Cool Climate Oenology & Viticulture Institute

Brock University

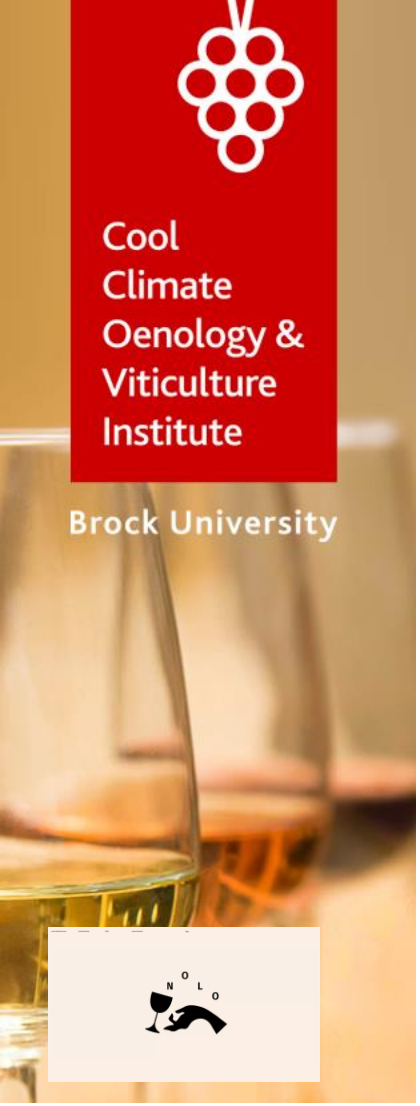
The Pursuit of Lower Alcohol: Strategies for the Future

Wednesday, January 28, 2026

Jennifer Kelly

Outline

- **Introduction**
  - Low and no alcohol wines
  - Climatic challenges in grape growing in Niagara
- **Sustainable Grape Varieties**
  - 2025 Preharvest Monitoring Program
  - Harvest and Fermentation
  - Results of Yeast Trial
- **Use of Post-Fermentation Ethanol Removal Technology**
  - Background
  - Research Trials
- **Future Directions**
  - Sensory Analysis
  - Brock Farm



Why Low Alcohol?

- Currently the NOLO beverage industry is transforming, with steady growth so far between 2018 and 2023 (Waehning and Wells, 2024)
  - These beverages are distinguished from soft drinks, as they are meant to mimic alcoholic beverages
- Consumers
  - More consumers are moderating their drinking, especially younger consumers (Waehning and Wells, 2024)
  - Consumers want: a favourable sensory profile, aroma, mouthfeel, colour, chemical composition and sound → Highly impactful on willingness to try (Smeets and de Graaf, 2019)
  - Alcohol is seen as important to consumers in the wine category, so mimicking that sensation is important (Paixao et al., 2020)
  - Marketing is also important to consumers, so effective labeling and branding and PRICE has a key effect of NOLO consumption (Anderson and Kokole 2022)
  - Previous positive experience with NOLO drinks are more likely to repeat purchase (Waehning and Wells, 2024)

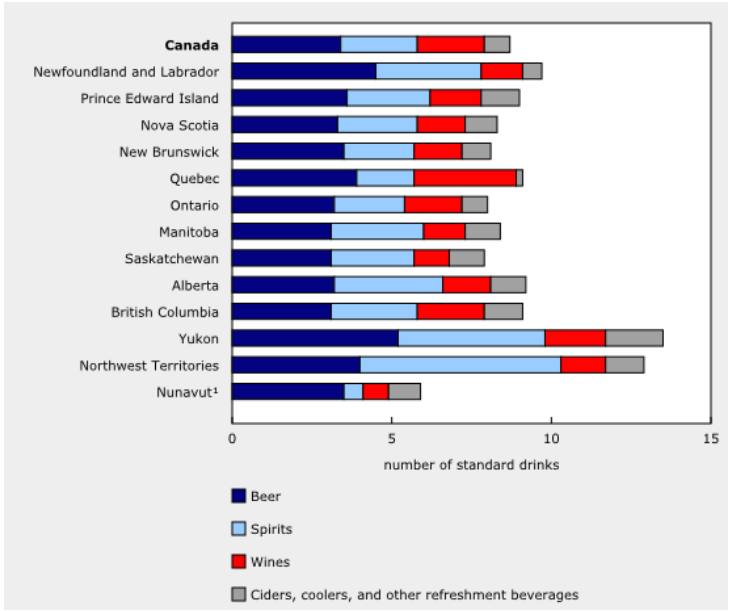
NØLO™
ADULT BEVERAGES. NO BOOZE.

Consumer Purchasing Trends

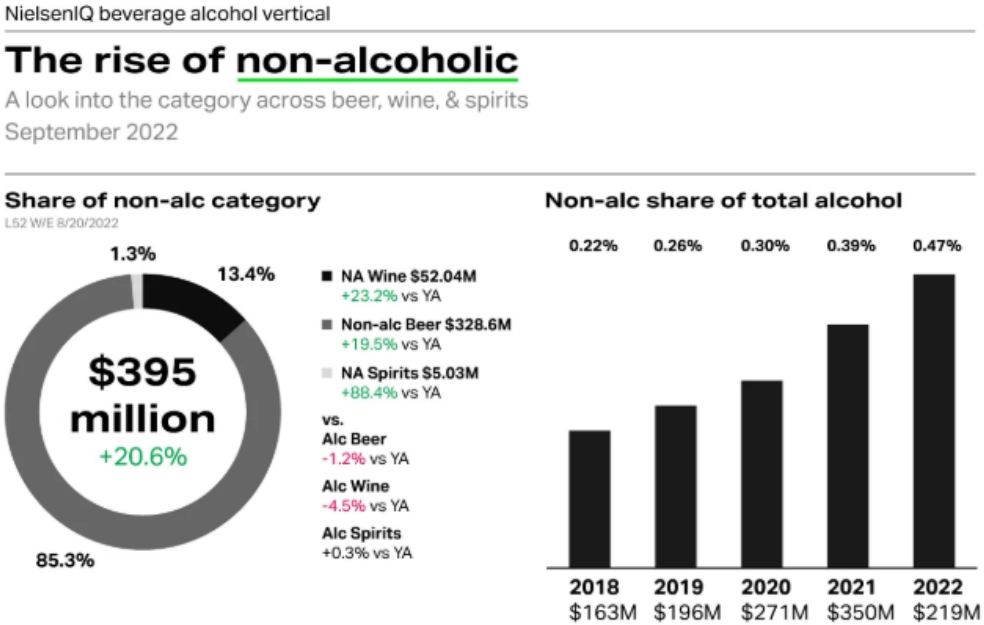
LCBO Data (Dec. 2025)

Wine

When it comes to wine, customers continued to seek out fresher styles including lighter reds, sparklers, and light wines. With more customers choosing to consume mindfully, de-alcoholized wines continued to gain popularity (+126%). In lieu of U.S.-produced wines, Ontario wines benefited from the strong customer sentiment to support local, with VQA sales increasing by +56%, led by Ontario red VQA (+66%) and Ontario white VQA (+54%). There was also notable increases in demand for wines from Canada (+19%), Australia (+17%), Italy (+10%) and France (+18%) — particularly red wines.



Statscan.gc.ca



Non Alcohol Is No Longer a Niche—It's a Billion-Dollar Movement

29 August 2025 , 2 mins read

NielsenIQ.com

Techniques for Reducing Alcohol

Vineyard:

- Late pruning (Frioni et al., 2016)
- Leaf area reduction (leaf area : crop weight) can delay sugar accumulation (Stoll et al., 2010)
- Application of growth regulators (Bucher et al., 2018)
- Harvest date management

Pre-Fermentation:

- Nanofiltration to reduce sugar from must (García-Martín et al., 2010)
- Glucose oxidase (GOX) to remove fermentable sugars from grape must (Sam et al., 2021)

Microbial Practices:

- Non-*sacch* yeast (Canonico et al., 2019)
- GMO yeast (Kutyna et al., 2010) *NOT ALLOWED IN CANADA*
- Arresting fermentation

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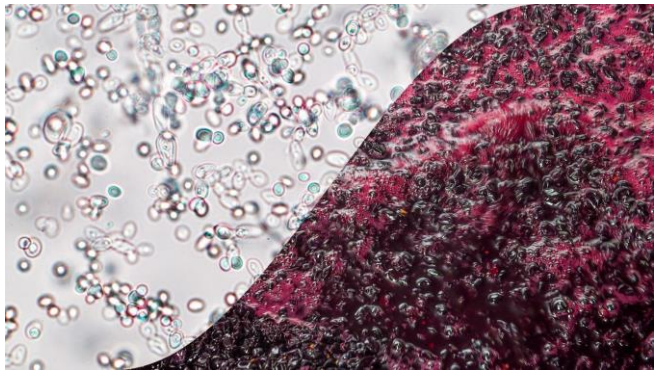
Protocols in Action

In this project, the approach to reducing ethanol in wine is 3-tiered:

- Grape selection
- Yeast selection
- Post-fermentation methods



Buchervaslin.com, dailysevenfifty.com

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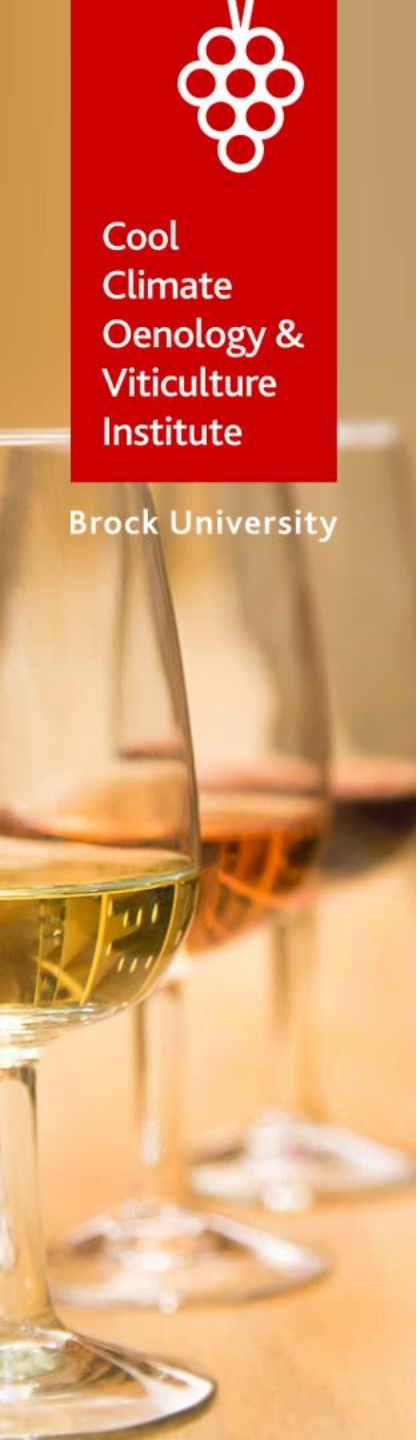
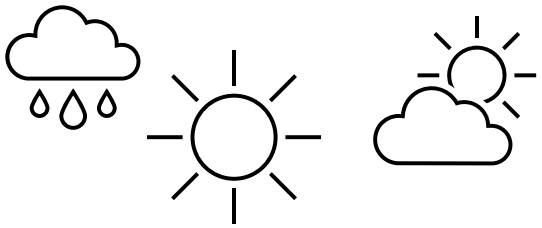
Link to Niagara Climate?



Background



- Challenges
  - Extreme temperature highs during the growing season – *fruit quality, vine survival*
  - Extreme cold events during the winter that threaten vine survival
  - Lack of rain or excessive rain, both compromise vine health, fruit quality
  - Additionally, hail, variable and unpredictable precipitation and early frost also challenge wine production (Duley et al., 2023)

- The emergence of new pests and diseases pose an ongoing challenge to grape growing

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Climate Shift

- **Incidence of drought**
  - "Normally" not considered a primary concern for Ontario vineyards
  - *2025 it was a concern*
    - *Young vines more susceptible to drought stress*

Rise in temperature

- Advancement of veraison (sometimes)

- **Increases susceptibility to:**
  - Sunburn
  - Dehydration
  - Fungal pathogen window increased
  - Increase in sugar accumulation in the grapes, resulting in wines with higher alcohol content

VQA Ontario Vintage Report: 2025
“Another year of weather plot twists”

Environment and Climate Change Canada predicted a warmer than usual June – and they were correct. The end of June was characterized by very hot weather that continued into July. Many parts of Wine Country and the Greater Toronto Area experienced a long and dry heat wave, punctuated by localized thunderstorms including one on July 24 that hit the Niagara region with a heavy down pour, high winds and hail, and then came across Lake Ontario and brought the same energy to downtown Toronto.

The July summer heat wave continued through the first few weeks of August. Prolonged heat can cause significant stress for the vines and where irrigation is possible, some vineyards opted to use it to stave off drought-stress.

The summer heat wave finally broke in the final week of August, bringing some much-needed cooler weather to wine country. Within weeks, the vines that had shut down under heat stress were recuperating and sugars were accumulating in the grapes, while the grape skins and seeds were starting to show phenolic ripeness.

A relatively warm and dry September followed. Harvest began, with growers and wineries opting to pick for Sparkling wine first, then aromatic whites. Thanks to dry conditions, growers could pick on their schedule – for optimum ripeness or the profile they preferred. By the end of September and into October, rainy days were more abundant than they had been all year. Good timing and precision-harvest techniques allowed grape growers and wineries to maximize the temperate weather they had left, minimize picking in the rain, and enabled them to bring in grapes with maximum flavour and ripeness.

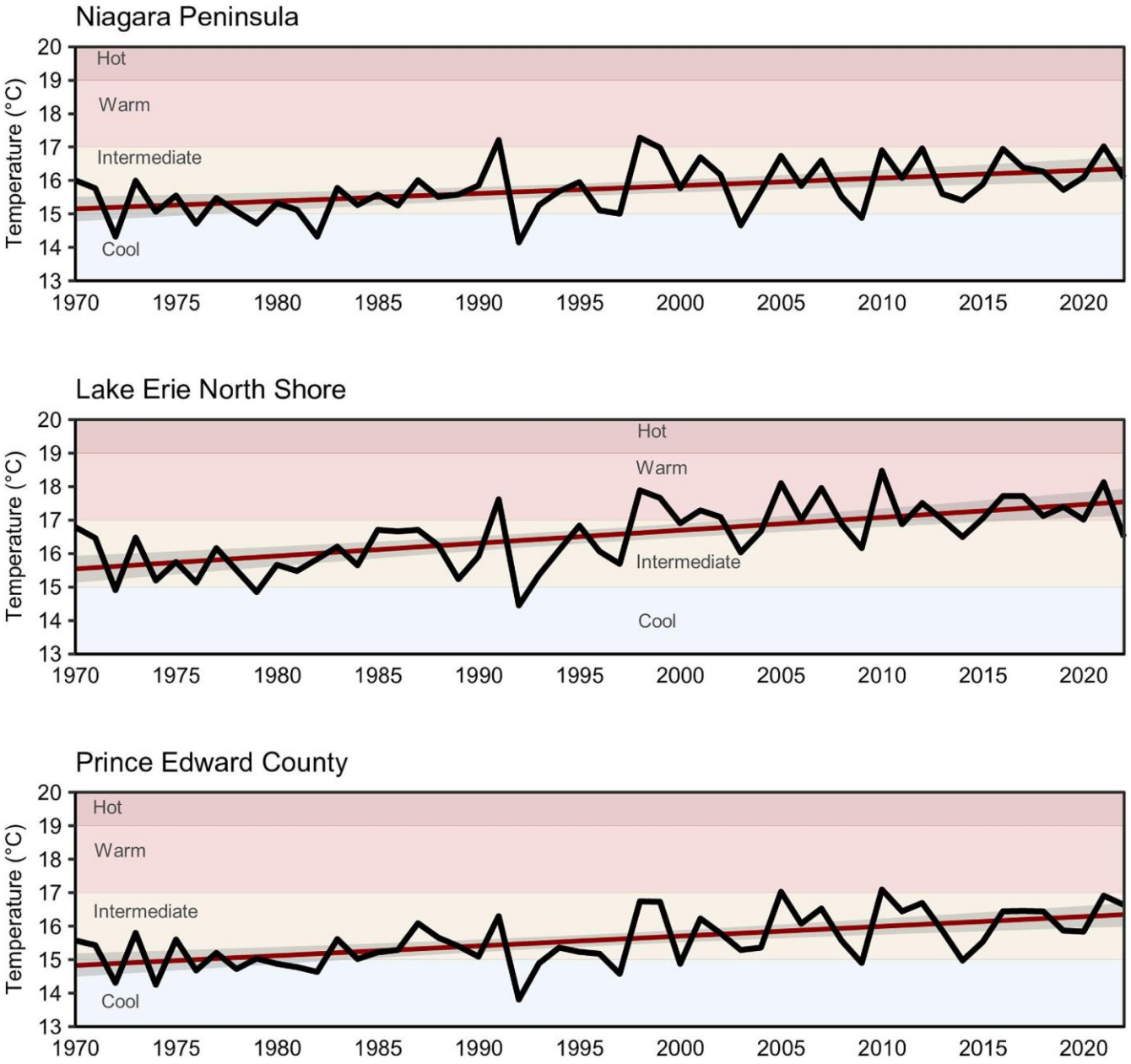
By November, it was clear that fall had arrived and winter was its way. Snow came early across southern and southwestern Ontario with snow falling on Sunday November 9 and sticking around. Fortunately, by all accounts, regular harvest was complete or almost complete throughout the wine growing regions.

Winter Conditions: 2026

Photo Credit: D. Gill

General patterning of some key grape growing regions in the province are indicating an overall rise in temperature

In Ontario, three distinct viticultural regions are experiencing climatic shifts towards warmer growing seasons



Williamson et al., 2024

Downy Mildew Symptoms

Oil spots

White down (sporulation of the fungus)

The spots turn brown with time

Infected shoot tips curl (shepherd's crook)

A white down occurs on the stem (sporulation of the fungus)

During severe infections, they can turn yellow, brown, then dry out completely

White down (sporulation of the fungus)

Quality impacts

Yield loss and uneven ripening (less fruit, more variability)

Higher juice pH and weaker flavour development can happen if vine function is compromised

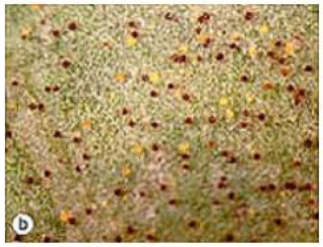
When leaves are hit hard, you get defoliation → reduced photosynthesis → slower sugar accumulation and delayed ripening

*Downy mildew can destroy crop quickly in a wet year, but it's often the **leaf loss + cluster damage** that drives quality issues*

Identification Guide to the Major Diseases of Grapes - agriculture.canada.ca

Powdery Mildew Symptoms

The first powdery mildew lesions are frequently found on the undersides of leaves



Very small orange to black spherical structures called cleistothecia develop on the upper and lower surfaces of leaves

The gradual degeneration of the fungus over the course of the season

They turn an ash grey colour and quickly become covered in spores

Cleistothecia also appear on the berries

Affected berries dry out and may drop off

Quality impacts
Higher risk of Botrytis and sour rot because cracks = entry points
Off aromas/flavours: can contribute to musty/moldy characters and reduced fruit expression
Lower extractability / mouthfeel changes (skin damage affects phenolics, colour and texture)
More winery headaches: more sorting, higher SO_2 demand, more unstable ferments if fruit is compromised
Early-season infection (pea-size/early berry growth) is the most damaging for the fruit

Identification Guide to the Major Diseases of Grapes - agriculture.canada.ca

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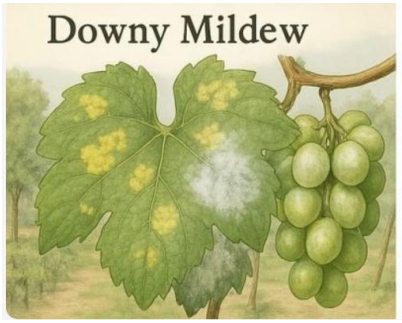
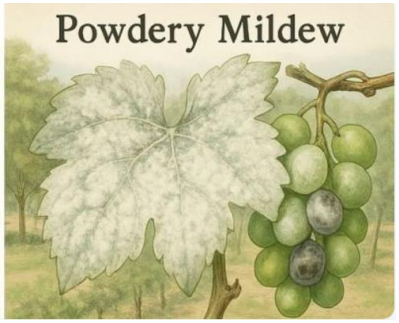
Enhancing Sustainability in Winemaking

- **Choice of sustainable varieties**
  - Known as **Fungus Resistant Varieties (FRGs)** in literature
  - Less susceptible to disease
  - Therefore, significant reduction in vineyard sprays
  - Early ripening (why do we want this?)
    - Less prone to early frost issues
    - For grapes to ripen, **a minimum of 155 frost free days is recommended for early-ripening grapes, while a minimum of 180 frost free days is recommended for late-ripening varieties** (Site selection for grapes | ontario.ca)
    - ***And importantly, a potential for wines with reduced alcohol***





Wikifarmer.com

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Available in Niagara? These plus more!

Photo Credit: J. Kelly

Cabernet volos
Parents: Cabernet Sauvignon x 20-3

Soreli
Parents: Tocai Friulano x 20-3

VQA Approval of Varieties, Aug. 2025

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NEWS RELEASE

Ontario Supporting Grape Growers and Wineries

Province expanding grape varieties for Vintners Quality Alliance Certified Wine

June 17, 2025

Public and Business Service Del

New grape varieties approved for Ontario's VQA certified wines

In 2024, more than $433.6 million in VQA wines were sold worldwide

Niagara-on-the-Lake Local Staff
Jun 18, 2025 8:30 AM

Ontario wine makers raise a glass to newly expanded grape list

The new VQA varieties will expand options for vinyards, especially those outside of Niagara

Travis Dolynny · CBC News · Posted: Aug 04, 2025 5:00 AM EDT | Last Updated: August 4, 2025

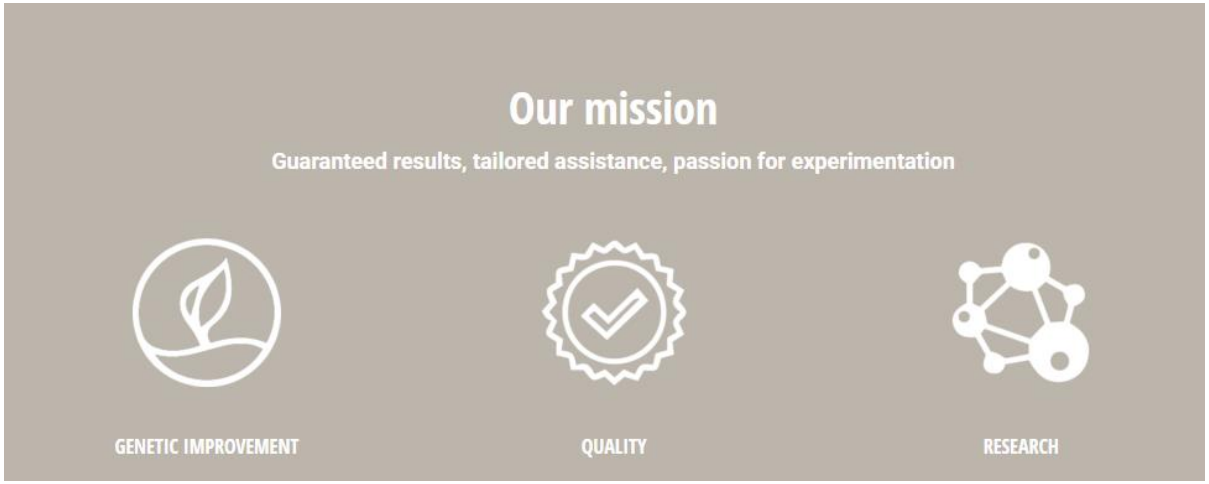
Listen to this article
Estimated 4 minutes

O. Reg. 406/00 RULES OF VINTNERS QUALITY ALLIANCE ONTARIO RELATING TO TERMS FOR VQA WINE | ontario.ca

TABLE 2

VARIETIES PRODUCED BY INTER-SPECIFIC CROSSBREEDING THAT MAY BE INDICATED ON THE LABEL OF VARIETAL WINES

VCR
VIVAI COOPERATIVI RAUSCEDO
L'INNOVAZIONE IN VITICOLTURA



Importance of Grapevine Material

With these resistant varieties it is possible to cut down the number of fungicide control treatments, limit water waste, avoid unnecessary soil compaction and reduce production costs. All this can be achieved without harm to the quality, the healthiness and the character of the resulting wine, as highlighted by several lab tests and tasting sessions, which have shown how the final consumers appreciate the aromatic and organoleptic profile of these wines

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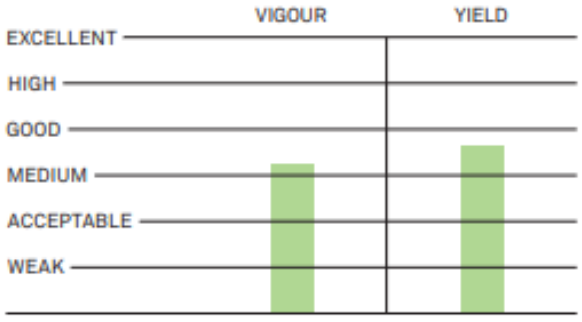
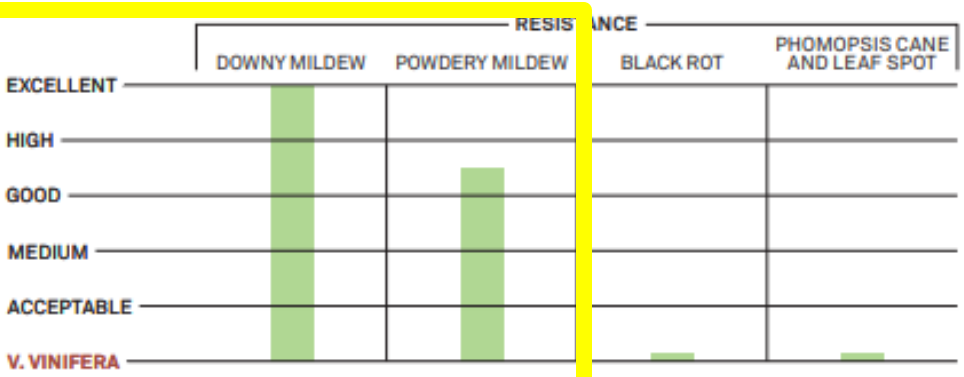
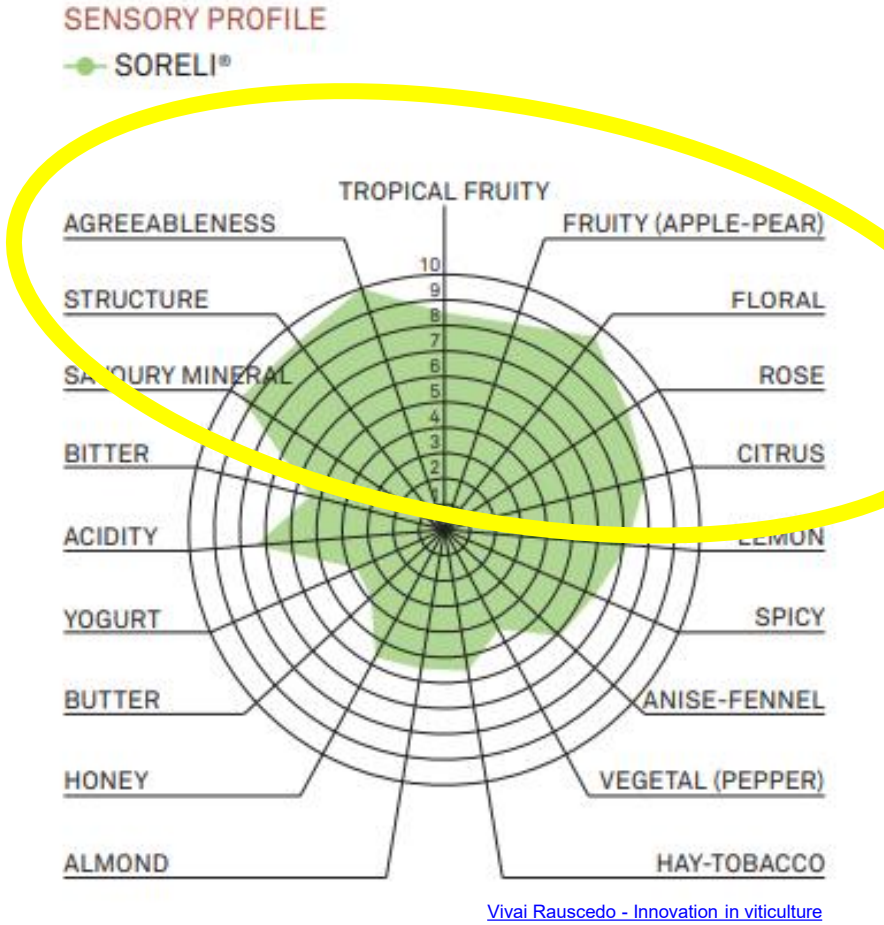
Soreli
Data from VCR







Vivai Rauscedo - Innovation in viticulture

Relevant to Ontario
Most commonly-sprayed grape diseases

Soreli
Data from VCR

DATI AGRONOMICI VARIETÀ SORELI® / *AGRONOMIC DATA OF THE VARIETY SORELI®*

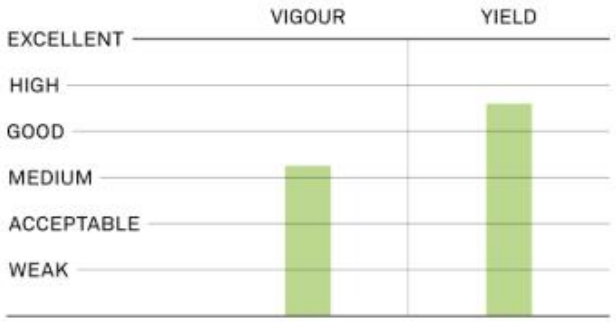
VENDEMMIA *HARVEST*	VIGNETO *VINEYARD*	PESO GRAPPOLO (GR) *CLUSTER WEIGHT (GR)*	PRODUZIONE PIANTA (KG) *YIELD PER PLANT (KG)*	PRODUZIONE PER HA (KG) *YIELD PER HA (KG)*	°BRIX	ACIDITÀ TOTALE (G/L) *TOTAL ACIDITY (G/L)*	PH
23-08*	Grado (IT)	185	3,3	10.710	22,5	5,5	3,3
09-08-2018	Grado (IT)	245	4,0	13.333	22,6	5,9	3,2
09-08-2018	Fermo (IT)	194	5,2	23.300	18,2	5,7	3,1
16-08-2018	Vipava (SLO)	171	5,1	22.660	20,7	5,0	3,4
23-08-2018	Arles (FR)	317	3,0	12.000	23,8	4,2	3,7

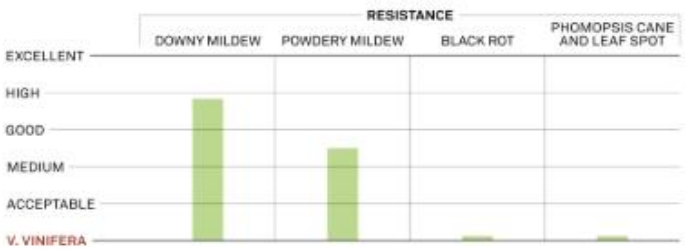
The harvest parameters are dynamic, and there are options for a range of styles, so harvest timing is an important consideration

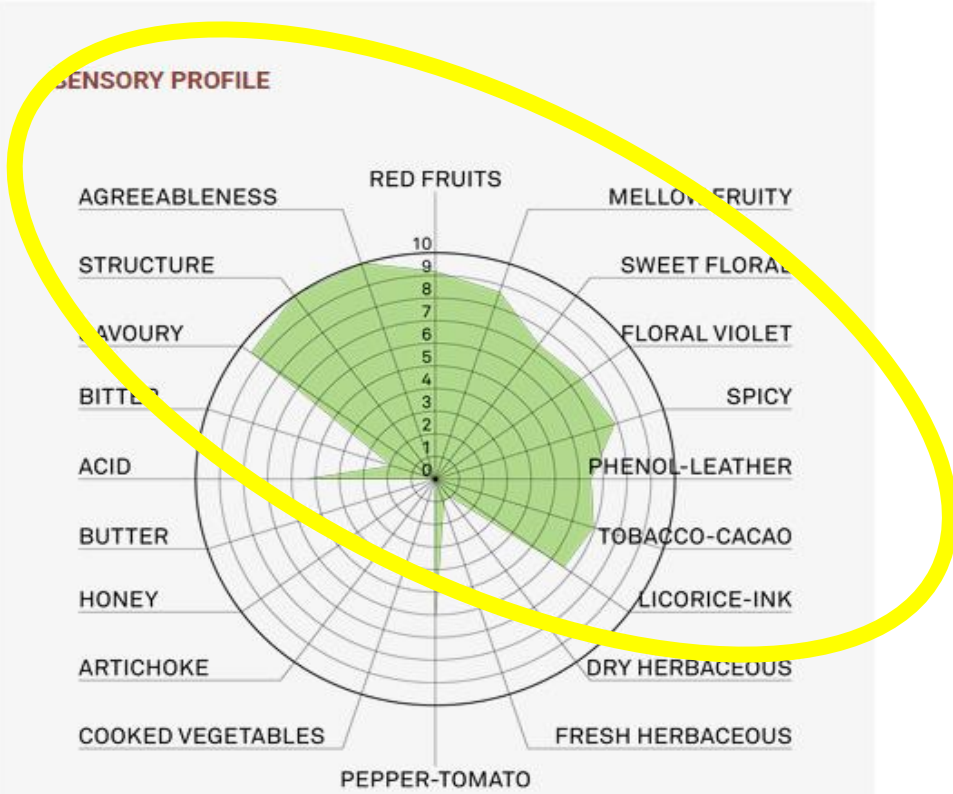
Want to watch acid doesn't drop too low

These represent a potential alcohol range of 10.4-13.6%

Cabernet volos







Vivai Rauscedo - Innovation in viticulture

Cabernet volos Data from Italy

DATI AGRONOMICI VARIETÀ CABERNET VOLOS® / *AGRONOMIC DATA OF THE VARIETY CABERNET VOLOS®*

VENDEMMIA *HARVEST*	VIGNETO *VINEYARD*	PESO GRAPPOLO (GR) *CLUSTER WEIGHT (GR)*	PRODUZIONE PIANTA (KG) *YIELD PER PLANT (KG)*	PRODUZIONE PER HA (KG) *YIELD PER HA (KG)*	°BRIX	ACIDITÀ TOTALE (G/L) *TOTAL ACIDITY (G/L)*	PH
10-09*	Grado (IT)	136	3,2	10.720	22,5	5,4	3,6
24-08-2018	Grado (IT)	133	3,0	10.000	23,0	5,9	3,3
09-08-2018	Fermo (IT)	142	3,8	16.900	21,6	6,0	3,6
06-09-2018	Arles (FR)	223	3,0	12.000	25,2	6,9	3,6
06-08-2018	Tebano (IT)	103	4,1	15.770	20,5	5,7	3,2
16-08-2018	Vipava (SLO)	120	3,1	13.776	20,5	4,9	3,6

Site specific differences are highlighted here

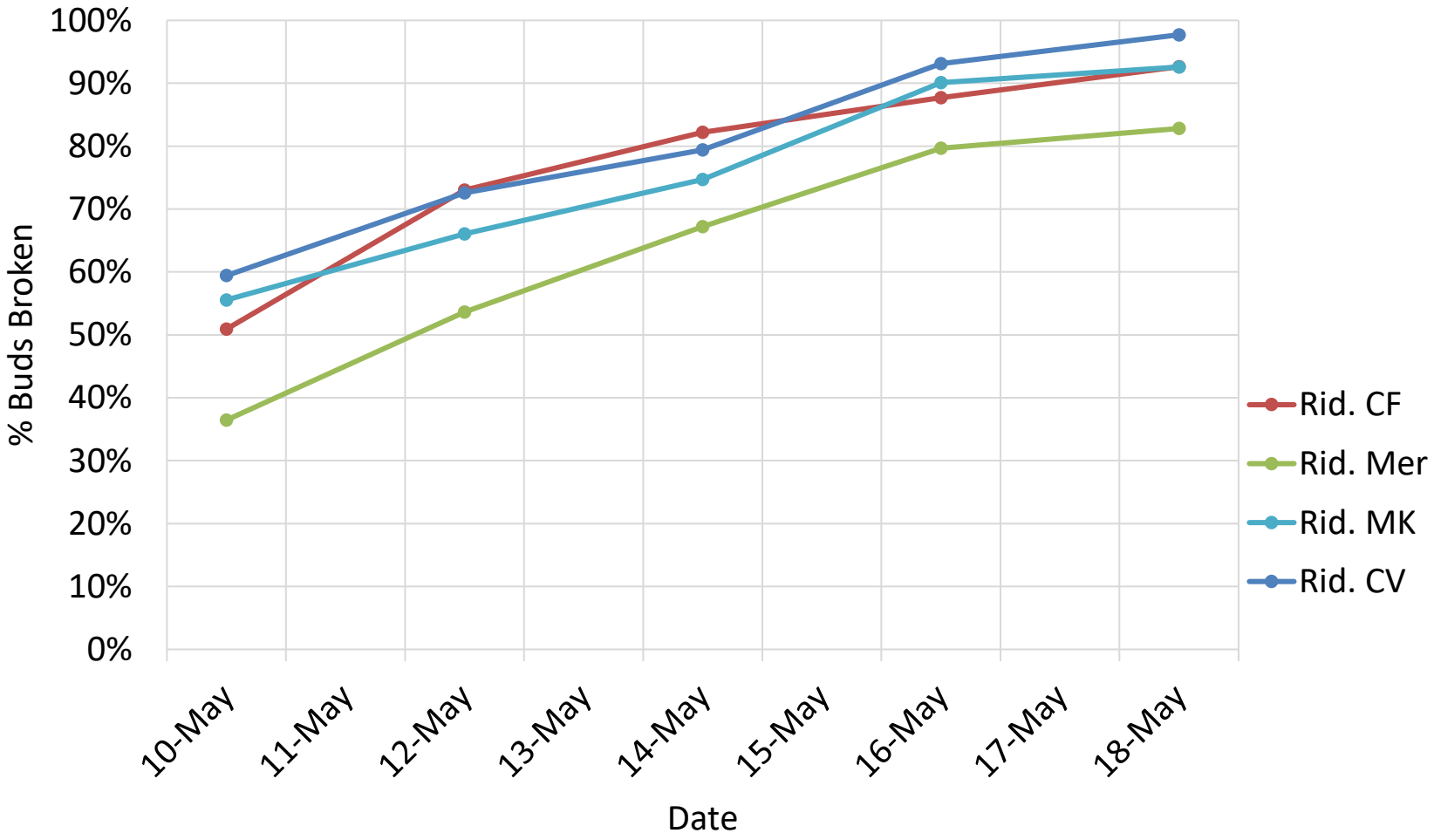
Yield range is site specific

These represent a potential alcohol range of 11.7-14.4%

Grape Selection: FRGs in Niagara

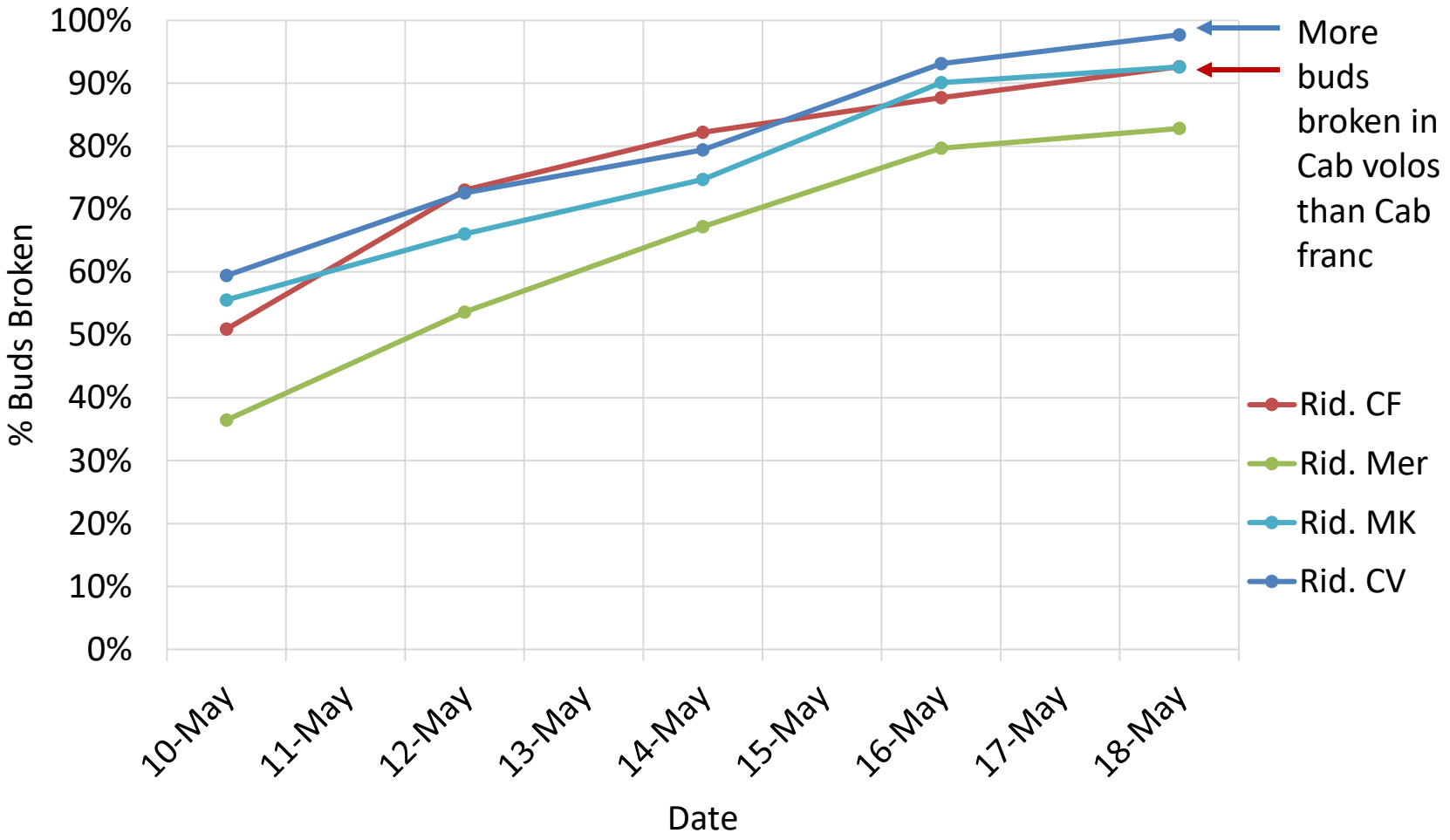
VQA Ontario Sub-appellation	Planting Year	Cultivar	Rootstock
Vinemount Ridge	2022	**Soreli**	3309C
	2021	**Sauvignon rytos**	3309C
		Cabernet volos	3309C
Four Mile Creek	2021	**Soreli**	SO4
Twenty Mile Bench	2022	**Merlot kanthus**	3309C

Budbreak Data
Thesis Work: Boris Mihajlovic, Willwerth Lab



Bud break is an indication of progression throughout the season

Budbreak Data
Thesis Work: Boris Mihajlovic, Willwerth Lab



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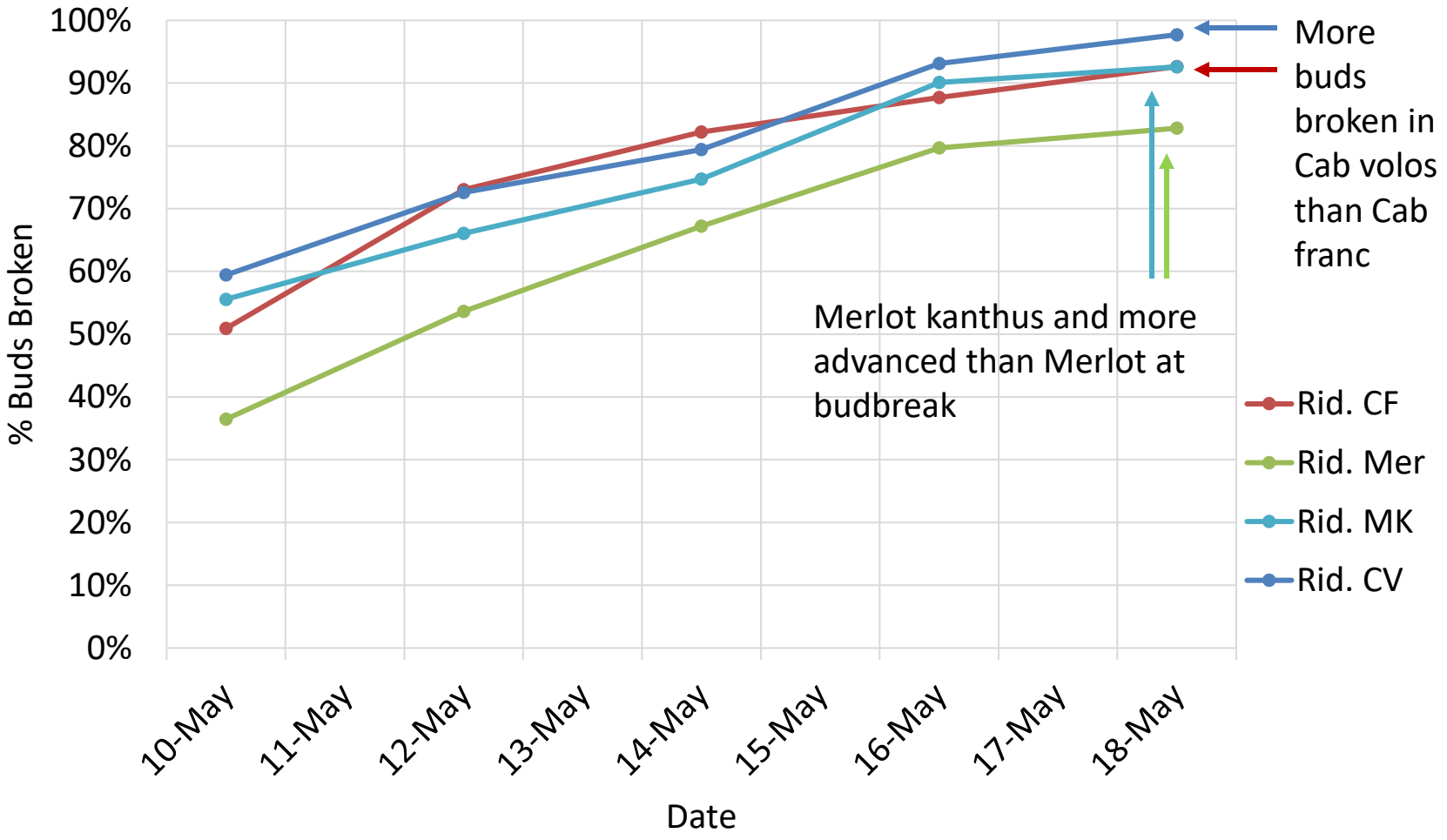
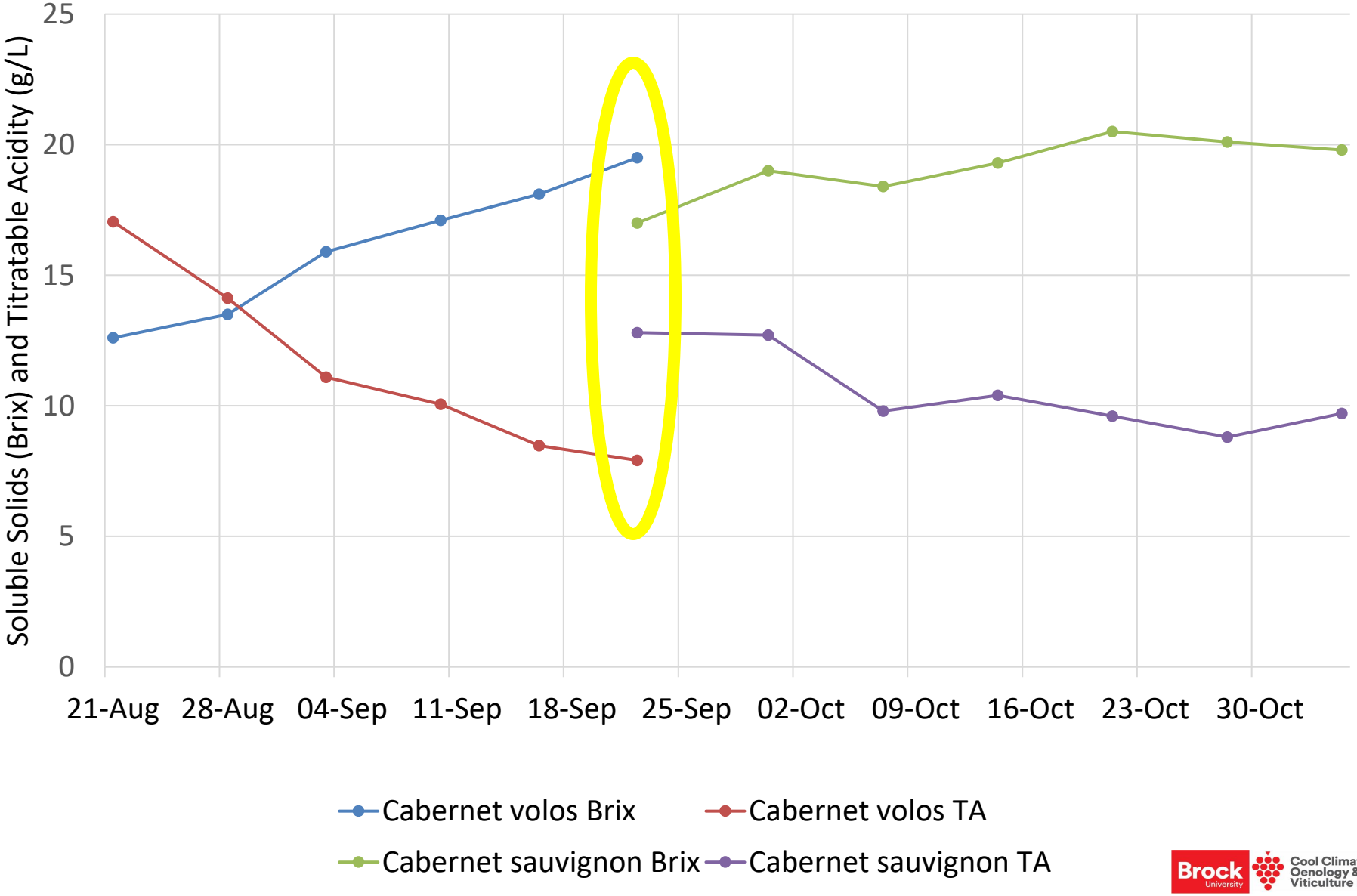


Bud break is an indication of progression throughout the season

Cabernet volos vs Cabernet sauvignon (Site 4): Brix and TA
2025 Preharvest Monitoring



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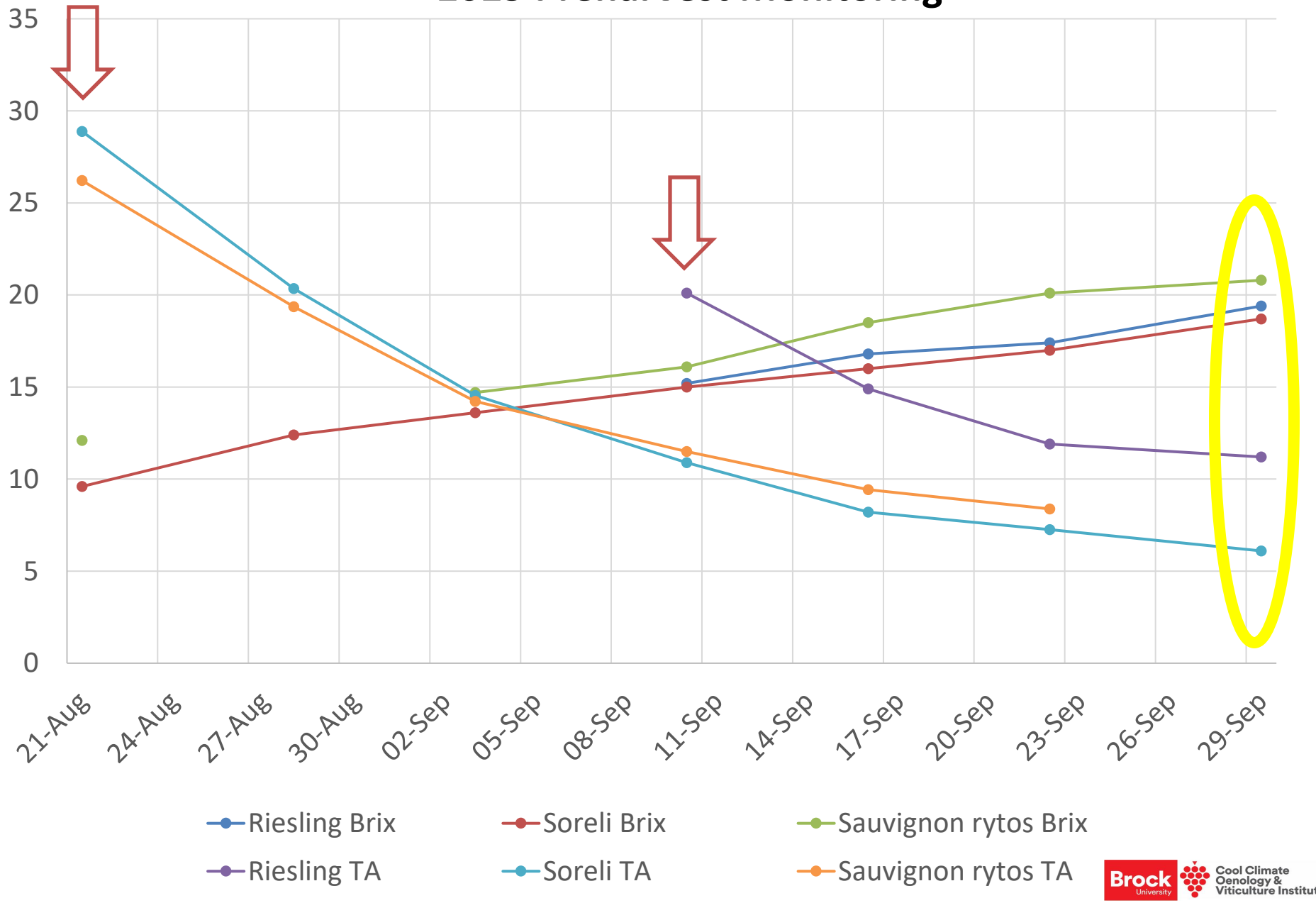
Soreli and Sauvignon rytos vs Riesling (Site 4): Brix and TA
2025 Preharvest Monitoring



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Preharvest Monitoring
Thesis Work: Holly Eaton

Variety	Date	°Brix	pH	TA (g/L)
Cabernet volos	August 21	12.6	2.89	17.05
	August 28	13.5	2.92	14.12
	September 3	15.9	2.87	11.09
	September 10	17.1	2.96	10.06
	September 16	18.1	3.12	8.47
	September 22	19.5	3.16	7.91
Soreli	August 21	9.6	2.71	28.88
	August 28	12.4	2.72	20.35
	September 3	13.6	2.90	14.54
	September 10	15.0	2.75	10.89
	September 16	16.0	2.87	8.20
	September 22	17.0	2.93	7.25
	September 29	18.7	2.95	6.10
Sauvignon rytos	August 18	12.1	2.53	26.21
	September 3	14.7	2.78	19.36
	September 10	16.1	2.62	14.22
	September 16	18.5	2.78	11.50
	September 22	20.1	2.84	9.43
	September 29	20.8	2.90	8.38

Last year harvest: Sept. 9

Last year harvest: Sept. 11

Cab volos: Sept. 23/25

Harvest!

Soreli: Sept. 30/25

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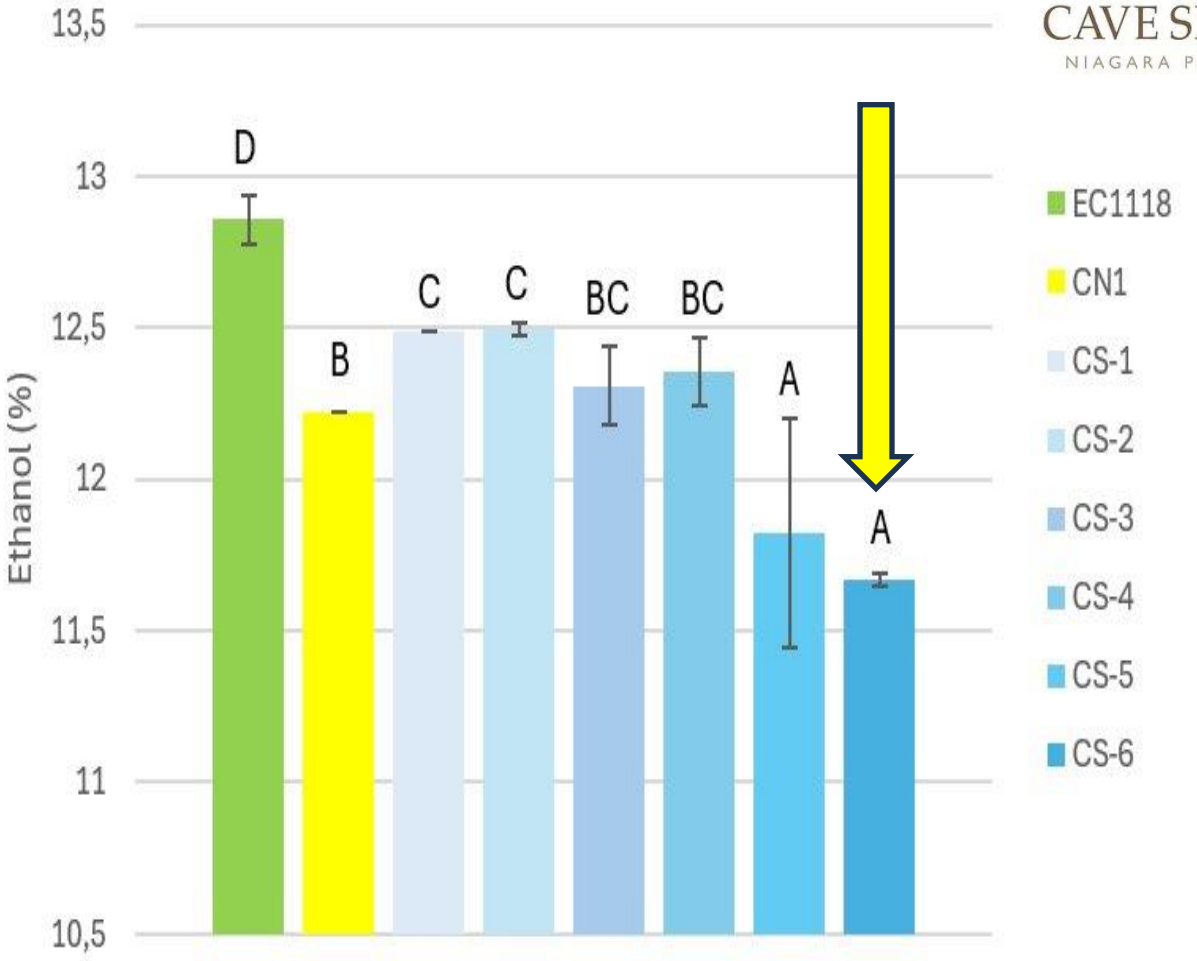
Yeast Selection for Reduced Ethanol: Rationale

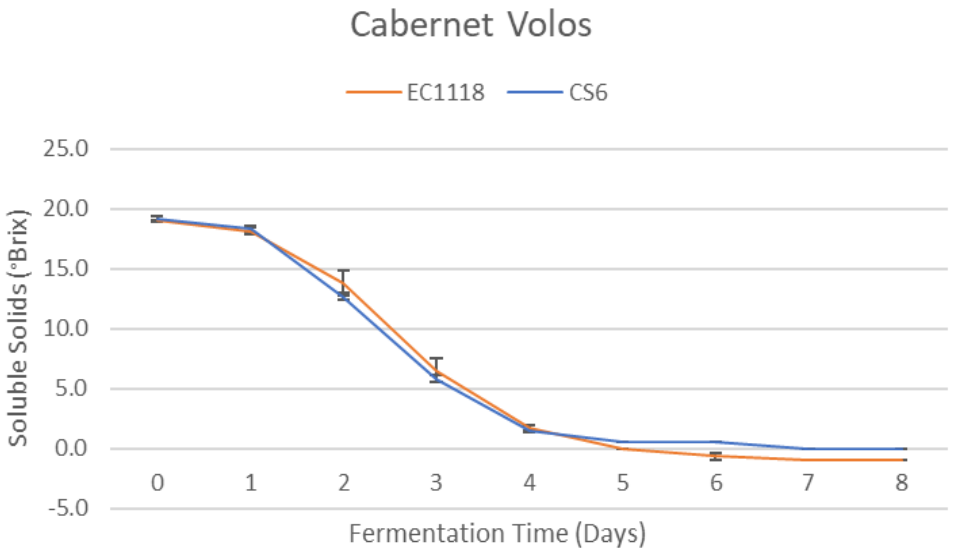
CAVE SPRING
NIAGARA PENINSULA



Data Credit: F. Rivard, MSc Thesis Work

Other *S. uvarum* characteristics: Reduction in acetic acid, acetaldehyde and ethyl acetate, along with increased concentration of glycerol and succinic acid

Cabernet volos (Al Borgo) Fermentations
Thesis Work: Holly Eaton



	EC1118 (Must)	CS6 (Must)	EC1118 (Wine)	CS6 (Wine)
Soluble Solids (Brix)	19.0±0.0	19.0±0.0	-	-
pH	3.06±0.02	3.09±0.01	3.44±0.02	3.40±0.02
TA (g/L)	7.1±0.0	6.8±0.2	7.0±0.1[a]	8.7±0.0[b]
Residual sugar (g/L)	232.64±14.80	241.35±9.65	<LOQ*	<LOQ
YAN (mg/L)	96±4	102±2	26±4	34±4
Acetic acid (g/L)	<LOQ**	<LOQ	0.12±0.01	0.12±0.01
Ethanol (% v/v)	0.02±0.00	0.02±0.00	10.65±0.20[a]	10.10±0.26[b]
Glycerol (g/L)	<LOQ***	<LOQ***	9.09±0.30[a]	14.38±0.56[b]
Succinic acid (g/L)	<LOQ****	<LOQ****	0.13±0.01[a]	0.20±0.03[b]

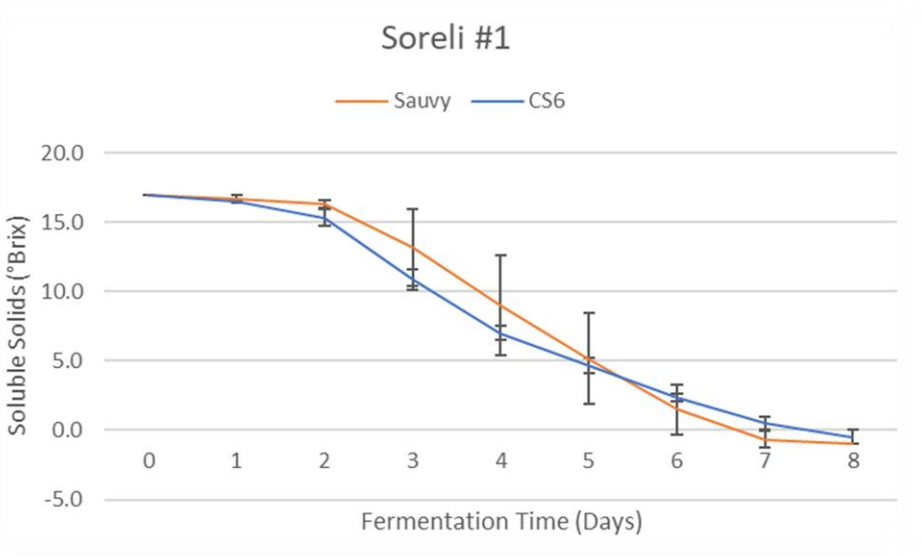
Commercial Strain: *S. cerevisiae* EC1118

Photo credit: Scott Labs

Robust, fast fermenter
Alc. Tolerance: 18%
Nitrogen needs: Low

Photo credit: J. Kelly

Soreli (Al Borgo Site) Fermentations
Thesis Work: Holly Eaton



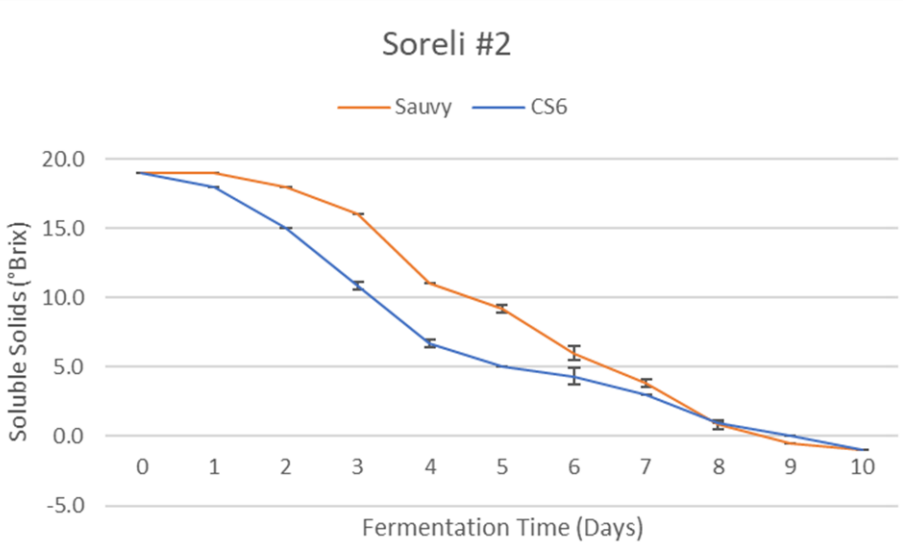
	Sauvy (Must)	CS6 (Must)	Sauvy (Wine)	CS6 (Wine)
Soluble Solids (Brix)	17.0±0.0	17.0±0.0	-	-
pH	3.04±0.02	3.01±0.01	2.95±0.02	2.93±0.00
TA (g/L)	5.9±0.0	5.9±0.0	7.0±0.0[a]	7.8±0.1[b]
Residual sugar (g/L)	215.55±2.44	229.87±13.73	0.25±0.23	<LOQ*
YAN (mg/L)	107±1	105±5	19±3[a]	<LOQ[b]**
Acetic acid (g/L)	<LOQ***	<LOQ	0.17±0.02[a]	0.07±0.05[b]
Ethanol (% v/v)	0.01±0.00	0.01±0.00	10.40±0.07[a]	9.91±0.08[b]
Glycerol (g/L)	0.11±0.00	0.11±0.00	5.68±0.09[a]	9.23±0.72[b]
Succinic acid (g/L)	<LOQ****	<LOQ	0.26±0.00	0.29±0.05

Commercial Strain: *S. cerevisiae* Sauvy

Photo credit: Scott Labs

Helps increase the aromatic expression white wine grapes
Little to no SO_2 production
Alc. Tolerance: 14.5%
Nitrogen needs: Medium

Soreli (Reimer Farms Site) Fermentations from Oct. 15th Harvest Thesis Work: Holly Eaton



	Sauvy (Must)	CS6 (Must)	Sauvy (Wine)	CS6 (Wine)
Soluble Solids (Brix)	19.0±0.0	19.0±0.0	-	-
pH	3.40±0.03	3.42±0.02	3.21±0.01	3.18±0.02
TA (g/L)	4.1±0.0	4.1±0.2	5.2±0.1[a]	5.9±0.1[b]
Residual sugar (g/L)	258.62±30.96	252.42±10.85	0.72±0.29[a]	<LOQ[b*]
YAN (mg/L)	136±0	134±5	<LOQ**	<LOQ
Acetic acid (g/L)	<LOQ***	<LOQ	<LOQ[a]	0.06±0.01[b]
Ethanol (% v/v)	0.01±0.00	0.01±0.00	11.35±0.04[a]	10.95±0.16[b]
Glycerol (g/L)	0.14±0.00	0.14±0.00	8.15±0.29[a]	8.98±0.31[b]
Succinic acid (g/L)	<LOQ****	<LOQ	0.26±0.00	0.25±0.04

Commercial Strain: *S. cerevisiae* Sauvy

Helps increase the aromatic expression white wine grapes
Little to no SO_2 production
Alc. Tolerance: 14.5%
Nitrogen needs: Medium

Photo credit: Scott Labs

Low Alcohol Wines: How do we define them?

VQA WINES OF ONTARIO

Column 1 Label Declarations	Column 2 Viticultural and Oenological Requirements	Column 3 Required Information (Principal display panel)	Column 4 Required Information (Any surface of the container, except the top or bottom)	Column 5 Conditions (including optional Nomenclature)
1. Wine or Table Wine	The wine shall be an alcoholic beverage produced by the complete or partial alcoholic fermentation of fresh grapes, grape juice or grape must and shall not include grape concentrate. The wine shall be produced from one or more grape varieties listed in Appendix B. The grapes used in the manufacture of wine shall be grown within a geographical indication as set out in this Table. The wine shall have an actual alcoholic content not less than 7.0% and not greater than 14.9% by volume.	VQA — Geographical indication — VQA	Vintage year (vintage year optional for table wines labelled exclusively with the Ontario geographical indication) Grape variety or varieties or proprietary name	None

Brock University

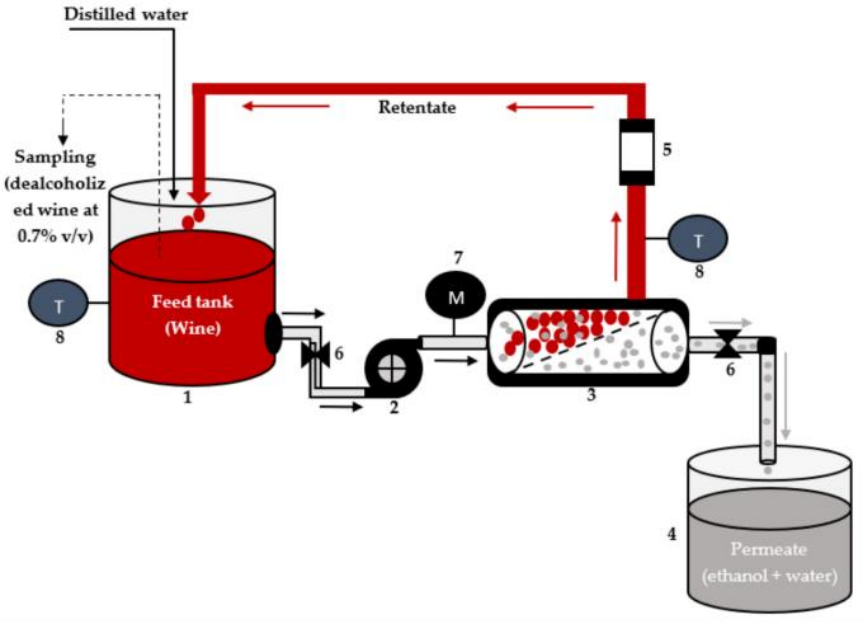
Cool Climate Oenology & Viticulture Institute

What About Post Fermentation?

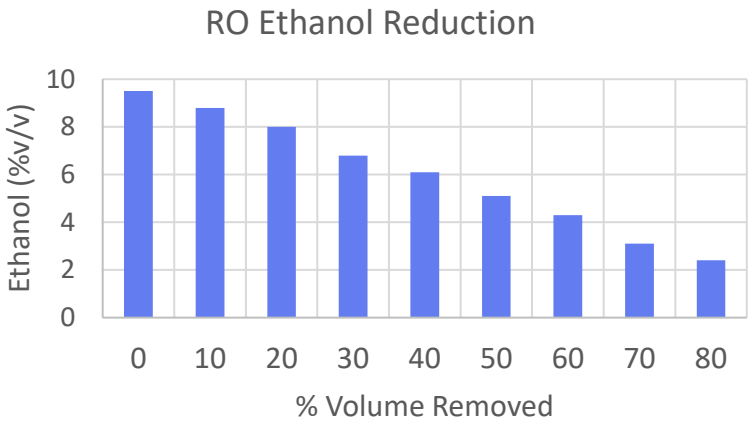
- Easiest option: Blending
- Many different technologies exist for removal of alcohol in wine
- Spinning Cone, vacuum distillation, pervaporation
- Reverse osmosis

Considerations:
Passage of ethanol through a semipermeable porous membrane

- Retention of important aromatic volatiles
- Temperature sensitive
- Volume sensitive
- Membrane pore size matters
- Wine is concentrated, and water taken out is added back in
  - Can impact organoleptic profile



Reverse Osmosis Trial 1



Ethanol concentration (%v/v) measured by GC-FID for each reconstituted sample.

	pH	TA (g/L)	Glucose/ Fructose (g/L)	Glycerol (g/L)	Ethanol (%v/v)
Starting wine	3.48	4.93±0.06	5.49±0.10	5.83±0.13	9.5±0.0
10% Removed	3.43	5.29±0.07	6.26±0.15	6.42±0.20	8.8±0.1
20% Removed	3.44	5.15±0.04	6.08±0.15	5.85±0.08	8.0±0.0
30% Removed	3.42	4.68±0.01	5.79±0.18	5.18±0.01	6.8±0.0
40% Removed	3.42	4.52±0.04	6.16±0.15	5.01±0.13	6.1±0.0
50% Removed	3.40	4.22±0.04	5.81±0.12	4.68±0.04	5.1±0.1
60% Removed	3.38	3.98±0.01	5.81±0.15	4.13±0.09	4.3±0.2
70% Removed	3.33	3.47±0.01	5.36±0.08	3.62±0.03	3.1±0.1
Final product ~80% removed*	3.30	3.17±0.01	5.01±0.12	2.91±0.04	2.4±0.0
Permeate	3.70	2.15±0.01	0.17±0.00	3.36±0.04	8.7±0.0

RO Trial of mixed bulk wine (~800L). Samples were taken after each 10% of the total volume was removed and collected as permeated. The retentate samples were reconstituted back to the initial volume using RO water. Glucose/fructose and glycerol concentrations were measured using enzyme kits. Ethanol was measured by GC-FID.
*RO process was stopped when critical temperature of 25°C was reached and volume was too low to continue. The final volume removed was approximately 75-80%.

Reverse Osmosis Trial 2

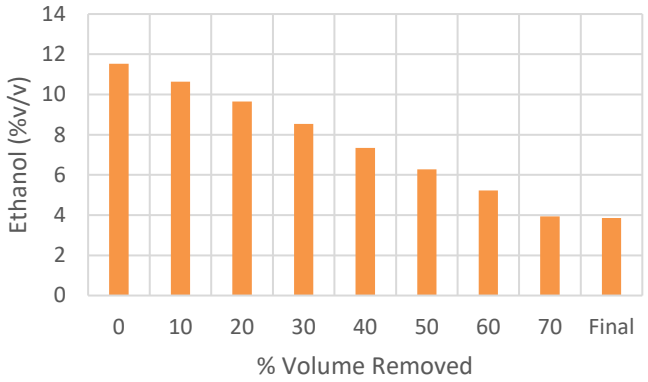


Figure 1. Ethanol concentration (%v/v) measured by GC-FID for each reconstituted sample.

- Membrane size
  - Nanofiltration membrane with 150-300 Da cut-off
  - Many RO membranes have 100 Da cut-off
- Loss of acidity

	pH	TA (g/L)	Glucose/ Fructose (g/L)	Glycerol (g/L)	Ethanol (%v/v)
Starting wine	3.23	7.50±0.03	3.28±0.03	7.35±0.07	11.53±0.03
10% Removed	3.22	7.42±0.02	3.55±0.01	7.20±0.02	10.64±0.01
20% Removed	3.22	7.26±0.01	3.48±0.01	6.74±0.01	9.65±0.00
30% Removed	3.18	6.92±0.06	3.43±0.03	6.28±0.07	8.54±0.01
40% Removed	3.19	6.44±0.03	3.29±0.06	5.83±0.10	7.34±0.04
50% Removed	3.14	5.89±0.05	3.12±0.05	5.19±0.13	6.28±0.04
60% Removed	3.09	5.26±0.00	3.18±0.06	4.93±0.12	5.23±0.01
70% Removed	3.08	4.56±0.01	2.87±0.04	4.15±0.18	3.94±0.01
Final product*	3.13	4.68±0.01	2.75±0.07	4.30±0.02	3.85±0.02
Permeate	3.55	3.06±0.01	0.07±0.00	3.86±0.00	10.76±0.01

Table 3. RO Trial of mixed bulk wine (~1000L). Samples were taken after each 10% of the total volume was removed and collected as permeated. The retentate samples were reconstituted back to the initial volume using RO water. Glucose/fructose and glycerol concentrations were measured using enzyme kits. Ethanol was measured by FOSS.
*RO process was stopped when critical temperature of 25°C was reached and volume was too low to continue.

Commercial Low and Non-Alcoholic Wine

Wine	pH	Titratable Acidity (g/L)	Free SO_2 (mg/L)	Total Sugar (g/L)	Glycerol (g/L)	Alcohol (%) (on bottle)
Nonalcoholic Wines						
Vin (zero) Chardonnay	3.29 ± 0	7.30 ± 0.09	19.9 ± 1.0	41.5 ± 0.1	6.23 ± 0.03	<0.5
Carl Jung White	3.25 ± 0	6.47 ± 0.05	15.5 ± 0.5	49.0 ± 0.4	5.68 ± 0.01	<0.5
St.Regis Chardonnay	3.26 ± 0	7.20 ± 0.11	46.4 ± 1.4	41.9 ± 0.1	4.94 ± 0.01	<0.5
Eins Zwet Riesling	2.92 ± 0	9.36 ± 0.1	28.6 ± 1.7	37.2 ± 0.2	7.95 ± 0.14	<0.5
Eins Zwet Chardonnay	3.13 ± 0	7.90 ± 0.11	36.4 ± 0.8	41.4 ± 0.3	6.63 ± 0.15	<0.5
Eins Zwet Rosé	3.27 ± 0	9.71 ± 0.02	35.8 ± 0.3	39.2 ± 0.2	6.98 ± 0.17	<0.5
Vin (zero) Cab. Sauv.	3.45 ± 0	5.41 ± 0.01	39.5 ± 0.9	49.8 ± 0.3	7.83 ± 0.11	<0.5
Carl Jung Red	3.57 ± 0	5.66 ± 0.02	39.4 ± 2.3	48.6 ± 0.7	8.83 ± 0.15	<0.5
Eins Zwet Pinot Noir	3.44 ± 0	5.91 ± 0.07	48.7 ± 0.1	38.2 ± 0.1	8.18 ± 0.1	<0.5
Reduced Alcohol Wines						
Casillero Sauvignon Blanc	3.13 ± 0	8.24 ± 0.02	16.6 ± 0.7	4.7 ± 0.1	6.09 ± 0.02	8.5
Peller Estates Pinot Grigio Light	3.37 ± 0	7.26 ± 0.14	17.0 ± 0	22.4 ± 0.1	5.22 ± 0.05	8
Stoneleigh Light Rose	3.13 ± 0	8.44 ± 0.4	9.0 ± 0.8	26.6 ± 0.2	4.79 ± 0.02	9
Peller Estates Cab. Sauv. Light	3.38 ± 0	5.44 ± 0.05	23.9 ± 0.6	4.6 ± 0.2	6.2 ± 0.05	8

Samples were taken from bottles of commercially available low and non-alcoholic wines. Basic wet chemistry protocols were followed for measuring pH, TA and free SO_2. Enzyme kits were used to measure total sugar and glycerol.

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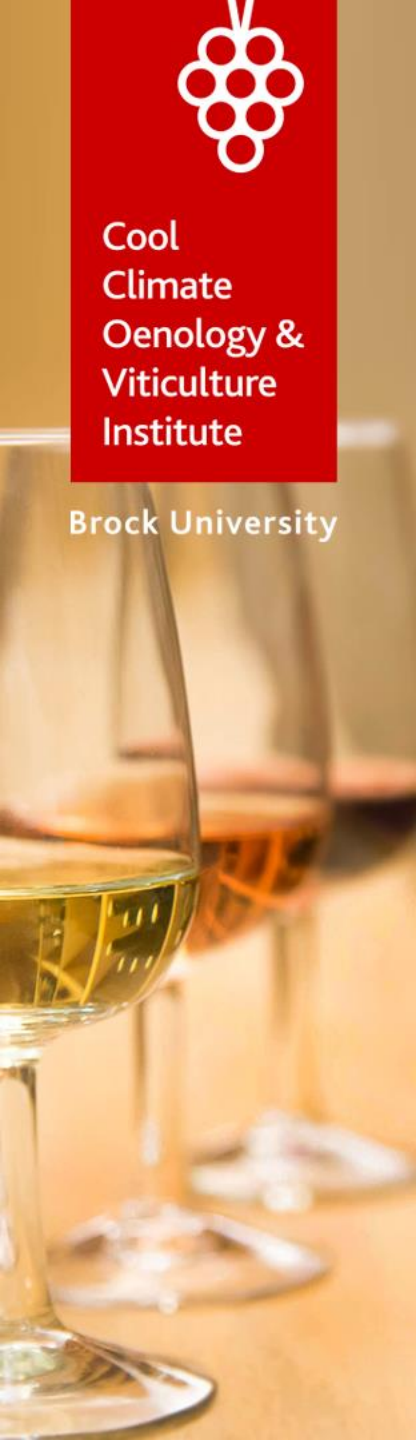


What's Next?

- **Sensory analysis**
  - Reducing alcohol in wines by small increments to better understand the optimal removal target
  - Better understanding of the FRGs through preliminary sensory analysis of the wines
- **Continued monitoring of grapes**
  - Cold hardiness
  - Preharvest monitoring
  - Whole genome sequencing
- **Additional fermentations**
  - 2026 ferments
  - 2027 scaled up (partnership with Niagara College)

ORF-RE: Enhancing Resilience

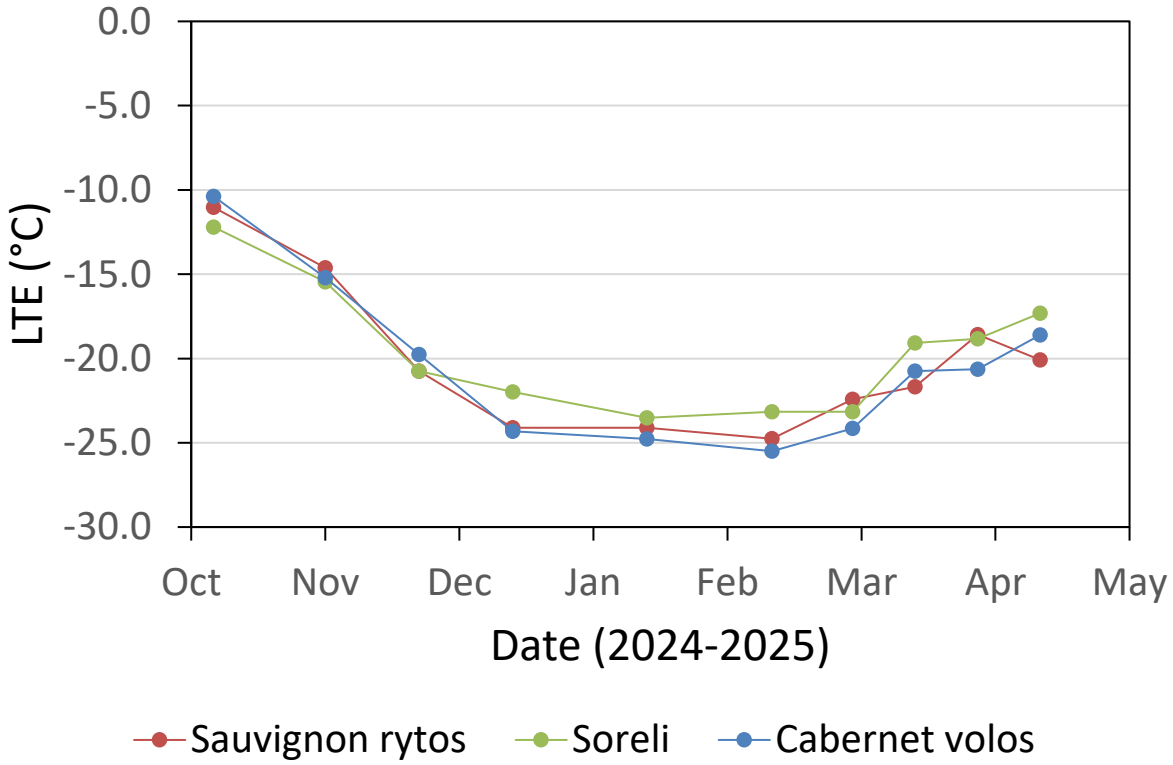
Ontario Research Fund

Superior Performing Grapevine Program

Enhance Resilience

- The Willwerth lab previously demonstrated that grapevine cultivar, clone, and rootstock can impact cold tolerance as well as yield and fruit quality
- We plan to continue clone and rootstock evaluations as well as testing new disease tolerant cultivars from European breeding efforts (i.e., Regent, Soleri, Cabernet Volos, Merlot Kanthus)
- We will examine vine performance and cold tolerance for these selections to determine best in class clones x rootstocks and new cultivars for ON

Cold Hardiness Data: Willwerth Lab Boris and Alex



In the 2024-2025 dormant season (Figure 2), Soreli demonstrated better early-acclimation hardiness but was less-hardy than Sauvignon rytos mid-winter. Cabernet volos exhibited the greatest cold tolerance at -24.9°C. The FRG cultivars exhibited varied responses to early-spring warming temperatures in March 2025. While both Soreli and Cabernet volos steadily lost cold hardiness in deacclimation, Sauvignon rytos appeared to reacclimate from an LTE of -18.6°C to -20.1°C mid-April. Still, all cultivars exhibited strong freeze tolerance (below -17°C) at the end of the DTA sampling window, providing ample protection from early spring frosts.

Thank you!

- **Industry Partners**
  - Al Borgo Estates
    - Alessandro Spassiani
    - Mauro Salvador
  - Reimer Vineyards
    - Art Reimer
  - Ridgepoint Vineyards
    - Mauro Scarsellone
  - Cave Spring Vineyards
    - Gabe DeMarco
- **Funding Partners**
  - ORF-RE
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  - Holly Eaton
  - Fred Rivard

- **Undergraduate Students**
  - Boris Mihajlovic
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  - Dr. Jim Willwerth
- **CCOVI Partners**
  - Shufen Xu
  - Lisa Dowling
  - Alex Gunn
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  - Reid Ball
  - Fei Yang
  - Harman Singh
  - Anuhya Madathil
  - Nick Mackie
  - Kevin D'Innocenzo