Cool Climate Oenology & Viticulture Institute

Brock University

Press fractions, timing of bentonite addition on Ontario sparkling wine quality and gushing.

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Background to studies

Applied scientific research studies that benefit Ontario sparkling winemakers

- ➢ What is applied research?
- ✓ **It is a discipline of science that uses existing scientific knowledge to devise solutions to specific problems.**
- ✓ **Applied scientific research is valuable and essential in our competitive global wine environment.**
- Dedicated CCOVI research trials specific to Ontario sparkling wines
- Requested by Ontario sparkling winemakers
- Fizz Club: 38 sparkling wine producers attended in 2014 (increase in 2015)

Sparkling wine trials

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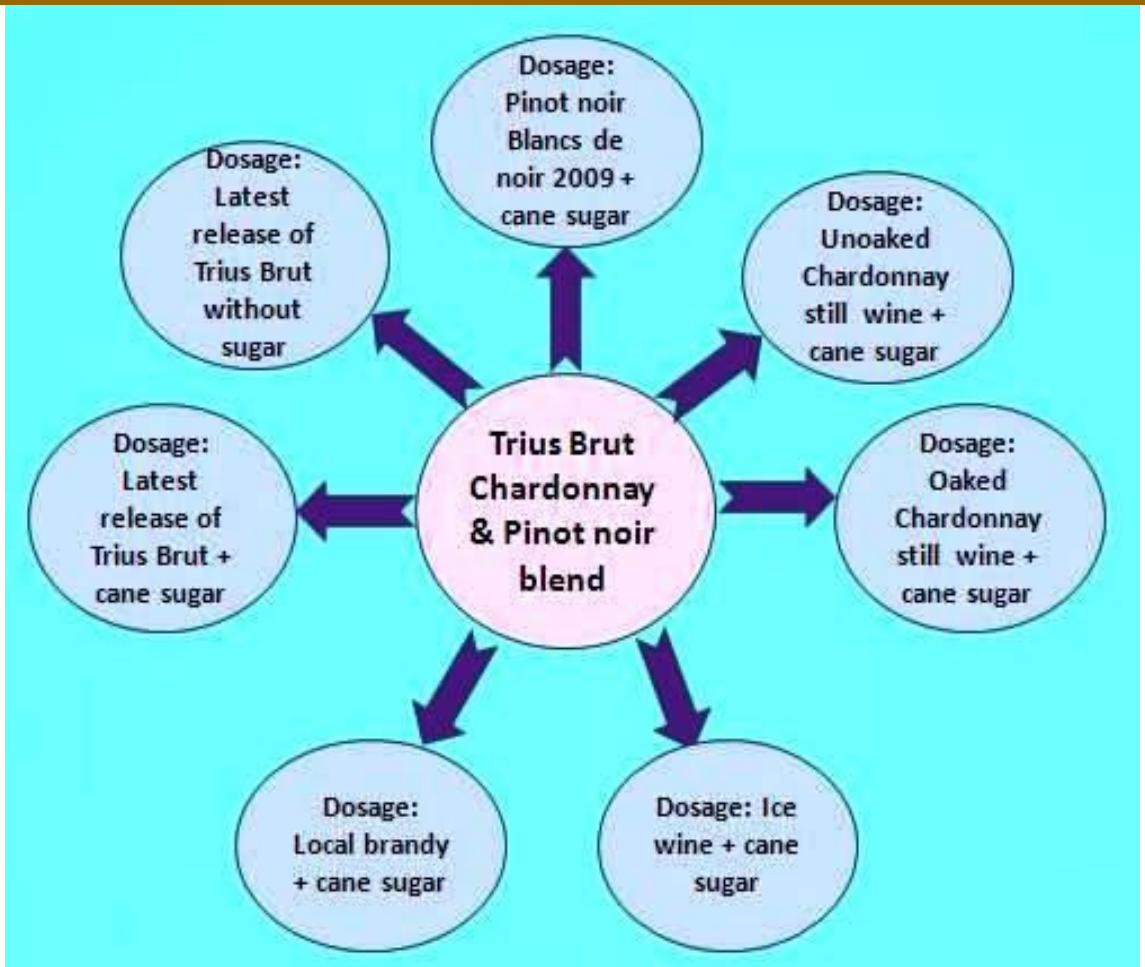
Continuation and expansion of trials i.e. *dosage* trial funded by NSERC Engage grant in collaboration with Trius at Hillebrand winery.



NSERC CRSNG

Trius WINERY AT HILLEBRAND

Press fractioning options

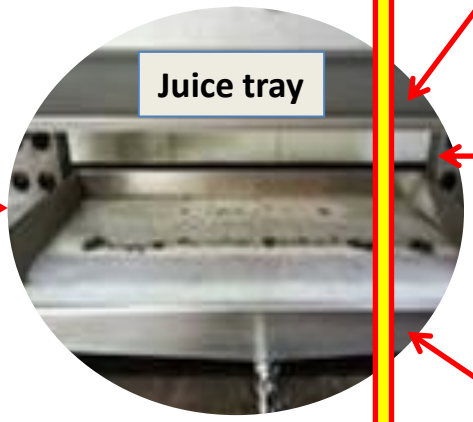
Without press fraction separation

With press fraction separation

First fraction (F1)

Quality base wine, more blending options, aging

All press fraction juice combined to produce one, low quality sparkling wine



Second fraction (F2)

2nd label, more blending options, could be used in *dosage*, lower quality than F1

Third fraction (F3)

2nd label, more blending options, could be used in *dosage*, lower quality than F2

Fourth fraction (F4)

Sell to local distillery for distillation $$$

Ontario Centres of Excellence

Where Next Happens

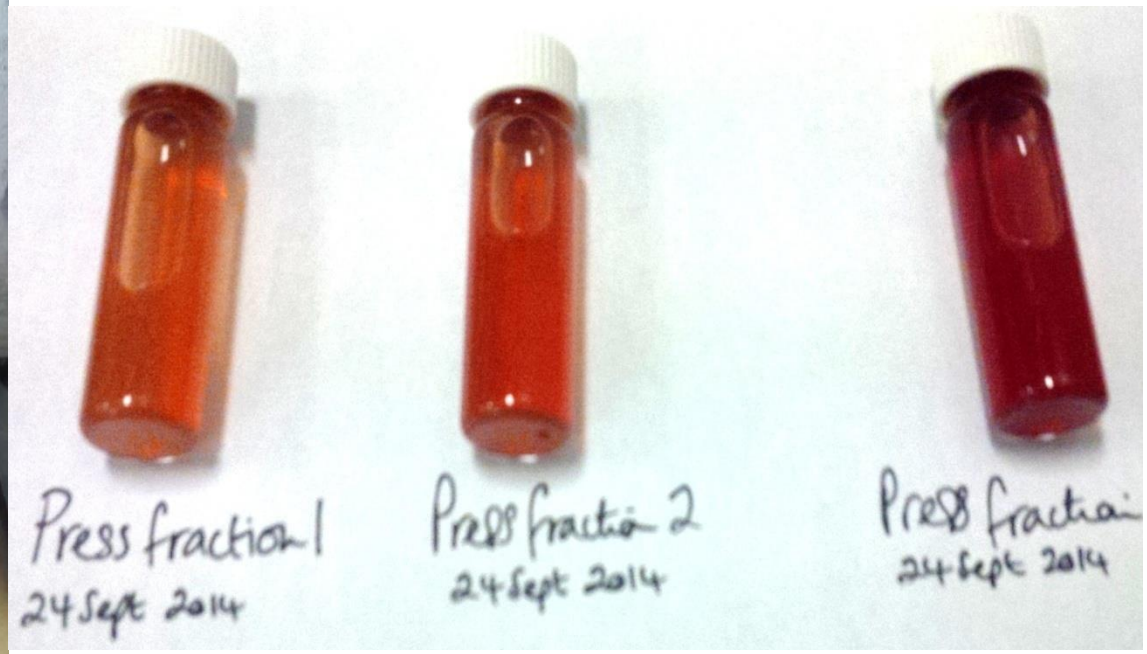
Press fractions

Champagne

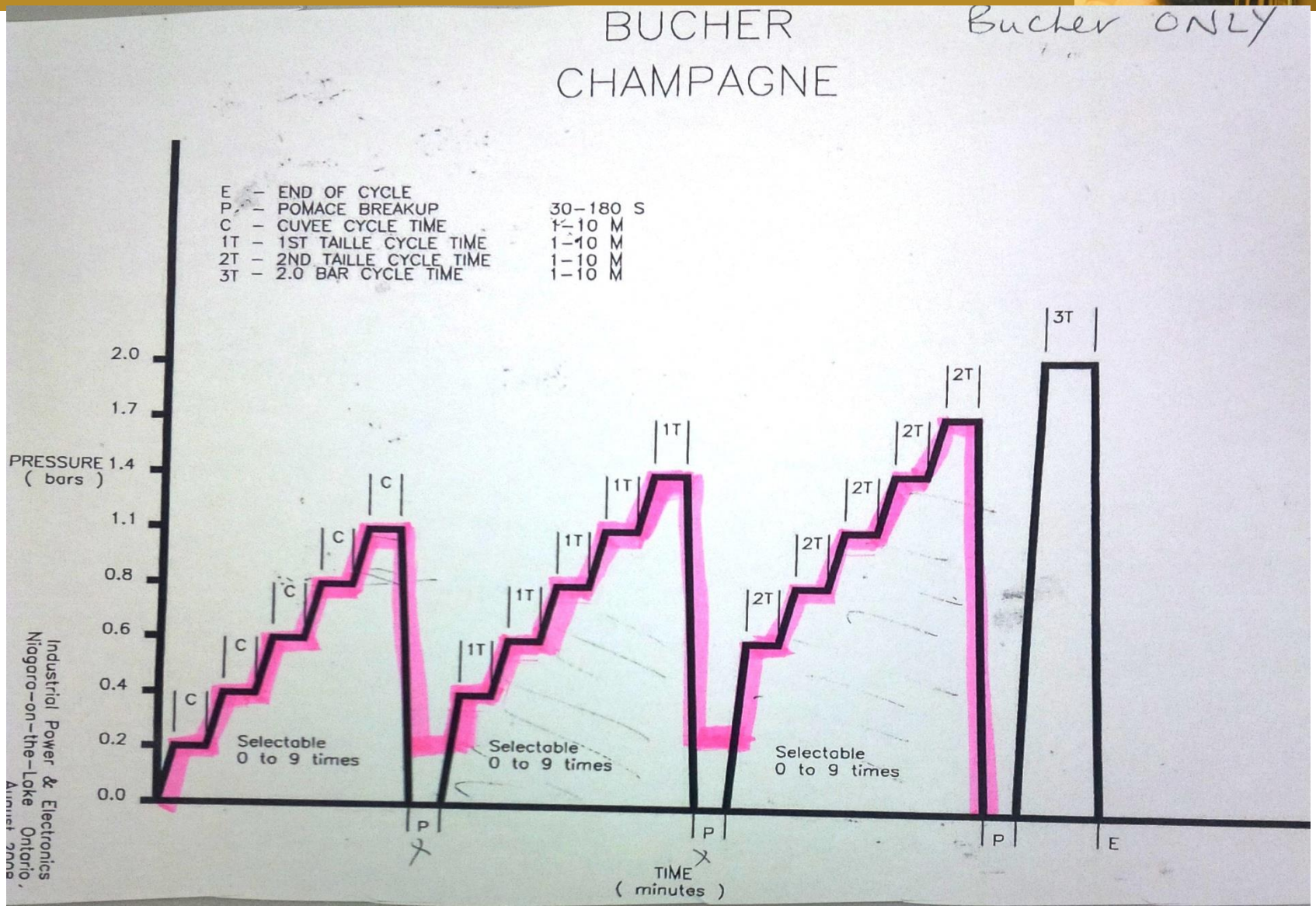
- **Cuvee = 20.5hL**
- **Tailles = 5hL (1st taille -3hL + 2nd taille 2hL)**
- **3rd taille 1-2hL distillation**

➢ **Press fraction volume and composition depends on press pressure of each cycle, type of press, length of each press cycle, grape variety, wines style and vintage**

Press fractions



Press fractions
CLONE 115 (Dijon clone)



Experimental winemaking method

- Pinot noir - Clone 115
- Whole bunch pressed
- Wine taken from tap before hitting the tray - middle of each cycle
- No enzymes added
- 30 ppm SO2
- Winemaking in triplicate – no MLF
- Chemical analysis of juice & wine pH, TA (g/L), Brix, fre & total SO2, ethanol, Nitrogen, turbidity, glucose, fructose, residual sugar, malic acid, heat stability, tartrate stability, total phenolics, conductivity & potassium.
- EC118 both fermentations
- *Tirage* same for all fractions (calculated on residual sugar & target of 24 g/L for 2nd fermentation

Press fraction juice and wine composition

(Analysis at every stage of winemaking but pre-fermentation and pre-bottling data presented today)

Table 1. Press fraction juice analysis

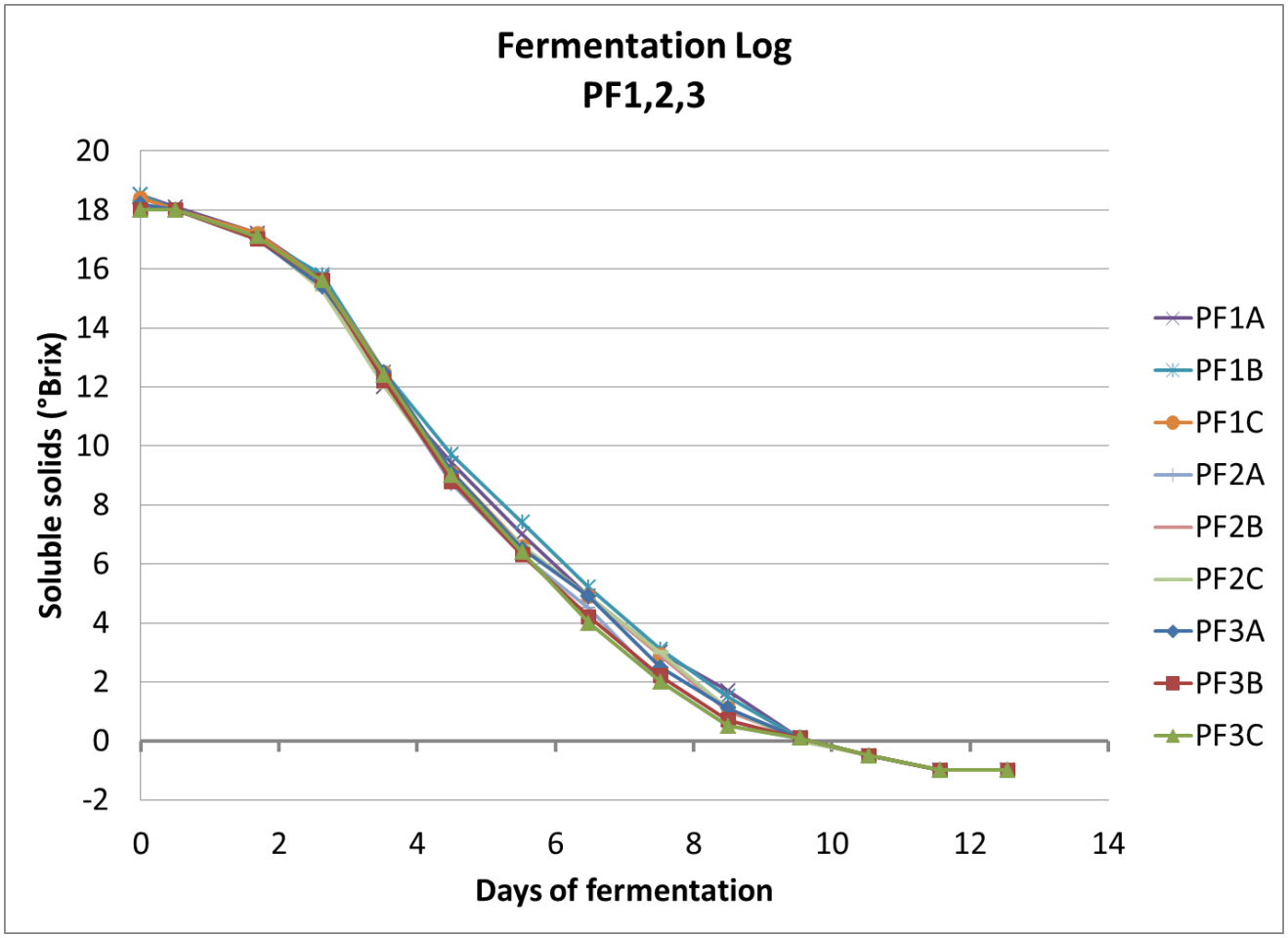
Press Fraction	Brix	TA (g/L)	pH	Total YAN (mg/L)	Glucose (g/L)	Fructose (g/L)	Malic acid (g/L)	Turbidity (NTU)	Acetic acid (g/L)
PF1	18.5	**8.3**	3.12	153	82	78	**3.9**	267	<0.01
PF2	18	**7.5**	3.19	154	83	77	3.6	297	<0.01
PF3	18	**6.3**	**3.39**	**160**	83	78	3.4	261	<0.01
Significance	NS	< 0.0001	< 0.0001	< 0.0001	NS	NS	< 0.0001	< 0.0001	NS

Table 2. Press fraction base wine analysis (prior to bottling)

Press fraction	Alcohol (% v/v)	TA (g/L)	pH	Total YAN (mg/L)	Glucose (g/L)	Fructose (g/L)	Residual sugar (mg/L)	Malic acid (g/L)	Turbidity (NTU)	Free SO2 (ppm)
PF1	**10.6**	**7.7**	**2.9**	**10.3**	**0.02**	**0.10**	**0.12**	**3**	**0.1**	**19**
PF2	**10.6**	**6.8**	**3.1**	**11.6**	**0.02**	**0.10**	**0.12**	**3**	**1.5**	**23**
PF3	**10.7**	**6.0**	**3.4**	**14.5**	**0.02**	**0.21**	**0.23**	**3**	**10**	**20**
Significance	**NS**	**< 0.0001**	**< 0.0001**	**< 0.0001**	**NS**	**< 0.0001**	**< 0.0001**	**NS**	**< 0.0001**	**< 0.0001**

*Turbidity decreased in other studies but increased in our wines

Press fraction primary fermentation



Press fraction primary fermentation rates at 16 °C

Relevance of results to wine?

- TA (g/L) increases & pH decreases
- Phenolic concentration influence on flavour and foaming (increase during pressing)
- Higher level of residual sugar in 2nd taille due to higher fructose levels
- Turbidity increase in 2nd taille
- Foaming?
- Flavour?
- Sparkling wine quality

Press fraction trial: Next steps

- Further chemical analysis i.e. phenolic analysis
- Further statistical data analysis
- Foam analysis of the final disgorged wines before and after *dosage*
- Tasting with Ontario sparkling winemakers at Fizz Club

Sparkling wine project: OMAFRA-U OF G PARTNERSHIP
Bentonite, protein & bubbles!

Preliminary investigation trial vintage 2014:

REGIONAL SPECIFIC STUDY

- **Pinot noir Mariafeld**

Mariafeld is a group of clones of Pinot noir. Vigorous, long & loose bunches, high disease resistance, big berries & high acidity. Planted in Germany from the beginning of the 90s.

Experimental design

- **Two base juices of 200L each**
  1. No bentonite treatment
  2. 1g/L Vitiben bentonite added to juice but removed prior to 1st fermentation

✓Contribution of grape proteins to foaming

Pinot noir Mariafeld,
juice after pressing, SS tank & enzyme addition (200L)

First fermentation

Second fermentation

T1: No bentonite EC1118 yeast 30L	T2: No bentonite Brock Isolate yeast 30L	T3: + bentonite 2nd ferment only, EC118 yeast 30L	T4: + bentonite 2nd ferment only, Brock isolate yeast 30L	T5: + bentonite 1st ferment only, EC118 yeast 30L	T6: + bentonite 1st ferment only, Brock isolate yeast 30L	T7: + bentonite 1st & 2nd ferment, Brock isolate yeast 30L	T8: + bentonite 1st & 2nd ferment , EC118 yeast 30L

* ***Bentonite used: Vitiben pre-fermentation and Inoclair 2 at tirage***

Trius WINERY AT HILLEBRAND

A pyramidal winemaking design

Stage 1: 200L juice

Stage 2: Juice: 1 treated bento & 1 no bento

Stage 3: Divided into 4 fermentation reps first fermentation EC118 yeast

Stage 4: Blended into 1 x bento & 1 x no bento in juice

Stage 5: Subdivided into 8 x treatments of bottled wines
(bottle replication bento timing x 2 vs yeast type x 2)

Bentonite trial winemaking

- Whole bunch pressed at winery (Bucher press)
- Pectic enzymes added to tank & settled
- First fermentation x 2 with EC118 yeast & nutrients

(+ bento & no bento)

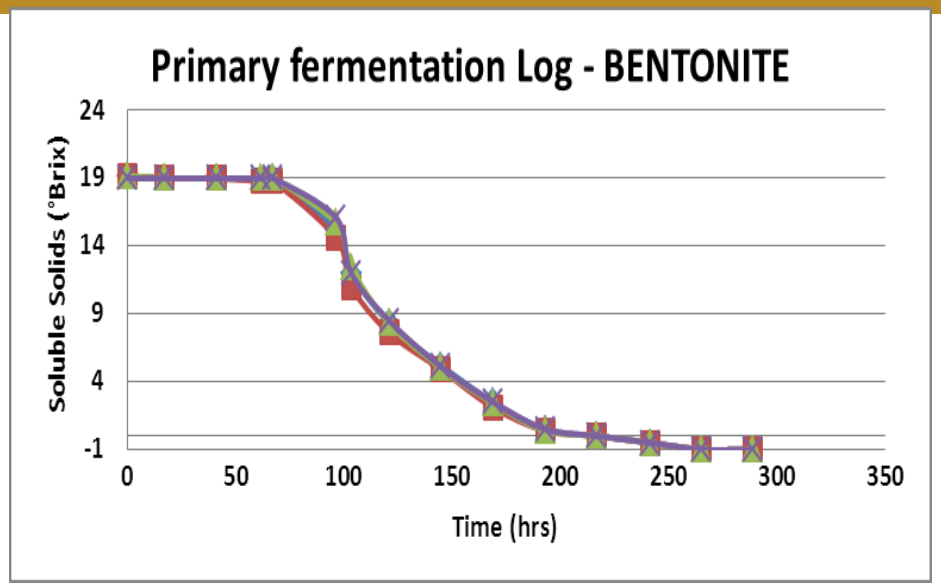
- No MLF
- Cold stabilised with seeding to -4°C
- Sheet & plate filtration to 0.45
- *Tirage*/bottled at Fielding Estate Winery
- 2nd fermentation/Storage

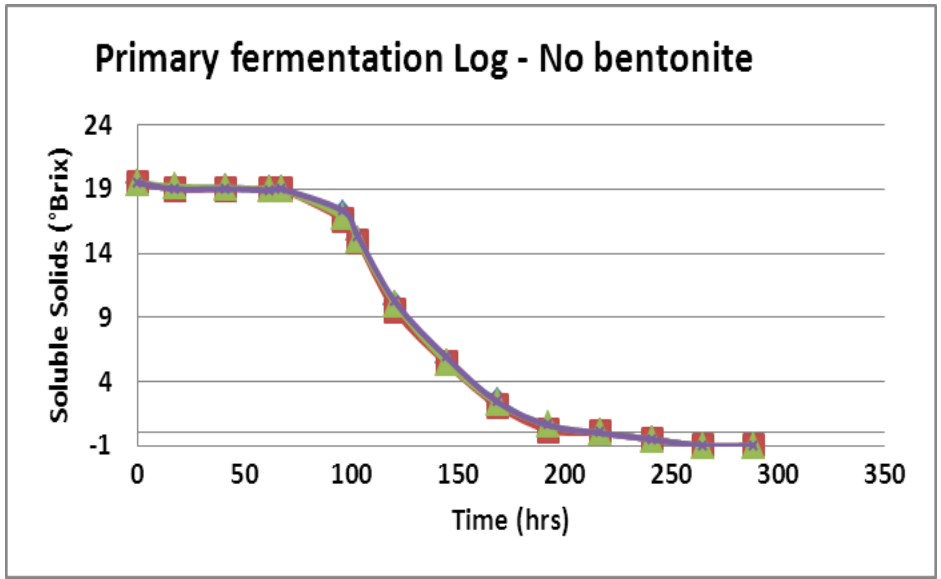
Trius WINERY AT HILLEBRAND

Juice analysis

Production stage	Treatment	Titratable Acidity (g/L)	pH	°Brix	Total N (mg/L)	Amino N (mg/L)
Pre-bentonite treatment	No bento	14 ±0.01	3.1 ±0.01	19 ±0.0	298 ±0.1	215 ±0.0
	Bento	14 ±0.01	3.1 ±0.02	19 ±0.0	291 ±0.1	208 ±0.1
After bentonite treatment	No bento	13 ±0.03	3.1 ±0.03	19 ±0.1	284 ±2.0	211 ±0.1
	Bento	12 ±0.02	3.1 ±0.04	19 ±0.0	304 ±3.0	216 ±0.0

Primary fermentation





Base wines

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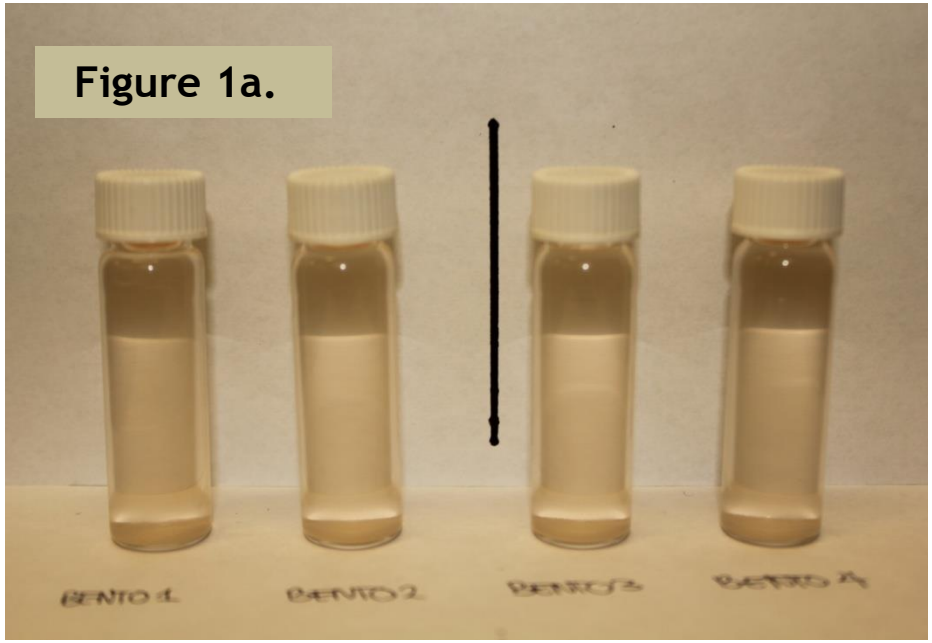

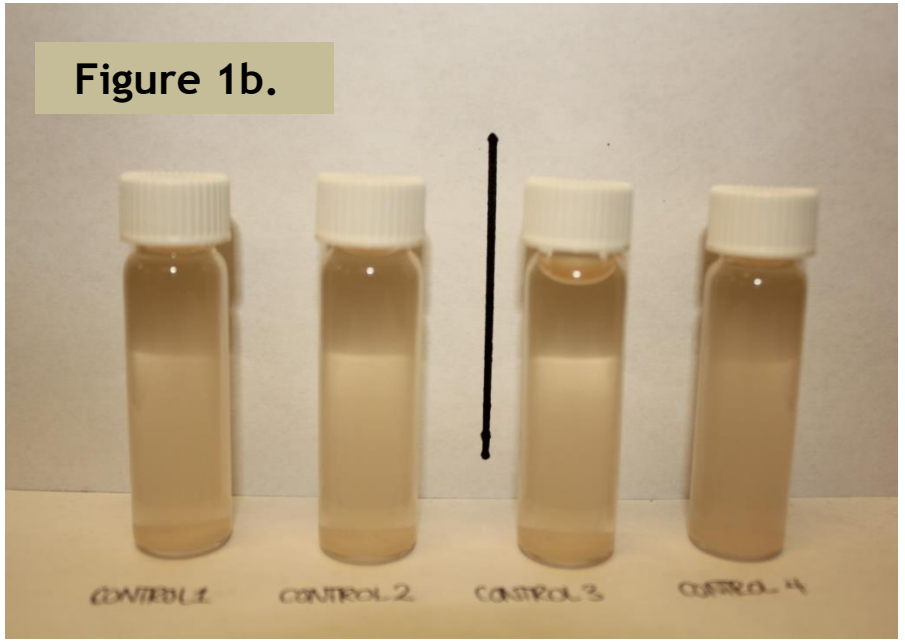

Figure 1a. Base wine produced from bentonite treated juice prior to bottling

Figure 1b. Base wine produced from untreated juice prior to bottling

Protein concentration(µg/mL) by the Bradford Assay during sparkling winemaking

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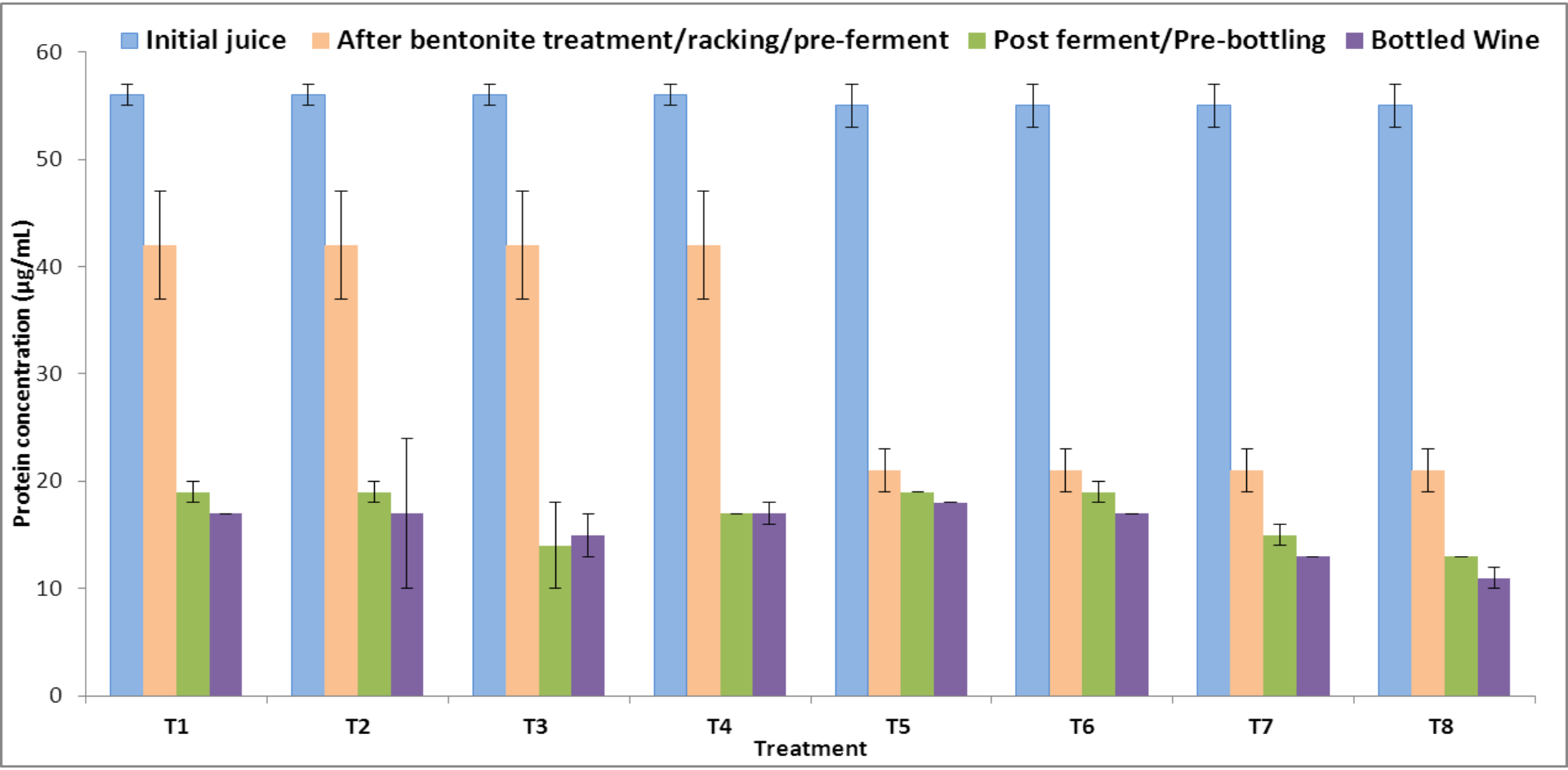


T1: No bento + EC1118	T2: No bento + Brock yeast	T3: + bento 2nd ferment only EC118	T4: + bento 2nd ferment only Brock yeast	T5: + bento 1st ferment only EC118	T6: + bento 1st ferment only Brock yeast	T7: + bento 1st & 2nd ferment Brock yeast	T8: + bento 1st & 2nd ferment EC118 yeast

Base wine analysis before bottling

Table 1. Wine analysis prior to subdividing into 2nd fermentation treatments

Treatment	Vol (L)	pH	TA (g/L)	Ethanol (% v/v)	Free SO_2 (ppm) {after cold stab & filtering}
Control	144	3.0	11	11	22
Bentonite added to juice	134	3.0	11	11	24

Table 2. Metabolite analyses pre-bottling of Bentonite/Yeast Trial wines

Trial	1st Treatment	Yeast	2nd Treatment	pH	TA (g/L)	Residual Sugar (g/L)	Amino N (mg/L)	Malic acid (g/L)
T1	Control	EC1118	-	3.0	11	**26 ±0.7**	31 ±0.1	7 ±0.1
T2	Control	*S. bayanus*	-	3.0	11	**27 ±0.1**	31 ±0.4	**6 ±0.0**
T3	Control	EC1118	Inoclair	3.0	11	**25 ±0.2**	31 ±0.9	7 ±0.0
T4	Control	*S. bayanus*	Inoclair	3.0	11	**26 ±0.2**	31 ±1.0	7 ±0.0
T5	Bentonite	EC1118	-	3.0	11	**25 ±0.0**	**28 ±0.2**	7 ±0.0
T6	Bentonite	*S. bayanus*	-	3.0	11	**25 ±0.1**	**26 ±1.1**	7 ±0.1
T7	Bentonite	EC1118	Inoclair	3.0	11	**25 ±1.1**	**27 ±2.3**	7 ±0.0
T8	Bentonite	*S. bayanus*	Inoclair	3.0	11	**27 ±0.7**	**27 ±0.5**	7 ±0.0

**Higher malic acid than clone 115*

Next steps….

- Monitoring wines
- Disgorging & *Dosage* x 8

(with sugar addition after a *dosage* sugar trial)

- 2 months on cork
- Protein analysis (concentration and identification)
- Chemical analysis before disgorging, after disgorging without *dosage* & with *dosage*
- Foaming analysis & correlation to

protein content & type of proteins

- Sensory analysis at Fizz Club

To bento? When to bento? or not to bento?

- Grape proteins affected by variety, vintage, grape maturity, pH and processing techniques.

- Protein composition and concentration differences between varieties and impact i.e. Chardonnay, Sauvignon blanc, Pinot noir and Riesling

- Sodium bentonite affects Chardonnay & Sauvignon Blanc foam more than Pinot noir. Calcium bentonite affects Pinot noir foam more than Chardonnay.

- Combination of both? Timing of addition? Vintage, variety & production style dependent

Next stage of variety x clone x soil type x bentonite trial 2015

Varieties: Pinot noir, Pinot gris, Chardonnay and Riesling

Clones: Clones on two soils on two sites

Soil types: Sandy & clay

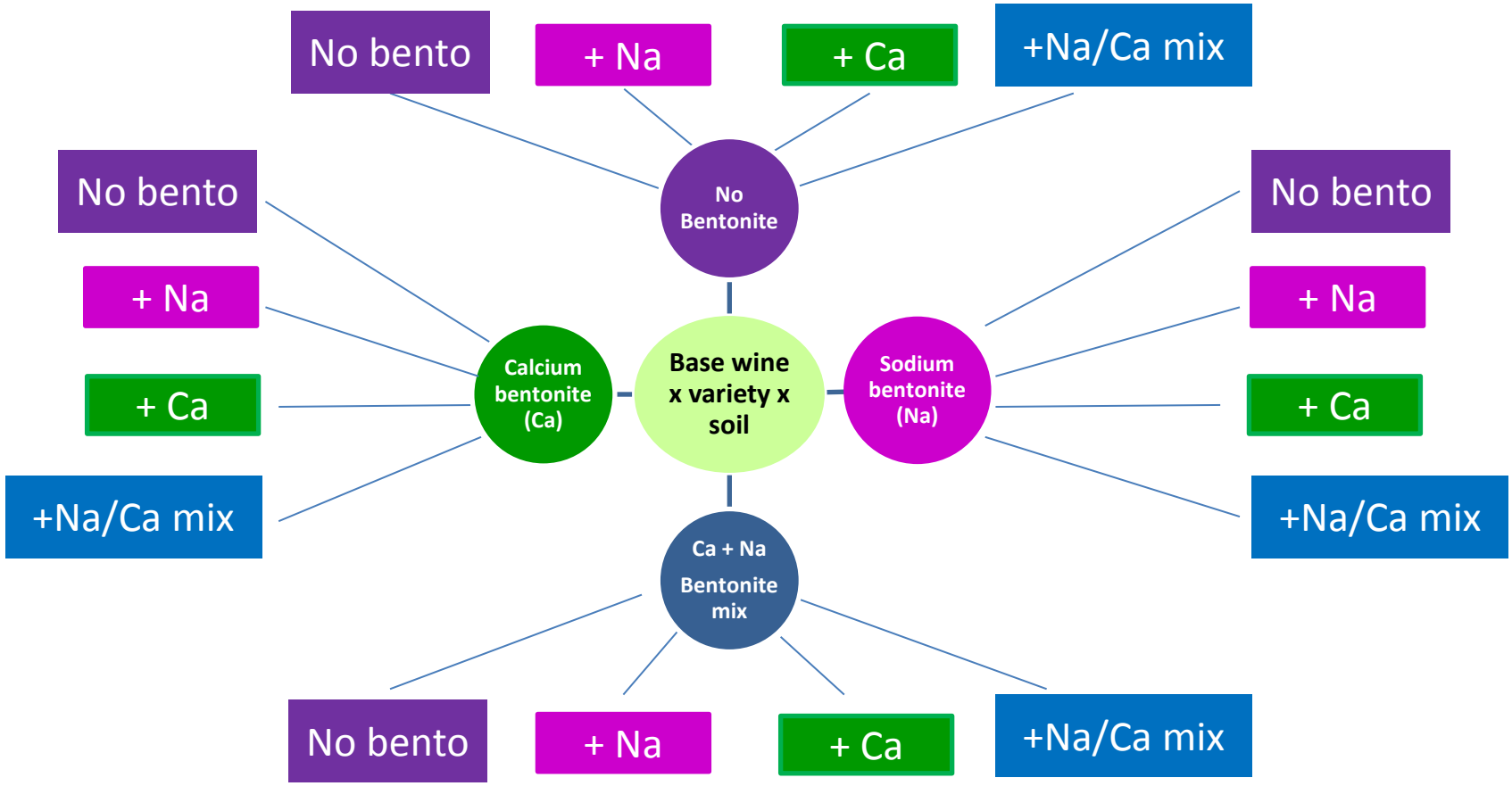
Bentonite types: Na, Ca & mixture

Bentonite timing: base wine and *tirage*

Trius WINERY AT HILLEBRAND

Bentonite type and timing trial
(using bentonite concentrations used by wineries)

In collaboration with Chateau des Charmes Winery and Trius at Hillebrand Winery



*Boxes denote wines at *tirage*/bottling

**Circles denote base wine fining

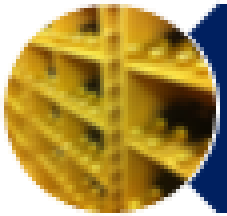
Gushing trial

Bottle handling & disgorging environment

- Light (UV)
- Ambient temperature
- Seasonal timing of disgorging
- Rough handling before disgorging
- Angle of the bottle
- Neck freezing too fast
- Rapid movement of wine from cold room to warm room

Wine composition

- Grape variety
- Vintage variation
- Protein instability
- Wine temperature and *dosage* temperature
- High bottle pressure
- Tartrate crystals
- Inconsistent mixing during *tirage*
- Undissolved sugar in the *dosage*
- Yeast (from inadequate riddling/disgorging)
- High phenolic concentration
- Turbidity
- Malolactic fermentation in bottle



Packaging materials

- Cork dust
- Glass imperfections in the bottle
- Dust in the bottle

GUSHING: Ambient temperature, bottle temperature and wine loss

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TAWSE
WINERY

Gushing


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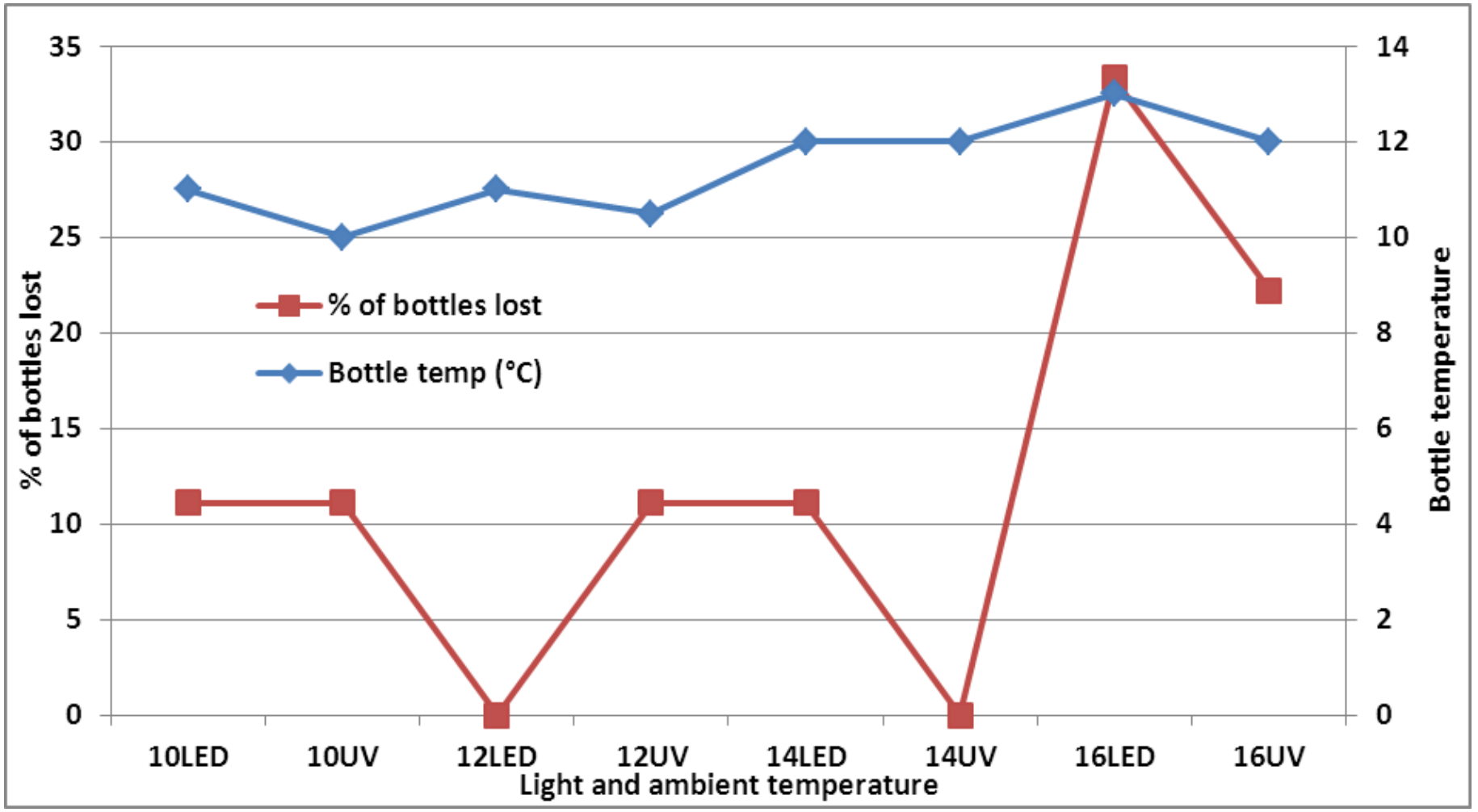
35
30
25
20
15
10
5
0
% of bottles lost
14
12
10
8
6
4
2
0
Bottle temperature
% of bottles lost
Bottle temp (°C)
10LED
10UV
12LED
12UV
14LED
14UV
16LED
16UV
Light and ambient temperature

GUSHING: Further analysis

- Pressure
- Yeast count
- Malic acid
- Protein concentration
- Tartrate stability
- Heat stability
- Phenolic concentration

TAWSE
WINERY

- Standard parameters - pH, TA (g/L), alcohol, residual sugar (g/L), free & total SO_2,

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- Ontario Centres of Excellence (OCE) VIP grant for funding the press fraction study
- Natural Sciences and Engineering Research Council (NSERC) Engage grant for funding the *Dosage* study

THATS ALL FOLKS!

Any questions?