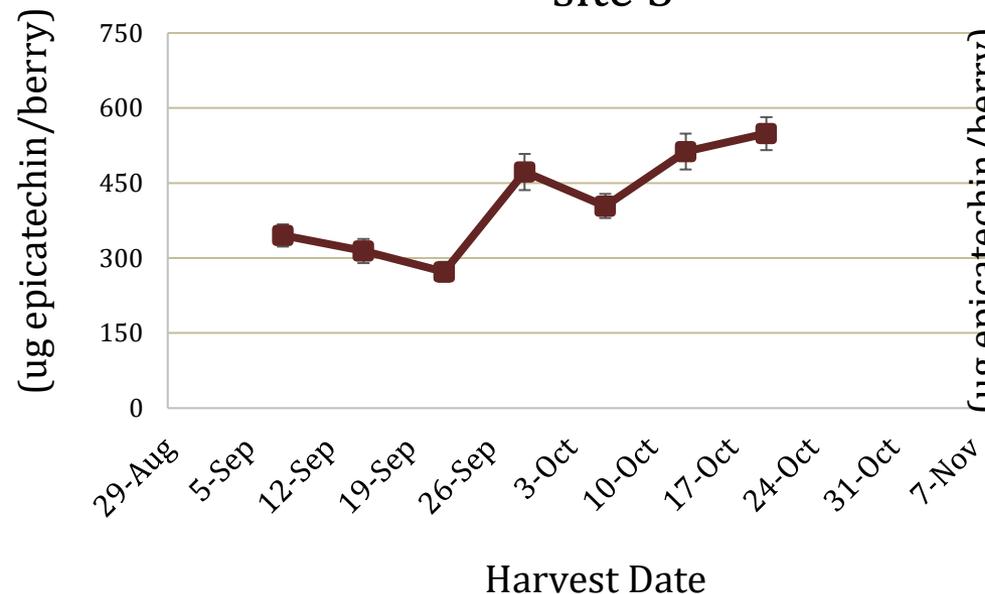


- Expecting extractable skin tannin to increase over time and extractable seed tannin to decrease over time

Cabernet Sauvignon 2020

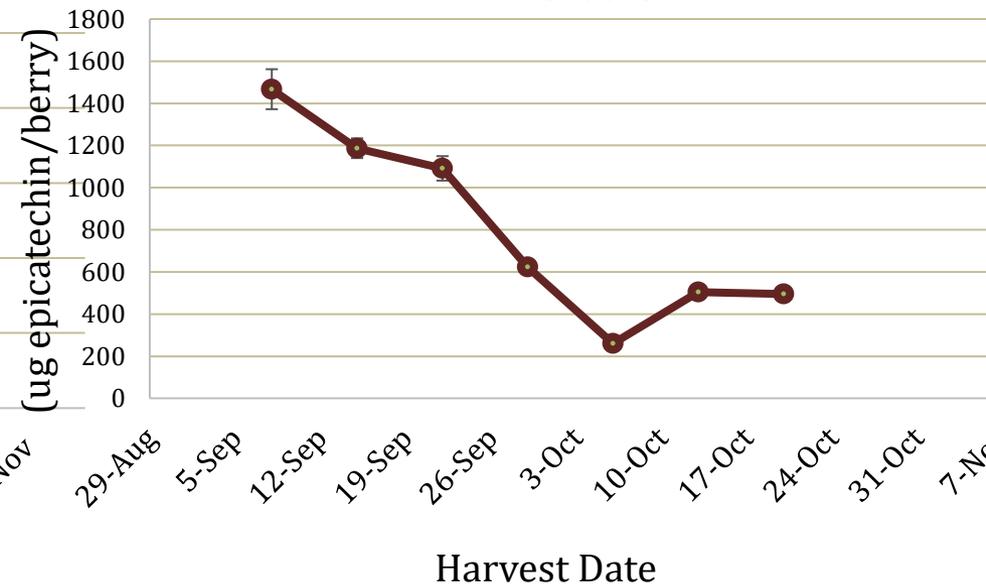
SKIN

■ site 3



SEED

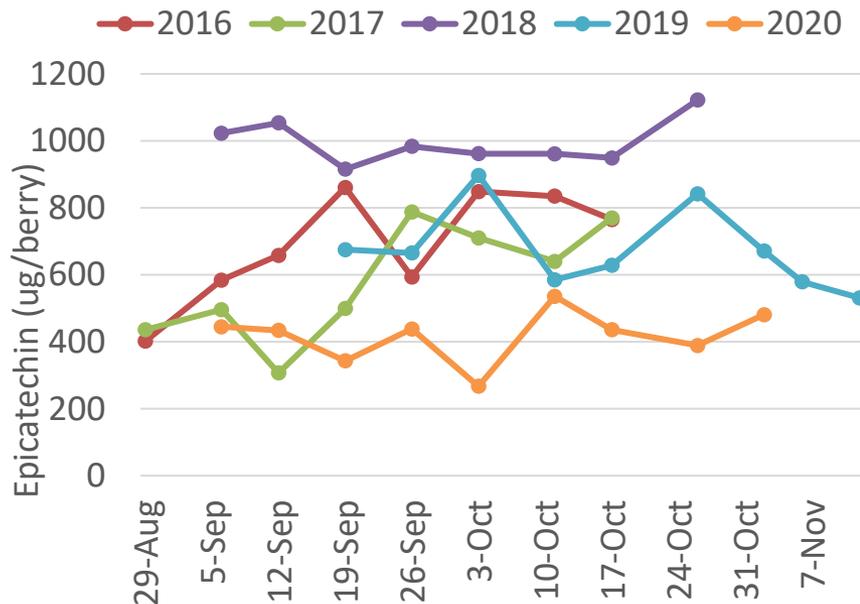
● site 3



Skin and seed tannin varies with vintage, does not always follow what we expect, 5 years site 1, Cab Sauv

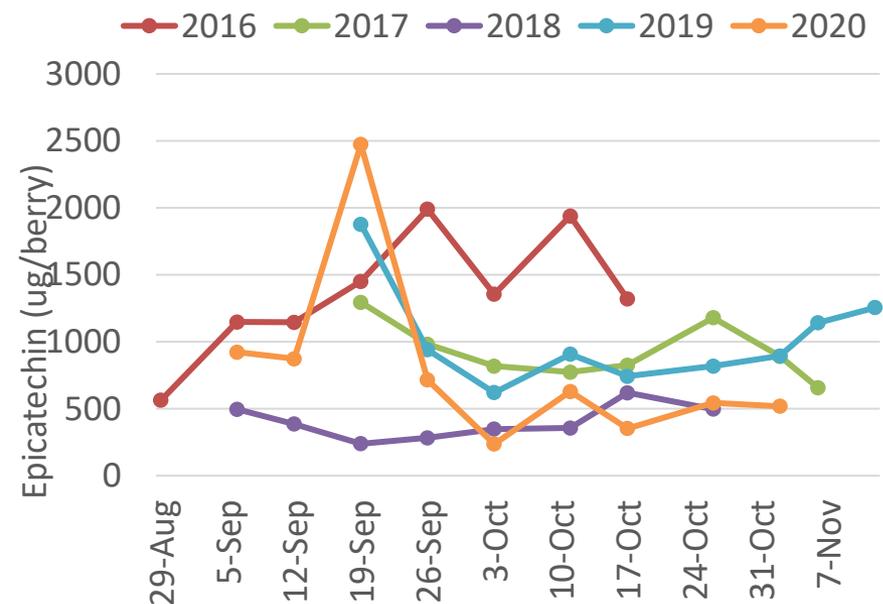


SKIN



SKIN tannin from veraison to harvest – CS – Site 1

SEED



SEED tannin from veraison to harvest – CS – Site 1

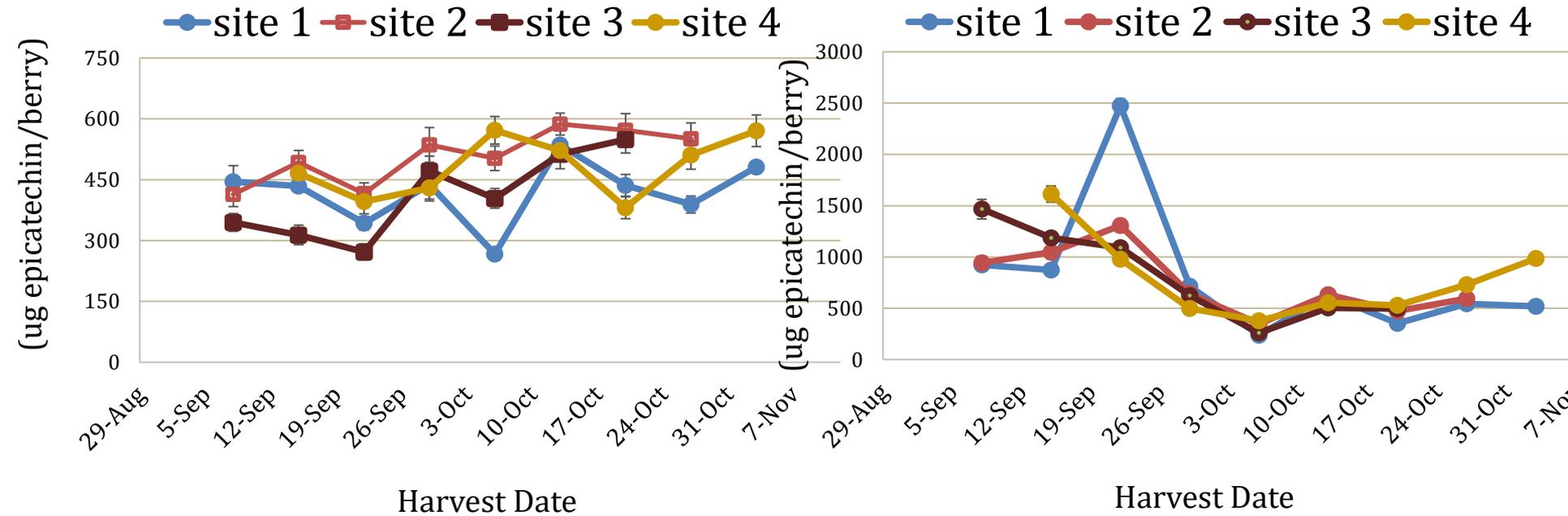
Skin and Seed Tannin vary with site



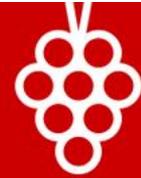
Cabernet Sauvignon 2020

SKIN

SEED



How would a winemaker
use the TanninAlert system
to benchmark their tannin
values against what is in
the database?



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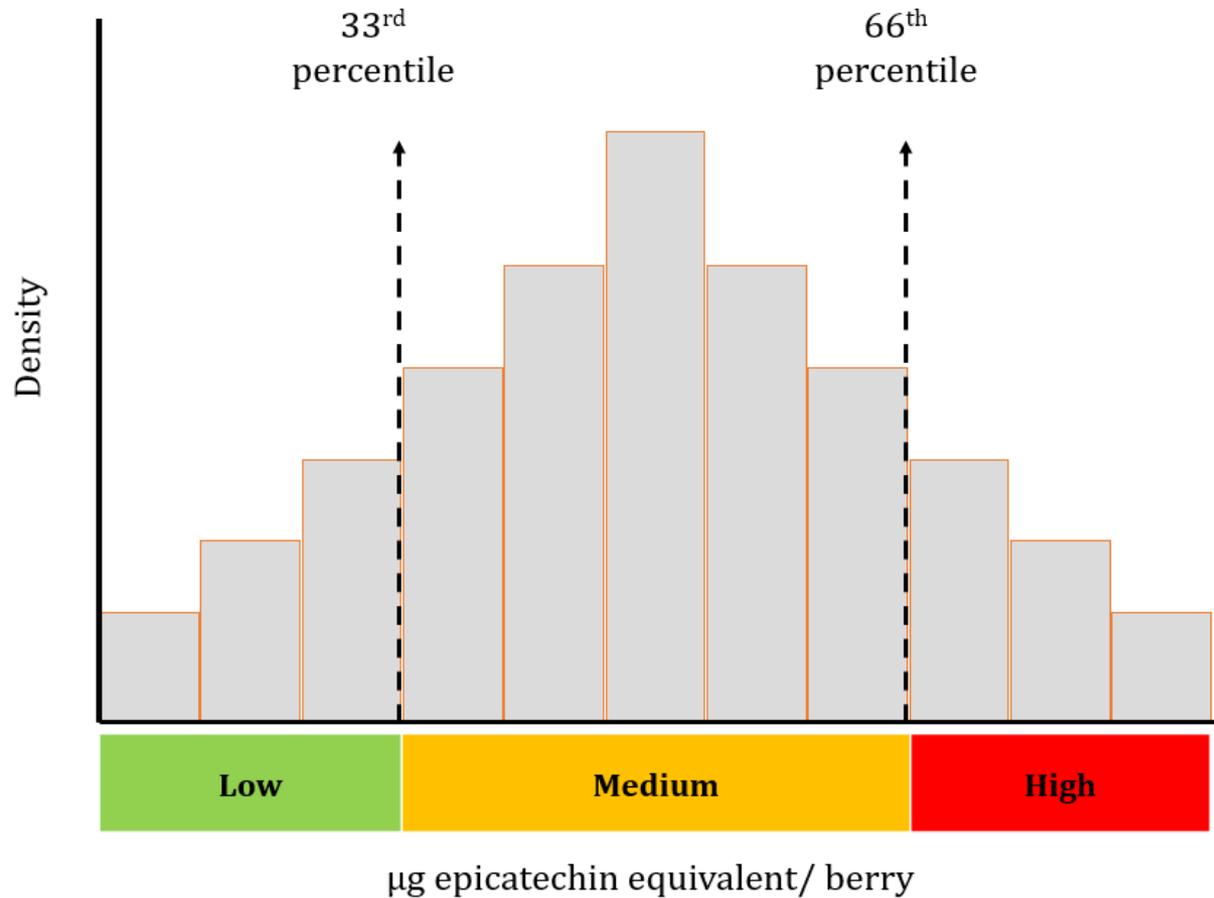


How do we display the distribution of tannin across the Niagara Region, ON, Canada



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Samples can be benchmarked against the database -low, medium, high

Charlene Marcotte MSc 2022



Cabernet Sauvignon 2020	Low (ug epicatechin/ berry)	Medium (ug epicatechin/ berry)	High (ug epicatechin/ berry)	Sample
Skin	40-512	513-734	735-1900	659
Seed	41-580	581-1126	1127-2025	1165

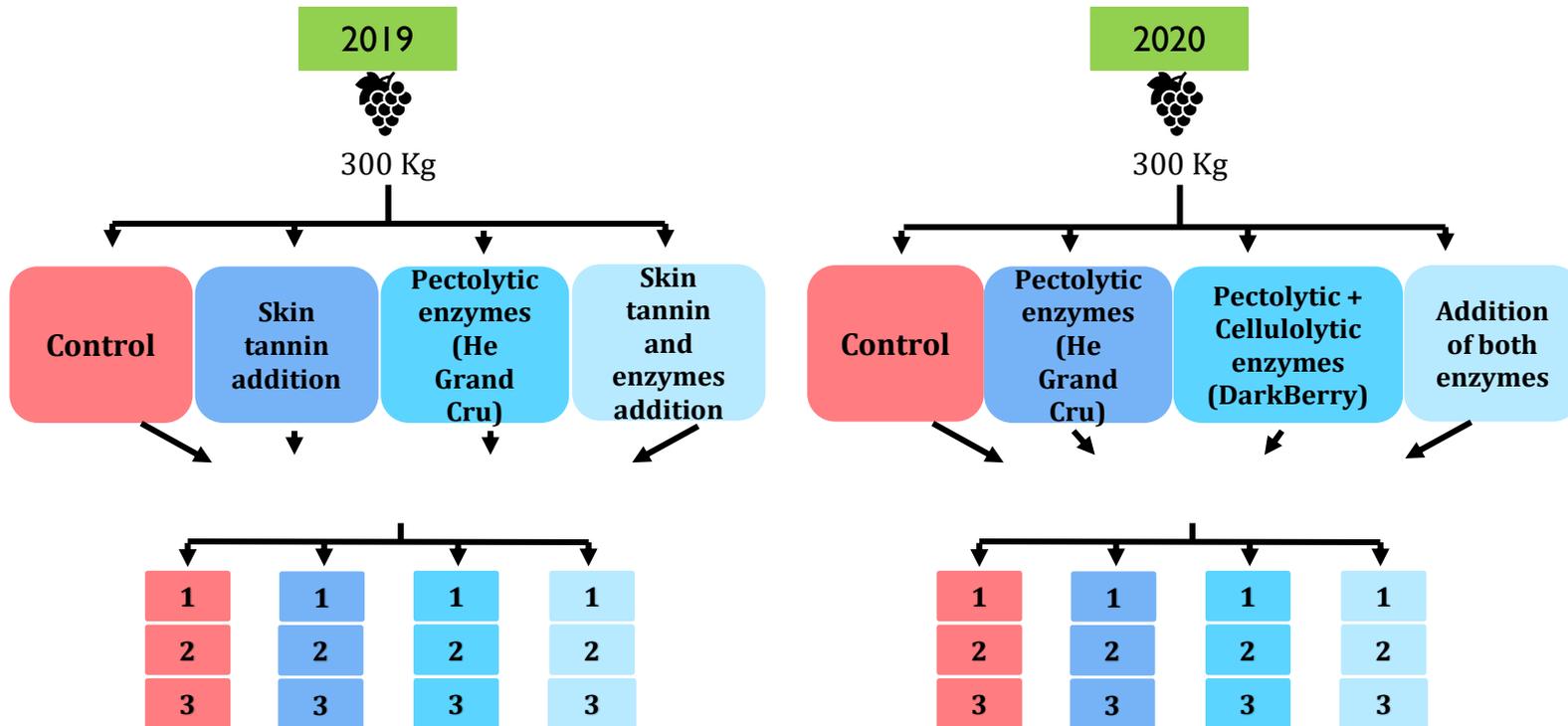
Pinot noir 2020	Low (ug epicatechin/ berry)	Medium (ug epicatechin/ berry)	High (ug epicatechin/ berry)	Sample
Skin	187-492	493-681	682-1326	697
Seed	160-952	953-1793	1794-3269	798

Pinot Noir: Testing winemaking methods at different skin and seed values (Charlene Marcotte, MSc)



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Tannin analysis

- MCP
- Phenolics (Iland et al, 1993)

Pinot Noir: Skin and seed values 2019 versus 2020, site 5 (C. Marcotte, MSc 2022)



Pinot Noir Skin and seed tannin concentrations at harvest, site 5

2019

	Low	Medium	High	Site 5
Skin	187-492	493-681	682-1326	562
Seed	160-952	953-1793	1794-3269	3124

Pinot Noir Skin and seed tannin concentration at harvest, site 5

2020

	Low	Medium	High	Site 5
Skin	187-492	493-681	682-1326	697
Seed	160-952	953-1793	1794-3269	798

Pinot Noir: Testing winemaking methods in 2019, medium skin, high seed tannin (C. Marcotte, MSc 2022)



Comparison of extractable tannin concentration (epicatechin ug/ml) between treatments at three different timepoints in the 2019 Pinot noir wines.

Treatments	Pressed wine	3 months post press	9 months post press
Control	701±120 ^b	748±72 ^B	389±73 ^b
Skin tannin addition	715±102 ^b	716±84 ^B	471±70 ^b
Enzyme addition	1007±137 ^a	985±124 ^A	717±141 ^a
Skin tannin and enzyme addition	1073±133 ^a	996±74 ^A	729±124 ^a

The extractable tannins from the four treatments were compared in the initial pressed wine, at 3 months and at 9 months in Pinot noir 2019 wines

At each time point tested, there is an increase in extractable tannins when enzymes are added in comparison to the control ($p < 0.05$) but skin tannin addition did not show a difference

Pinot Noir: Testing winemaking methods 2020, high skin, low seed tannin (C. Marcotte, 2022)



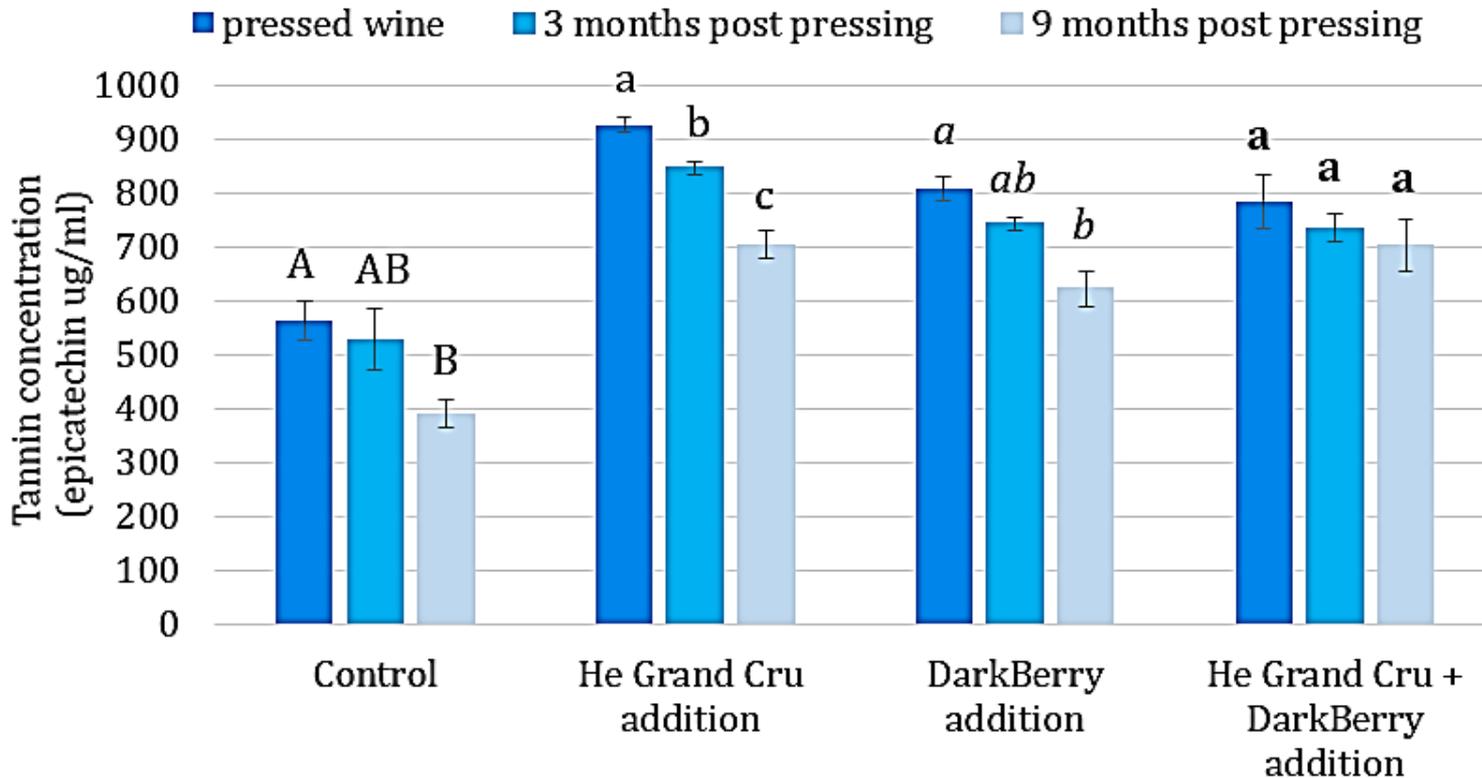
Comparison of extractable tannin concentration (epicatechin ug/ml) between treatments at three different timepoints in the 2020 Pinot noir wines.

Treatments	Pressed wine	3 months post press	6 months post press
Control	563±37 ^b	624±57 ^B	391±26 ^b
He Grand Cru addition	926±14 ^a	822±12 ^A	704±25 ^a
DarkBerry addition	808±21 ^a	719±12 ^{AB}	622±31 ^a
He Grand Cru + DarkBerry addition	784±51 ^a	787±27 ^A	703±47 ^a

The extractable tannins from the four treatments were compared in the initial pressed wine, at 3 months and at 6 months in Pinot noir 2020 wines.

At each time point tested, the addition of enzymes, either pectolytic or cellulosic, increased the concentration of extractable tannins in wines when compared to the control (p<0.05)

Pinot Noir: 2020 tannin retention over time (C. Marcotte, 2022)



Tannin retention also better with enzyme addition versus the control

Other Wine Making Trials based on extractable skin and seed measurements



- Pinot Noir: various commercial skin and seed tannin preparations (B. Kemp)
- Cabernet Franc: pre-fermentation skin disruption or post fermentation pressing pressures (L. de Felice Renton (MSc))
- Cabernet Sauvignon: extended maceration time post fermentation (Robin Holford, BSc thesis); pre-fermentation skin disruption, enzyme addition and Saignee (C. Marcotte)
- Gamay: skin and seed tannin additions (Robin Holford, BSc thesis); inclusion of whole bunches (B. Kemp)
- Merlot: Flash Détente (B. Kemp and Nuance)
- Syrah: addition of liquid tannin post racking or post racking and post filtration (B. Kemp)

Launch of TanninAlert Service, Summer of 2022



**Summer of 2022, TanninAlert will launch through
CCOVI Analytical Services**

**Testing of skin and seed tannin at harvest for red
grape varieties**

- **3 day turnaround from sample drop off to
results from 2021 test run**
- **Results provide not only skin and seed tannin
but also tell you if you are in the low, medium
or high range and access to TanninAlert site**
- **\$100 per sample**
- **Bulk rate if more than one sample**

Projected Outcome from TanninAlert



- ✓ Create an online *tool* for grape growers and winemakers to improve red wine quality
- ✓ Increase domestic market share by 21% in 10 years
- ✓ Create 800 new jobs in 10 years
- ✓ Increase average price point of domestic wines
- ✓ Significantly increase reputation and branding of Ontario wines

Industry partners



- **Ontario Grape and Wine Research Inc**
- **Allan Schmidt - Vineland Estates**
- **Dave Sheppard - Coyotes Run/Flat Rock Cellars**
- **Amelie Boury - Chateau des Charmes**
- **Craig McDonald - Andrew Peller Ltd**

Grape Donations

- **Chateau des Charmes**
- **Andrew Peller Ltd**
- **Falk Farms**
- **Lawrie vineyards**
- **Hughes vineyards**
- **Creekside winery**
- **Pondview**
- **13th Street Winery**
- **Schenck Farms**
- **Huebel Grape Estates**
- **Koop Farms**
- **George Vineyards**
- **Fielding Estates**
- **Arterra**



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Research Collaborators



Collaborators

- **Dr. Belinda Kemp (co-PI on this project)**
- **MSc Leah de Felice Renton**
- **MSc Charlene Marcotte**
- **BSc Robin Holford**
- **Technicians Fei Yang, Tony Wang, Sampa Shakya, Rachel Gerroir, Dan Greaves**

Funding Partners



CRSNG
NSERC

Canadian Grapevine Certification Network
CGCN · RCCV
Réseau canadien de certification de la vigne

Ontario
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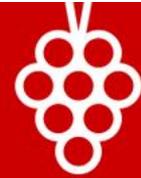


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Excellence

Where Next Happens

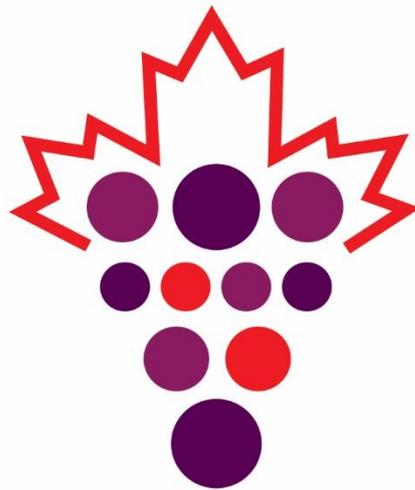


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Thank you!



Questions?

Cheers!

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