Wine flavour modification through non-traditional yeasts, oenological treatments and taint remediation

CGCN Research update

May 28, 2026

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CCOVI, Brock University

Three parts to the Wine Flavour Modification project

- **Part 1: Mitigating the impact of Grape rots on wine using locally isolated yeast**
- **Part 2: Using Microbial Terroir to enhance flavour**
- **Part 3: Enhancing Volatile Thiols in Vidal table wine through fermentation temperature, yeast additive and yeast strain**

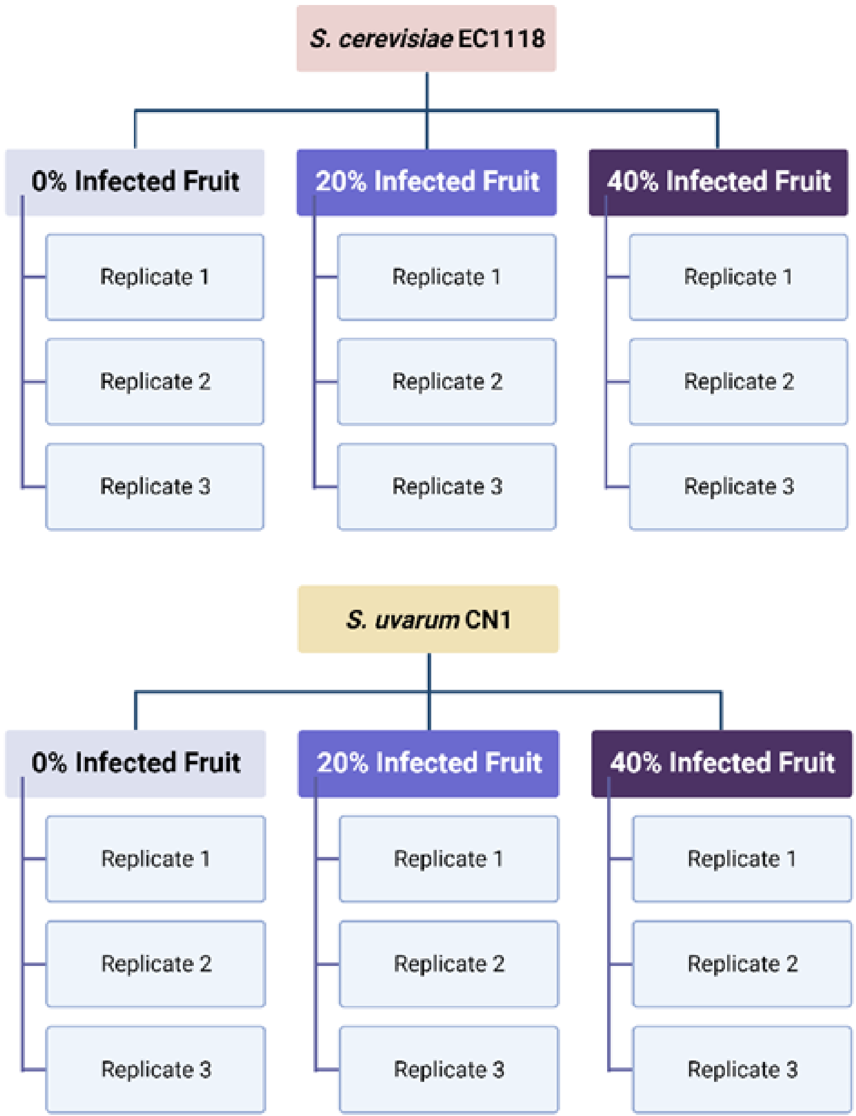
Part 1: Mitigating the impact of Grape rots on wine using locally isolated yeast

Sour Rot

- *Botrytis* or sour rot infected fruit: high acetic acid, ethyl acetate, ethanol, acetaldehyde, glycerol, galacturonic acid, and gluconic acid that carry though to wine
- **Fruit is rejected at wineries with 0.2-0.24 g/L acetic acid**
- locally isolated *S. uvarum* CN1 produced appassimento red wines with significantly lower acetic acid, ethyl acetate, consumed acetic acid and enhanced the wine aroma profile
- Can CN1 help white wines made from sour rot fruit?

Botrytis

Experimental Design – test CN1
Sour Rot/Botrytis inclusion in Riesling



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Juice Parameters of Riesling Juice 2024, approx. 18°Brix, with added sour rot fruit (CCOVI Technologist Fei Yang)

Table 1: Chemical components in Riesling juice with increasing rot levels.

Metabolite	Control (0 g/L acetic acid)		Rot (0.2 g/L acetic acid)		Rot (0.4 g/L acetic acid)	
	EC1118	CN1	EC1118	CN1	EC1118	CN1
Soluble Solids (Brix)	18.1±0.1 c	18.1±0.1 c	18.3±0.1 b	18.4±0.1 b	18.6±0.1 a	18.6±0.1 a
pH	3.18±0.03	3.18±0.02	3.18±0.03	3.20±0.03	3.18±0.04	3.25±0.04
Titratable Acidity (g/L)	6.3±0.0 c	6.3±0.0 c	6.8±0.0 b	6.8±0.0 b	7.3±0.1 a	7.3±0.1 a
Acetic Acid (g/L)	**0.04 ±0 c**	**0.04±0 c**	**0.21±0 b**	**0.21±0 b**	**0.43±0.01 a**	**0.43±0 a**
Glycerol (g/L)	0.3±0 c	0.3±0 c	0.7±0 b	0.7±0 b	1.1±0 a	1.1±0 a
Acetaldehyde (mg/L)	6.9±0.2 cd	5.4±0.5 d	8.1±0.3 bc	7.3±1.1 bc	9.0±0.9ab	10.0±0.3 a
Ethanol (%v/v)	0.05±0 c	0.03±.01 d	0.08±0 b	0.06±0.01 c	0.10±0.01 a	0.10±0 a

Fermentation Kinetics of sour rot infected fruit (Riesling) (CCOVI Technologist Fei Yang)

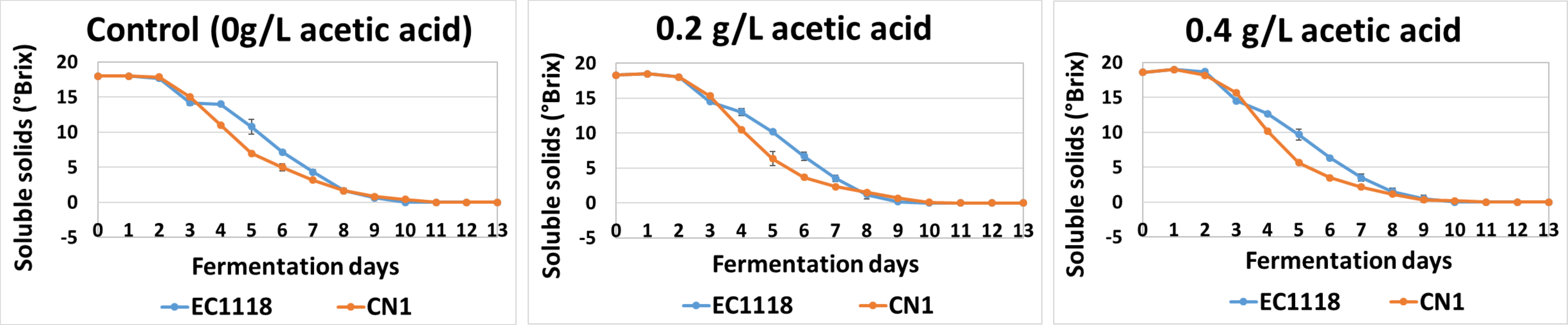
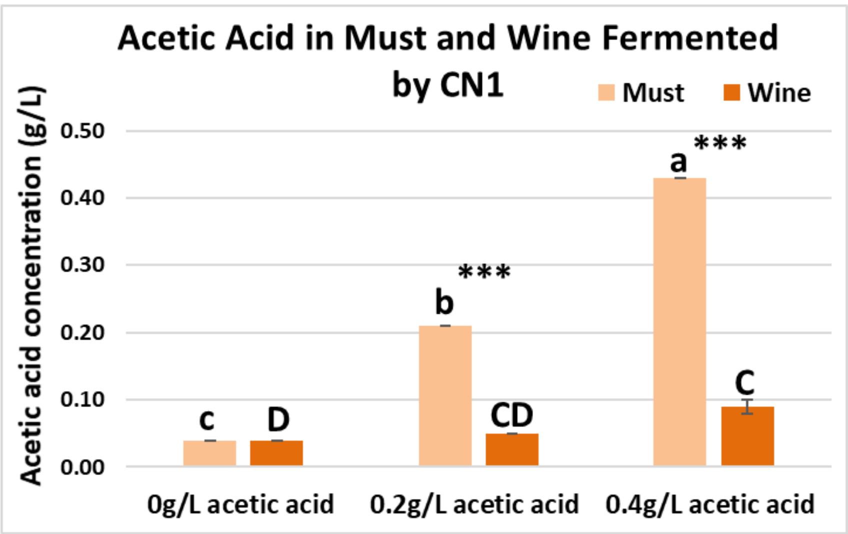


Figure 1: Soluble solid levels monitored during fermentation of Riesling must with various rot levels inoculated by *S. cerevisiae* EC1118 and *S. uvarum* CN1.

- CN1 exhibited a higher sugar consumption rate than EC1118 during the mid-stage of fermentation across all rot levels
- CN1 required an additional day to complete fermentation (13 days) compared to EC1118 (12 days).

Acetic Acid Production & Consumption (CCOVI Technologist Fei Yang)

CN1



EC1118

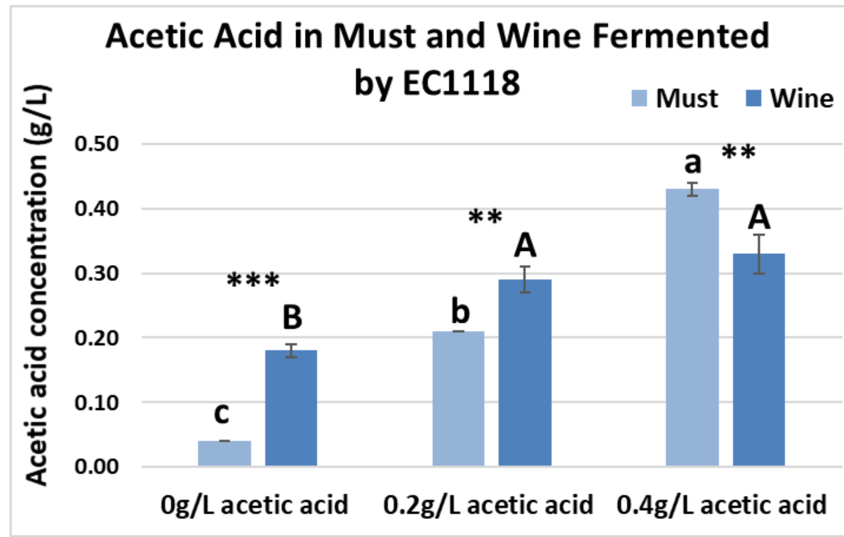
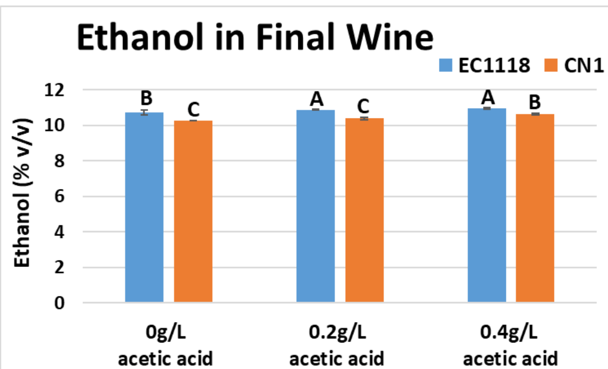


Figure 2: Acetic acid concentration in initial Riesling must and finished wines from juice with increasing rot levels, vinified using EC1118 or CN1.

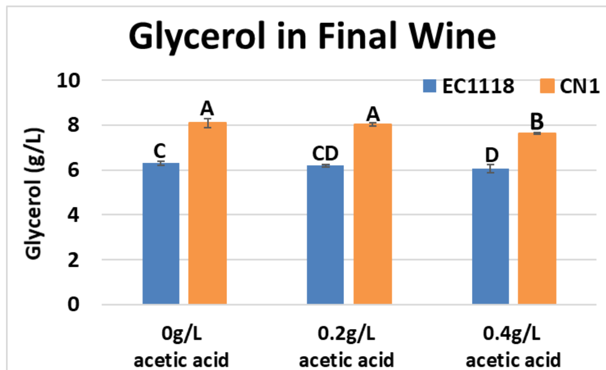
S. uvarum CN1 consumes acetic acid, reducing the value from the starting juice by up to 80%. *S. uvarum* does not add acetic acid to the wine whereas EC1118 did add acetic acid at the cut off level of sour rot for commercial wineries.

Ethanol, glycerol and acetaldehyde in finished Riesling wine (CCOVI Technologist Fei Yang)

Ethanol



Glycerol



Acetaldehyde

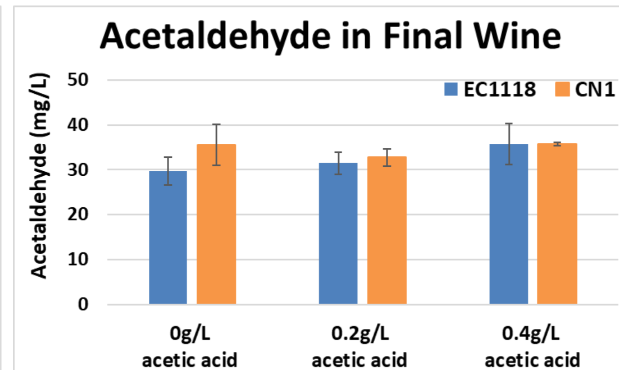


Figure 3: Ethanol, glycerol, and acetaldehyde concentration in finished wines made from juice with increasing rot levels, vinified using EC1118 or CN1.

CN1 produced up to 0.5% less ethanol compared to EC1118, 2 g/L more glycerol and no significant difference in acetaldehyde

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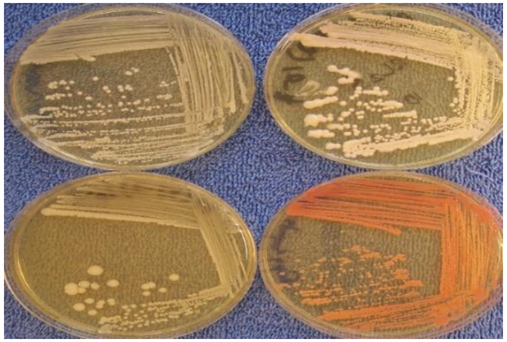
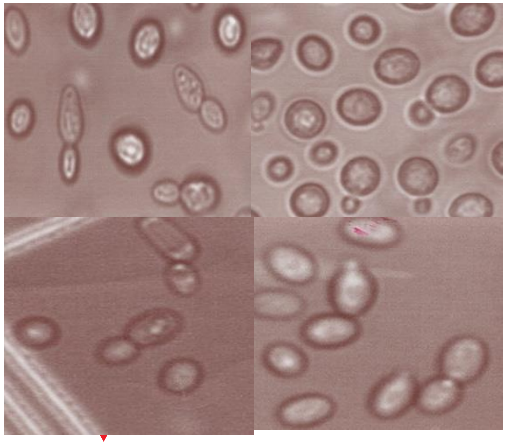
Part 2: Using Microbial Terroir to enhance flavour

- **Growing interest worldwide, including Canada, to further differentiate wines by expressing a region's microbial terroir**
  - Use the natural yeast on the fruit to ferment wine
  - Add complexity to wine due to contributions of many yeast species
  - Hall et al, 2011; Jolly et al, 2014; Scholl et al, 2016; Morgan et al, 2019; Kelly et al, 2020; McCarthy et al, 2021; Bunbury-Blanchette et al, 2022
- **Risks: inconsistency, off flavours, oxidation faults**
- **What if we isolated local yeast that can complete the fermentation and tested them**





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Testing 7 locally <u>isolated</u> *S. uvarum* in Chardonnay fermentations

- Chardonnay Fermentations with 6 different *S. uvarum* strains isolated from a local winery plus previously isolated *S. uvarum* CN1 from Icewine grapes
- Fermentations performed at the CCOVI research winery (30L)
- Fermentations compared to *S.cerevisiae* EC1118 control

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Chardonnay Juice Chemistry, Fall 2024 (MSc Student Frederik Rivard)

ºBrix	21.1
Starting sugar (g/L)	225
pH	3.65
TA g/L (tartaric acid)	6.23
Ammonia nitrogen (mg/L)	24
Amino Acid Nitrogen (mg/L)	102
Total YAN (mg/L)	126

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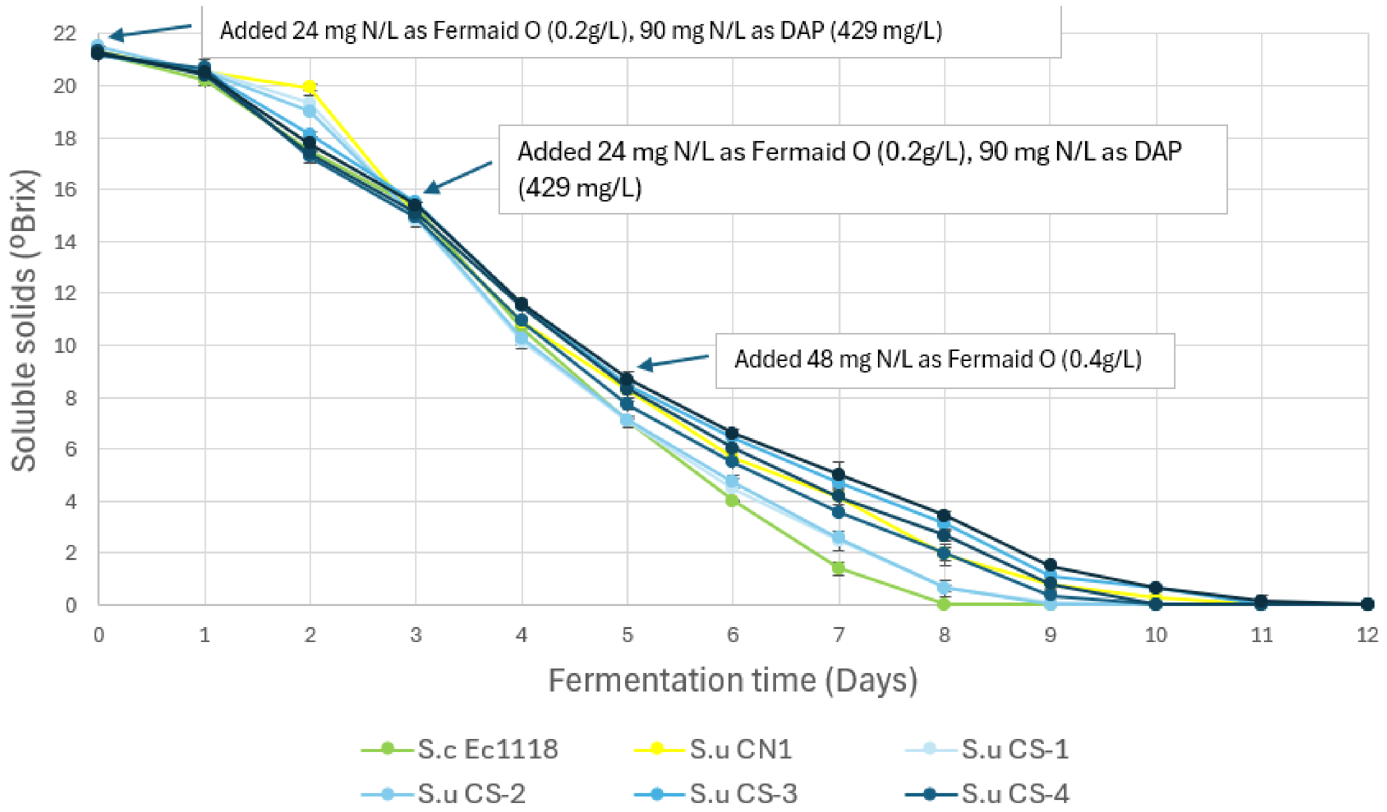
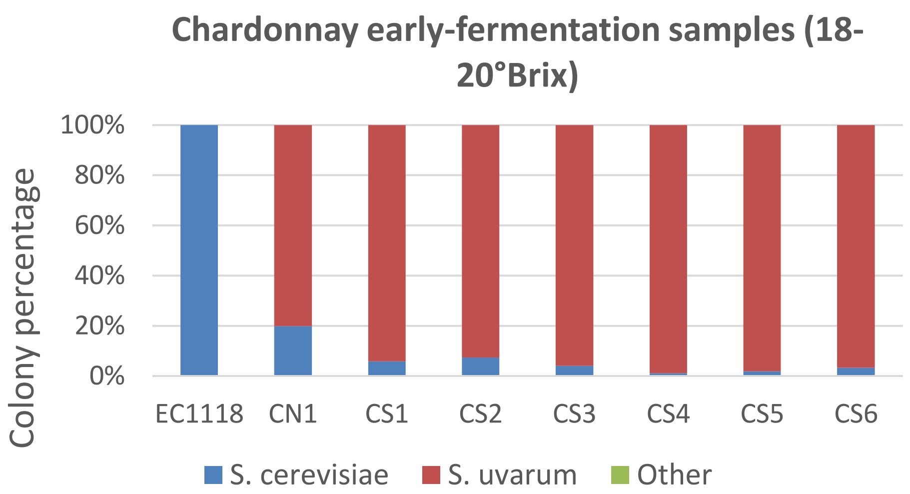
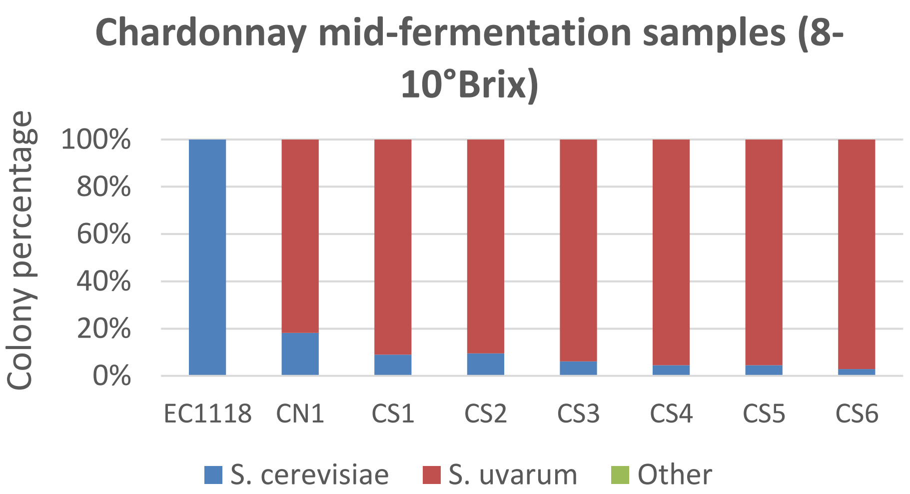
Chardonnay Fermentations, 2024 (MSc Student Frederik Rivard)

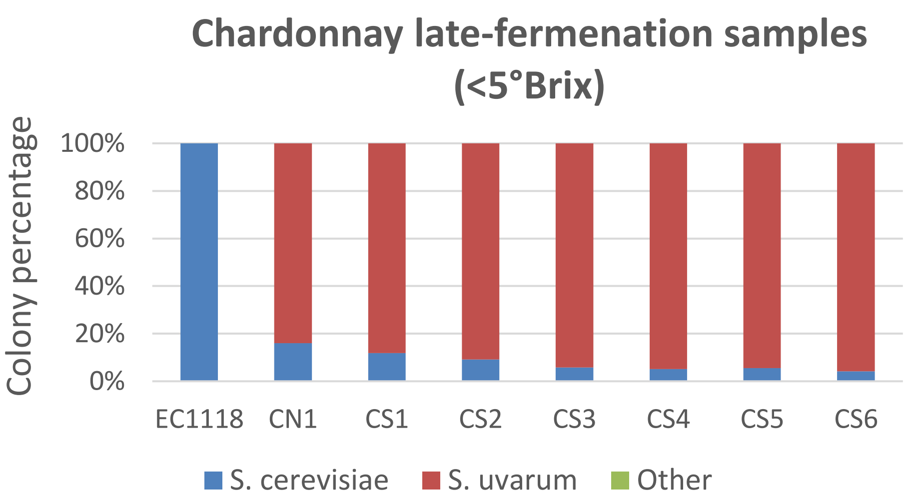


- All yeasts can ferment to dryness without any problem (no stuck fermentations)
- *S. uvarum* strains take 1-3 more days to complete fermentation.

Yeast Implantation of *S. uvarum* strains







- All test strains implanted into the fermentation successfully

Wine chemistry of 2024 Chardonnay (MSc student Frederik Rivard)

Strain	Ec1118	CN1	CS-1	CS-2	CS-3	CS-4	CS-5	CS-6
Brix	<0 ± 0,0	<0 ± 0,0	<0 ± 0,0	<0 ± 0,0	<0 ± 0,0	<0 ± 0,0	<0 ± 0,0	<0 ± 0,0
pH	3,61 ± 0,02 AB	3,62 ± 0,02 BC	3,60 ± 0,02 AB	3,59 ± 0,01 A	3,64 ± 0,01 C	3,61 ± 0,01 AB	3,61 ± 0,02 BC	3,61 ± 0,01 AB
TA	6,42 ± 0,15 A	6,33 ± 0,26 A	6,38 ± 0,07 A	6,53 ± 0,04 A	6,47 ± 0,14 A	6,54 ± 0,08 A	7,01 ± 0,09 B	7,19 ± 0,22 B
Ethanol	12,9 ± 0,08 D	12,2 ± 0,04 B	12,5 ± 0,01 C	12,5 ± 0,02 C	12,3 ± 0,13 BC	12,4 ± 0,11 BC	11,8 ± 0,38 A	11,7 ± 0,02 A
Residual sugar	0,15 ± 0,006 B	7,6 ± 1,97 A	0,167 ± 0,21 B	0,16 ± 0,11 B	1,17 ± 0,20 B	0,04 ± 0,004 B	0,11 ± 0,006 B	0,35 ± 0,256 B
Acetic Acid	0,034 ± 0,004 D	0,02 ± 0,005 BC	0,02 ± 0,002 C	0,01 ± 0,003 AB	0,01 ± 0,002 A	0,01 ± 0,001 A	0,01 ± 0,0006 A	0,01 ± 0,005 A
Gluconic Acid	0,25 ± 0,002 A	0,25 ± 0,004 A	0,26 ± 0,007 A	0,25 ± 0,002 A	0,26 ± 0,01 A	0,25 ± 0,004 A	0,26 ± 0,00[illegible] A	0,25 ± 0,001 A
Glycerol	6,86 ± 0,24 A	9,22 ± 1,02 B	11,12 ± 0,60 DE	9,62 ± 0,74 C	11,04 ± 1,09 DE	10,18 ± 0,38 CD	11,86 ± 0,56 E	11,75 ± 0,70 E
Amonia	0,52 ± 0,16	0 ± 0,00	0,085 ± 0,11	0,51 ± 0,30	0,29 ± 0,45	0,29 ± 0,27	0,25 ± 0,16	0,19 ± 0,24
PAN	36,80 ± 1,12	12,82 ± 3,06	17,74 ± 1,05	17,70 ± 1,74	20,41 ± 0,74	15,80 ± 1,30	12,24 ± 1,46	12,57 ± 1,48
YAN	37,82 ± 1,12	12,82 ± 3,06	17,83 ± 1,05	18,21 ± 1,74	20,70 ± 0,74	16,10 ± 1,30	12,49 ± 1,46	12,76 ± 1,48
Succinic Acid	0,43 ± 0,004 F	1,00 ± 0,071 E	1,14 ± 0,084 D	1,24 ± 0,025 C	1,27 ± 0,064 C	1,33 ± 0,066 B	1,52 ± 0,004 A	1,47 ± 0,028 A
Acetaldehyde	0,02 ± 0,0009 BCD	0,02 ± 0,0009 D	0,02 ± 0,0011 CD	0,02 ± 0,0009 CD	0,04 ± 0,0014 A	0,03 ± 0,0018 BC	0,03 ± 0,0018 B	0,04 ± 0,0054 A

CS-5 and CS-6 make lower ethanol, higher glycerol and higher succinic acid compared to EC1118 and other S. uvarum strains

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Bench Trial of Wine Aromas and Flavours (MSc Student Frederik Rivard)

Strains	Odour/flavour profile
EC1118	Apple, Pear, Pineapple
CN1	Pineapple, Rose, Floral
CS-1	Banana, Pear, Floral
CS-2	Fruity, Floral, Sweat, Honey
CS-3	Rose, Grapes, Banana, Fruity
CS-4	Rose, Apple, Grapes, Banana, Sweet
CS-5	Pineapple, Banana, Pear, Rose, Strawberry like
CS-6	Sweet fruity, Pear, Banana, Apple

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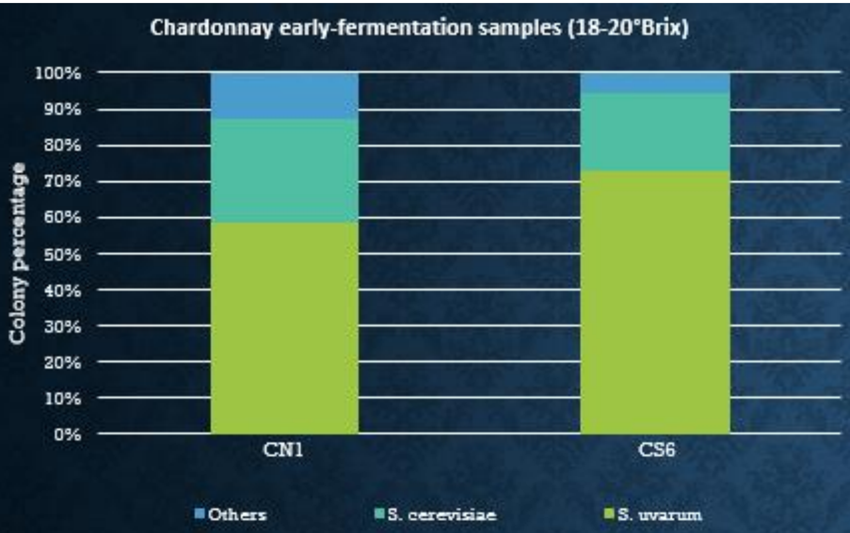
Next step: Commercial Chardonnay fermentations – 2025 (MSc Student Frederik Rivard)

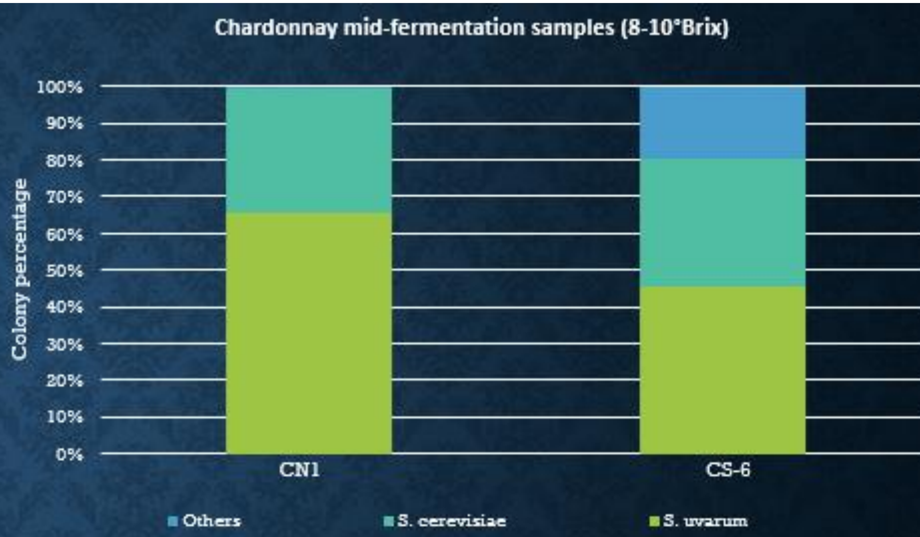
- **CN1 and CS-6 selected to trial in commercial chardonnay fermentations at the winery in 2025**

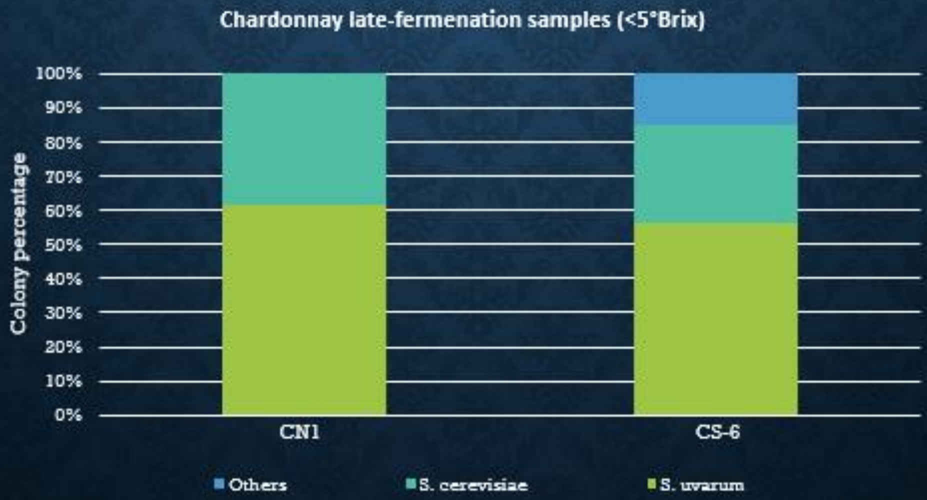
Chardonnay juice chemistry October 2025

Measurement	Value
Brix	21°Brix
Starting sugar	197.3 g/L
pH	3.8
Titratable Acidity	5.07 g/L tartaric acid
Ammonia Nitrogen	71 mg N/L
Amino Acid Nitrogen	120 mg N/L
Total YAN	191 mg N/L

Inoculated yeast dominated the fermentations, but background of other yeasts also contributed to fermentations







- CN1 and CS6 strains dominate every stage of the fermentation.
- Compared to first year fermentation the concentration of *S. cerevisiae* and other yeasts is higher.

Wine Chemistry Summary
Comparable results between yeast strains

Strain	CN1	CS-6
Brix	<0 ± 0.0	<0 ± 0.0
pH	3.8 ± 0.01	3.8 ± 0.01
TA	7.19 ± 0.2	7.6 ± 0.3
Ethanol	12.77 ± 0.1	12.75 ± 0.1
Residual sugar	0.99 ± 0.53	0.28 ± 0.16
Acetic Acid	0.14 ± 0.009	0.16 ± 0.026
Glycerol	5.92 ± 0.41	6.53 ± 0.16

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Part 3: Enhancing Volatile Thiols in Vidal table wine through fermentation temperature, yeast additive and yeast strain

- Vidal accounts for approx. 25% of grape tonnage in Ontario
- Project brought to us by industry to see if we could increase quality of Vidal table wine within the context of decreasing Icewine market
- In the past, I noted a few select commercial Vidal table wines had notes of Sauvignon blanc

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Volatile Thiols, Signature compounds of Sauvignon blanc

Volatile Thiol Name	Short Form	Sensory Descriptors
4-methyl-4-mercaptopentan-2-one	4MMP	Box tree, broom, black currant bud, cat urine
4-mercapto-4-methylpentan-2-ol	4MMPOH	Citrus zest
3-Mercaptohexan-1-ol	3MH	Grapefruit, passionfruit, vegetable, dry
3-mercaptohexylacetate (3MHA)	3MHA	Box tree, broom, grapefruit, passionfruit, anise, gooseberry

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Method development for measuring 3MH and 3MHA

Jennifer Kelly, Shufen Xu, Dave Bowman, Reid Ball

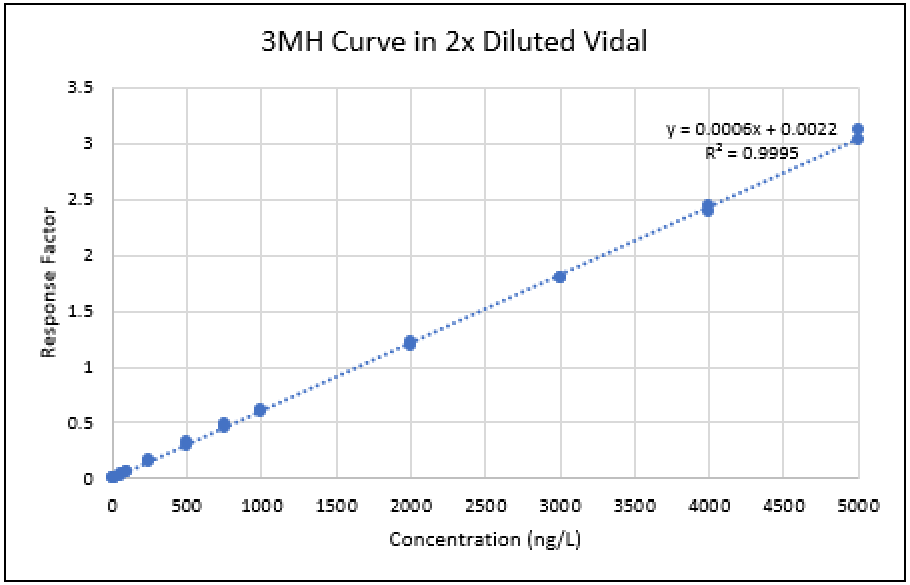

Figure: 3MH standard curve prepared in duplicate in 2x diluted Vidal for LC-MS/MS analysis.

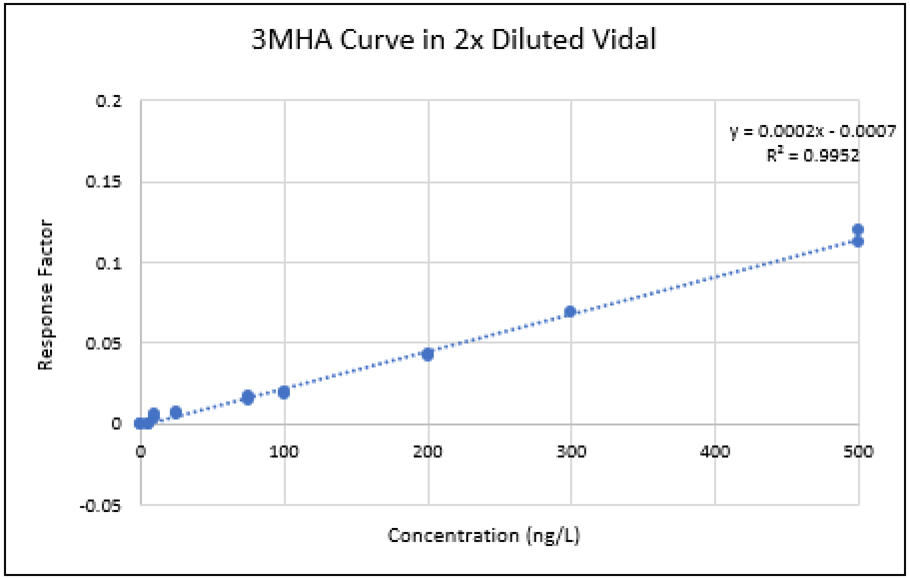

Figure. 3MHA standard curve prepared in duplicate in 2x diluted Vidal for LC-MS/MS analysis.

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Testing higher fermentation temperatures and use of Stimula additive 2024 fermentations (MSC student Reid Ball)

Year 1 – Treatments

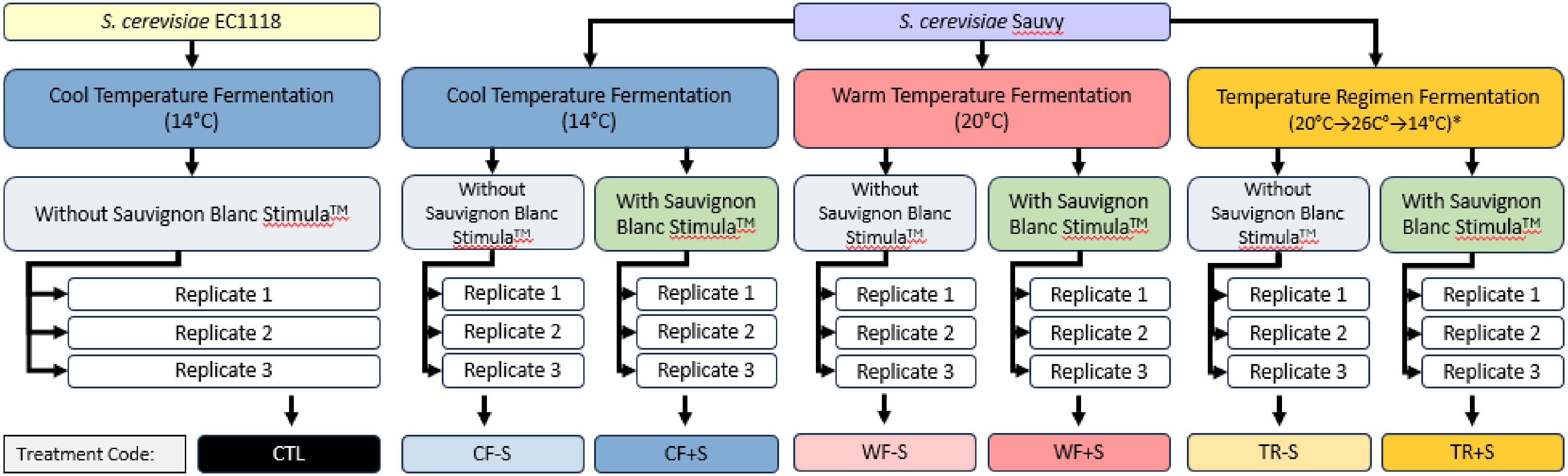

Figure 4. Visual representation of the differences between the 7 treatment groups used to investigate the effects of temperature, yeast, and micronutrients. *Starts at 20°C until Brix has dropped 2°Bx, increased to 26°C for a 10°Bx drop, then set to 14°C for remainder of fermentation.

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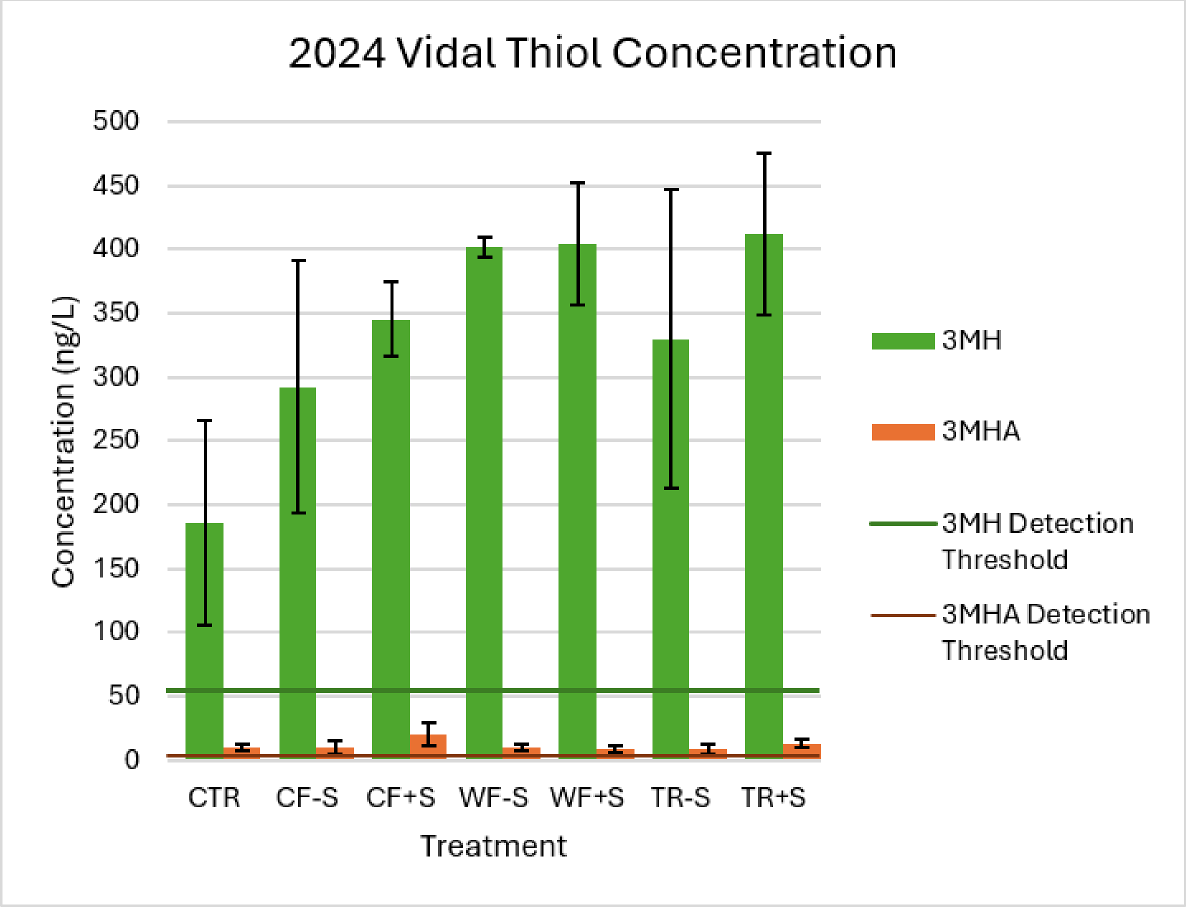
Volatile thiols are detected in Vidal above sensory detection threshold (MSc student Reid Ball)



- Treatment at the higher fermentation spike of 26C with Stimula additive resulted in highest volatile thiols

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Yeast strain comparison at the higher temperature regime with Stimula 2025 fermentations

Year 2 – Treatments

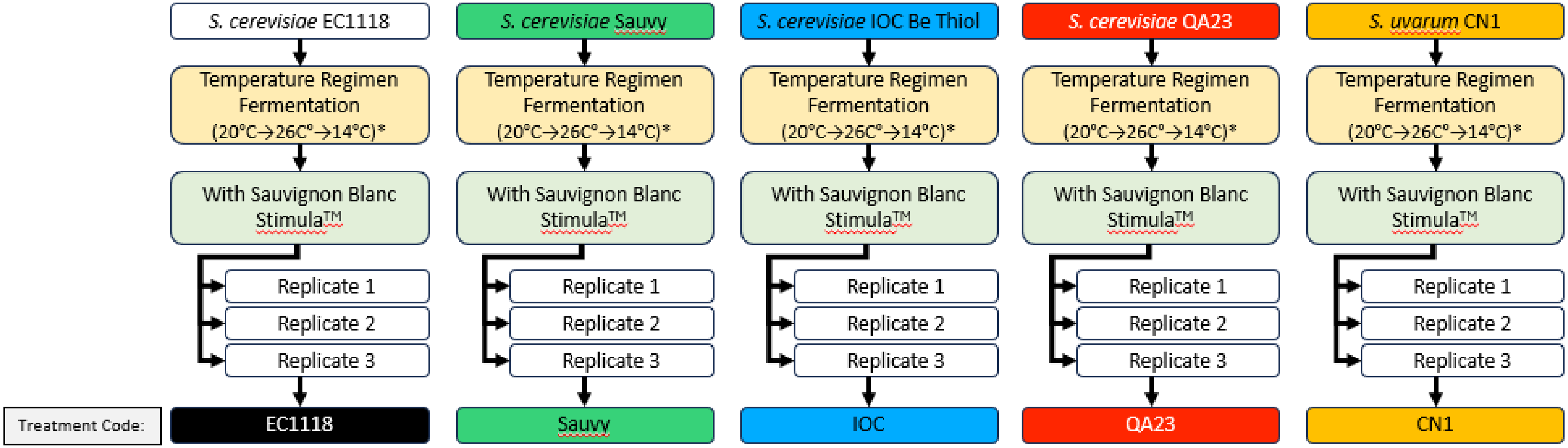

Figure 12. Visual representation of the differences between the 5 treatment groups used to investigate the effects of yeast strain. *Starts at 20°C until Brix has dropped 2°Bx, increased to 26°C for a 10°Bx drop, then set to 14°C for remainder of fermentation.

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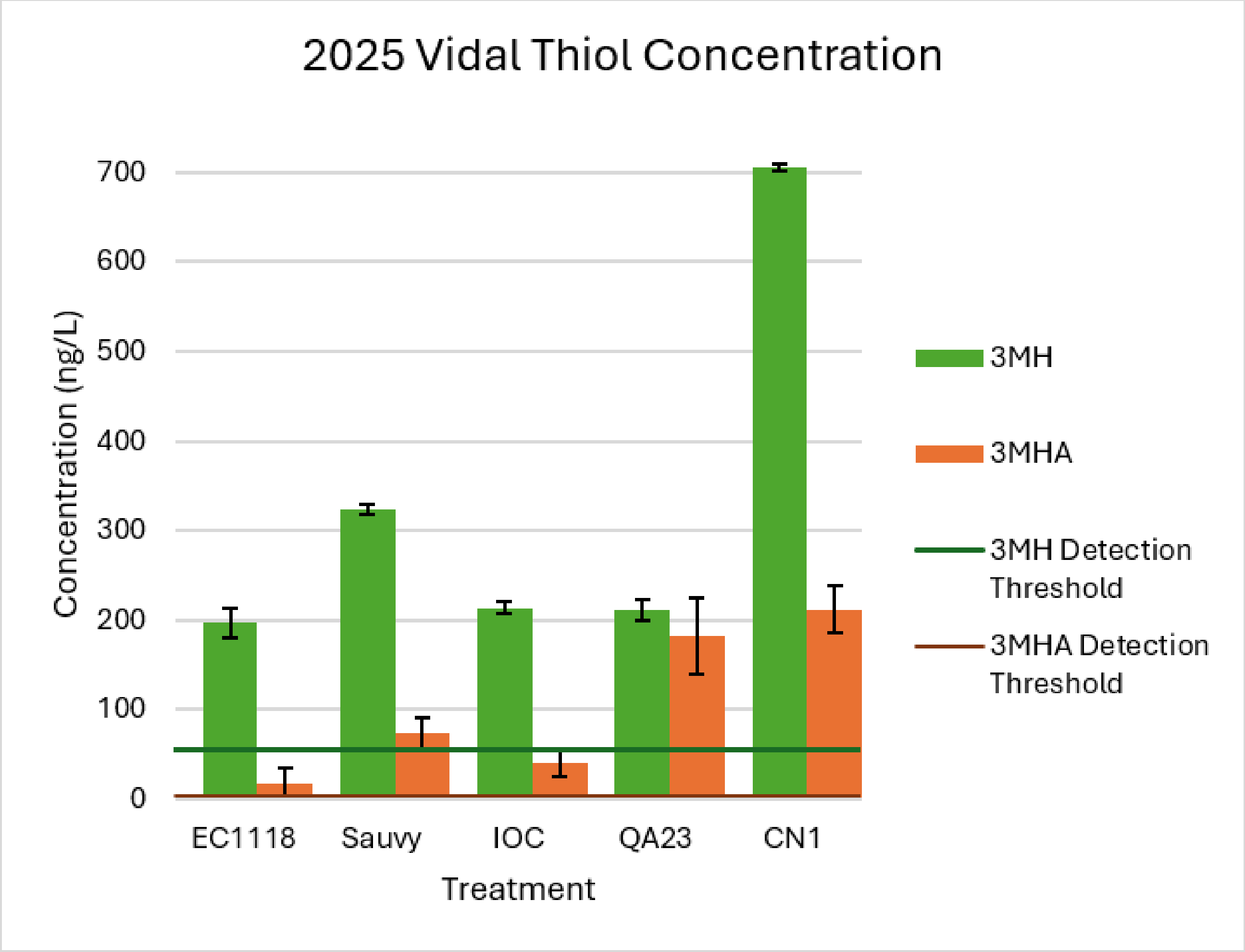
Yeast strain does impact Volatile Thiols production (MSc Student Reid Ball)



CN1 produced the highest concentration of 3MH and 3MHA

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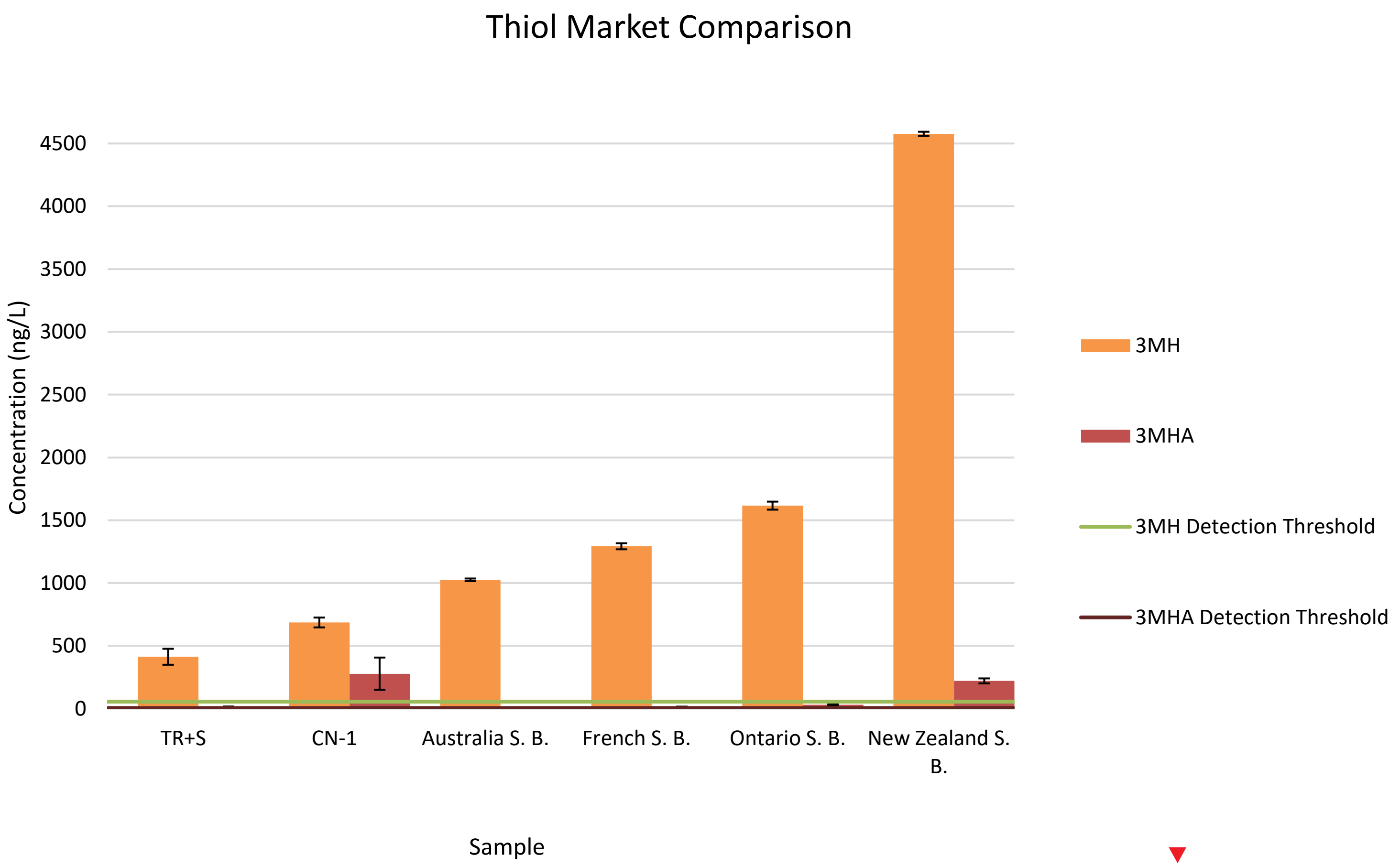
Thiol Comparison among commercial wines
(MSc student Reid Ball)



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Other trials with CN1

- Method has been developed at Escarpment Labs (Guelph) to grow up *S. uvarum* yeast in a paste format for larger commercial fermentations
- CN1 has been trialed at a second local winery for addition midway through spontaneous fermentations to avoid issues of stuck fermentation and high VA wines – it worked!
- CN1 has also been tested with mead production from honey with positive rose aromatics

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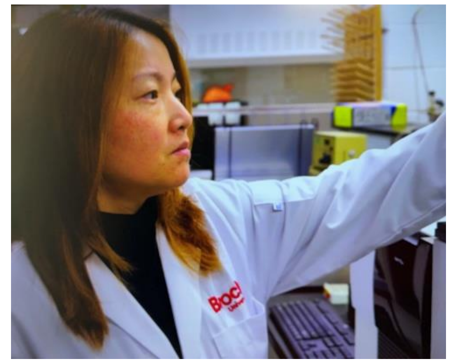
Summary

- *S. uvarum* strains may be beneficial to enhance the aromatic profile of wines produced from sound fruit, providing a unique identity to the wine for market differentiation
- *S. uvarum* CN1 continues to show application for use in botrytis/sour rot infected fruit by reducing acetic acid in wines while enhancing the volatile aroma profile of the wines
- *S. uvarum* may prove useful in reducing alcohol from 0.5-1% v/v in wine by diverting sugar to compounds other than ethanol
- Volatile thiols are present in Vidal and can be enhanced by temperature, additives and yeast strain choice

Future Research

- Commercial fermentations with *S. uvarum* strains for Riesling
- Sensory analysis of the wines

Thank you!



- Dr. Jennifer Kelly
- Tech Support: Fei Yang, Shufen Xu, Dave Bowman, Lisa Dowling
- Frederik Rivard, Reid Ball - MSc students
- Industry Partners: Seeger Vineyards, Cave Spring Vineyards, Escarpment Labs

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