Leaf removal and press fractioning for sparkling wine.

Belinda Kemp

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Background to leaf removal study

- Industry-led, long term study over five years that includes leaf removal
- Pinot noir for sparkling & red table wine on the same vineyard & Cabernet franc.
- Title: Adaptation and Innovation: An integrative research program to improve grapevine health, wine quality, competitiveness and sustainability of the Canadian wine grape industry.

Funded by Natural Sciences and Engineering Research Council of Canada (NSERC) CRD grant and Ontario Grape & Wine Research Inc (OGWRI).

Ontario GRAPE & WINE RESEARCH Incorporated

Trius WINERY

NSERC CRSNG

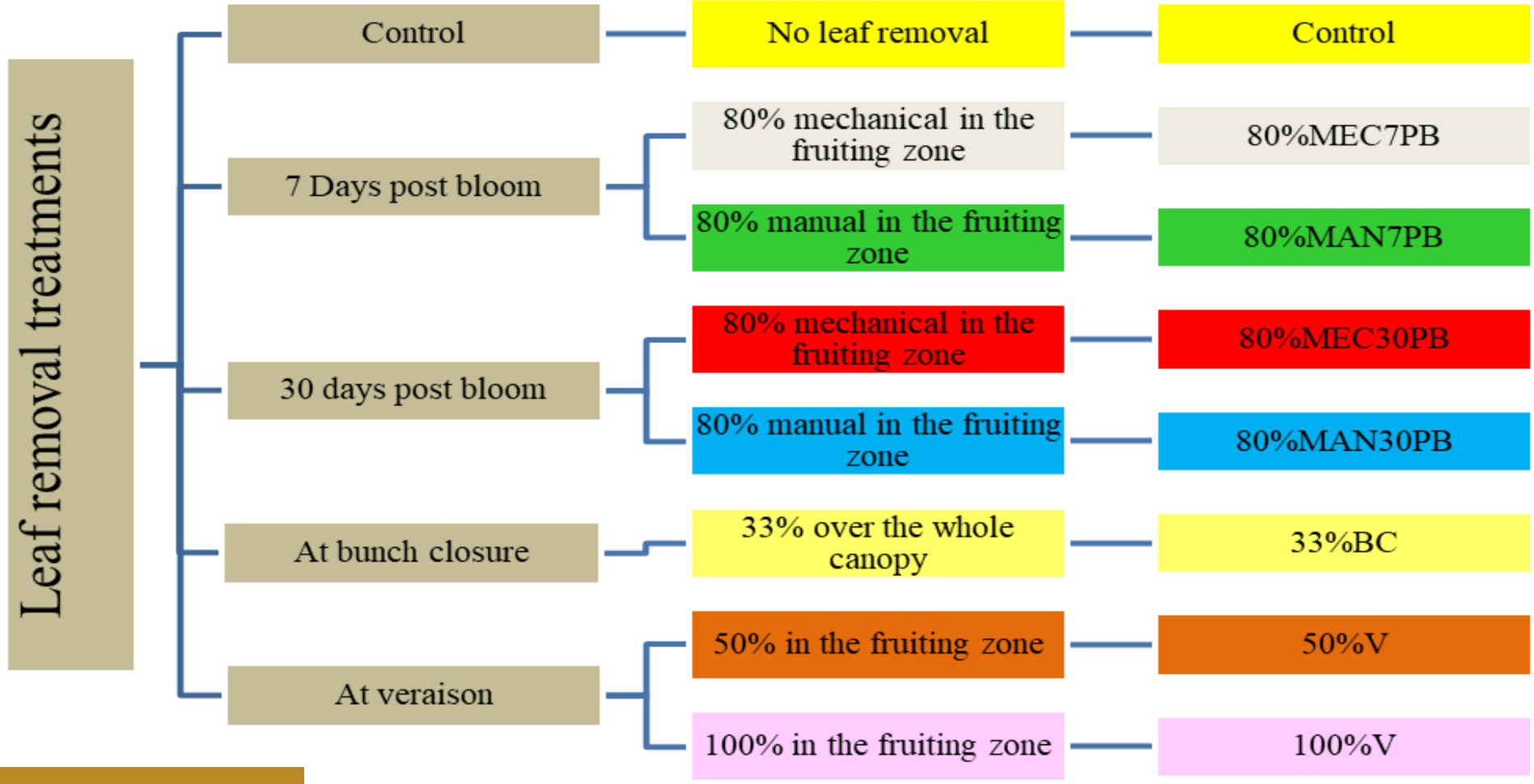
What is your compositional target for sparkling wine grapes at harvest?

1. Champagne: 10/10 rule = 10g/L acidity (expressed as sulphuric acid) & 10% potential alcohol. *(Emma Rice, Hattingley Valley, UK).*
2. We are looking for ripe fruit flavours even if the acid is still high. Apple, lemon and grapefruit in the Chardonnay and raspberry, strawberry and cherry in the Pinots. *(Emma Rice, Hattingley Valley, UK).*
3. Clean is king! That said, when tasting the berries, I am looking for any green characters to have diminished and the acid to be firm. I am also not looking for any typical ripe flavour characteristics but more neutral. *(Emma Garner, Trius Winery, Niagara).*

Remember

Do NOT treat grapes in the vineyard or base wine in the same way you do a still white wine!

Method, timing & severity of leaf removal for sparkling wine, NOTL
(clone 667)



Savard (2016)

Experimental vineyard design

- Niagara-on-the-Lake Vineyard, Four Mile Creek sub-appellation, Ontario.
- Clone 667/SO2 rootstock
- Vine spacing was 2.7m x 1.5m
- 25 vines per replicate per treatment
- 3 rows as replicates = 75 vines/treatment in a randomised block design
- A buffer zone of 5 vines before treatments began and grapes not picked from these vines
- Pendelbogen VSP system
- Soil type: Chinguacousy clay loam
- All harvested on same day

Leaf removal machines

- 80%MEC7PB leaf removal: a Gregoire DX30 was used each year.
- This model uses suction to remove leaves from the fruiting zone.

- 80%MEC30PB leaf removal: Collard P3000LZP Polyvalent was used each year.
- This model uses pulsed air to blow the leaves from the fruiting zone.

Treatment dates

Stage	Treatment	Date executed 2016	Date executed 2017
7 day PB	80% Leaf removal mechanical	28-Jun	04-Jul
7 day PB	80% Leaf removal manual	28-Jun	04-Jul
30 day PB	80% Leaf removal mechanical	26-Jul	28-Jul
30 day PB	80% Leaf removal manual	26-Jul	28-Jul
Bunch Closure	33% of entire Canopy	21-Jul	25-Jul
Véraison	50% Leaf removal	17-Aug	23-Aug
Véraison	100% Leaf removal	17-Aug	23-Aug

Winemaking

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Traditional Method/ *Méthode Champenoise*	1. Grape picking & pressing	2. Settling & clarification	3. 1st Fermentation	~~4. Malolactic fermentation~~ (if required)	5. Blending base wines	6. Bottling & liqueur de *Tirage* (yeast, nutrients, riddling agent & sugar)	7. 2nd Fermentation & aging on lees	8. Riddling	9. Disgorging & *dosage* (wine & sugar)	10. Closure & packaging

Whole bunch pressed after grape chilling, to 1 bar

24hrs cold settling with enzymes & 1st ferment at16°C (EC1118)

Bottled at Fielding Estate Winery, EC1118 for 2nd ferment at 14°C

12mths lees aging

Riddling/dis gorging, no sugar added *dosage*, at Millesime

°Brix & titratable acidity (TA g/L) trend at harvest

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2015: Highest °Brix: 80% MANUAL 7 & 30PB

Highest TA (g/L): 80% MECHANICAL30PB & 33%BC

2016: Highest °Brix: No LR/C & 100%V

Highest TA (g/L): No LR/C

2017: Highest °Brix No LR/C & 100%V

Highest TA (g/L) No LR/C & 50%V

2015 pH & TA (g/L) base wines & similar in finished sparkling wine

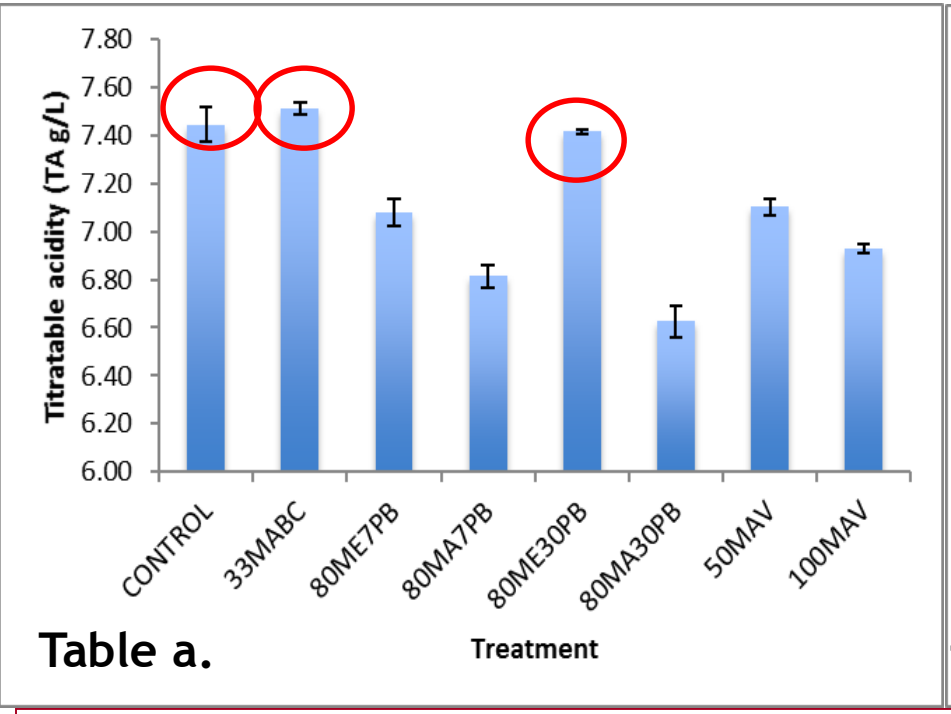

Table a.

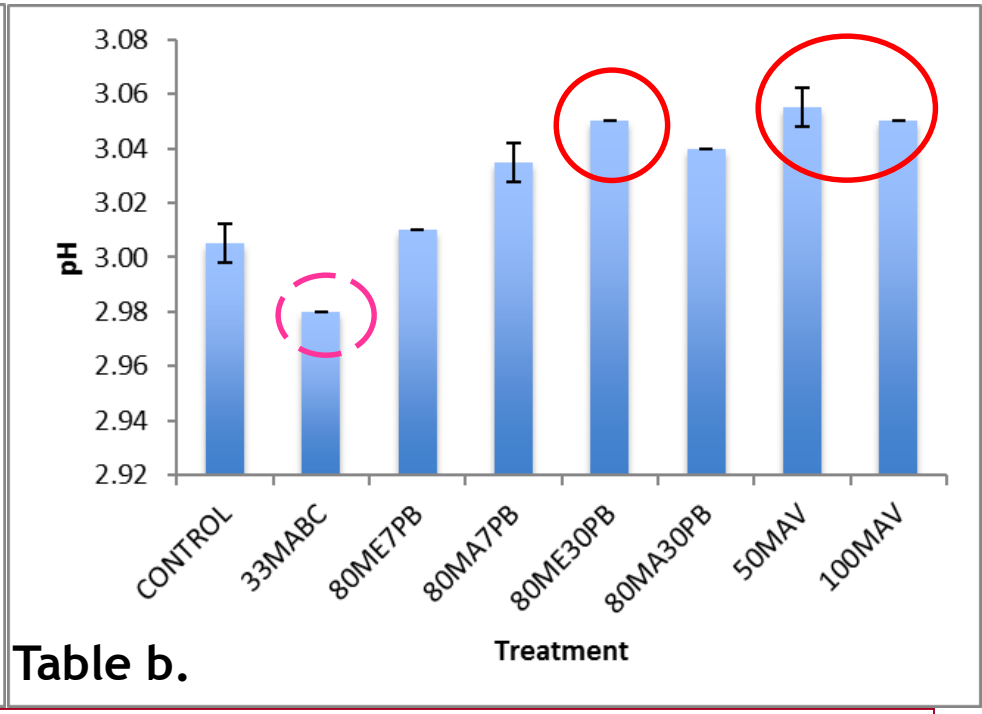

Table b.

TA (g/L) & pH of base wines in 2015 *(Van de Meurwe 2015)*

JUICE- Highest TA (g/L): 80% MECHANICAL30PB & 33%BC

Leaf removal treatments
Pinot noir juice & base wine (Clone 667)
(Savard 2015)

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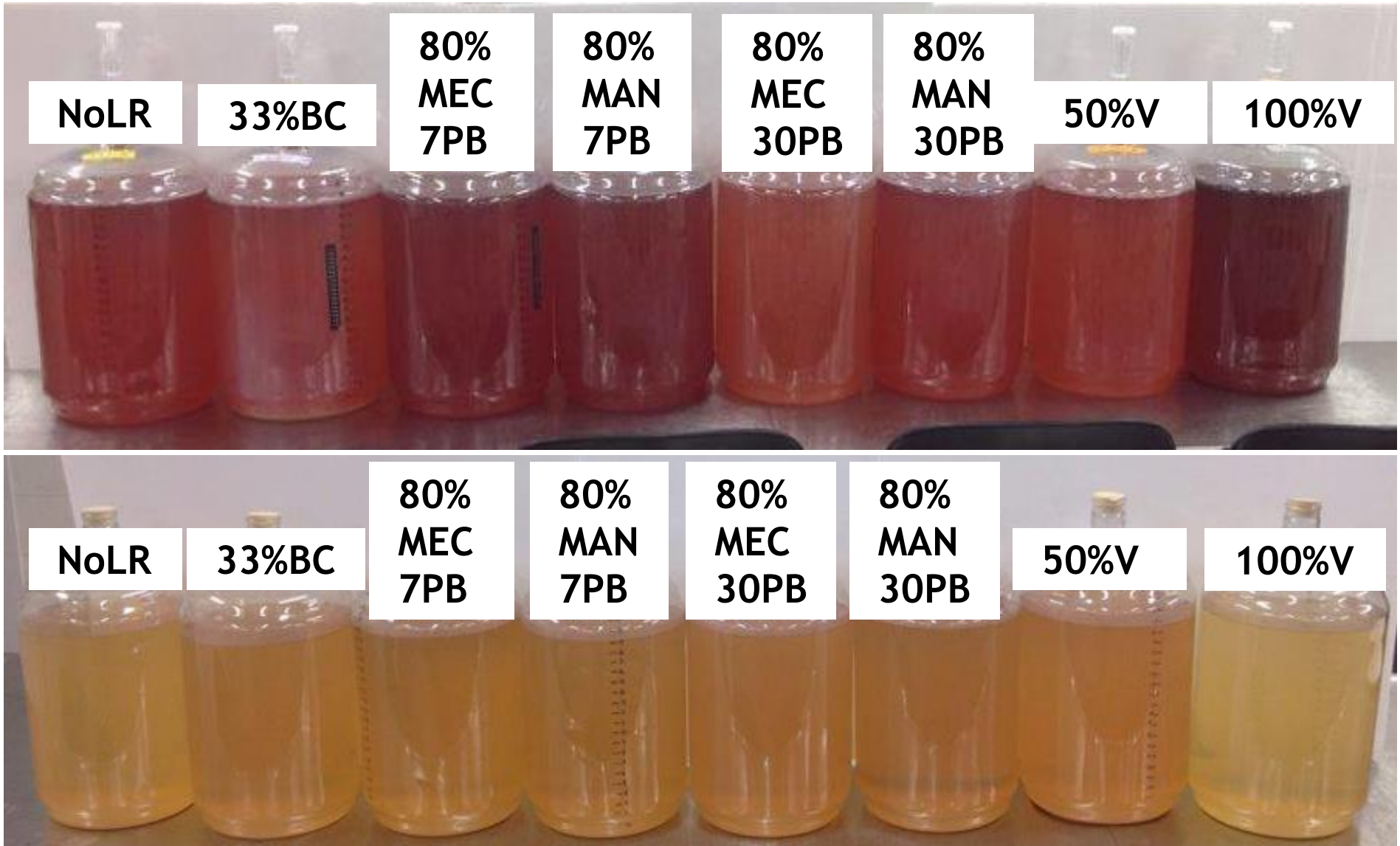
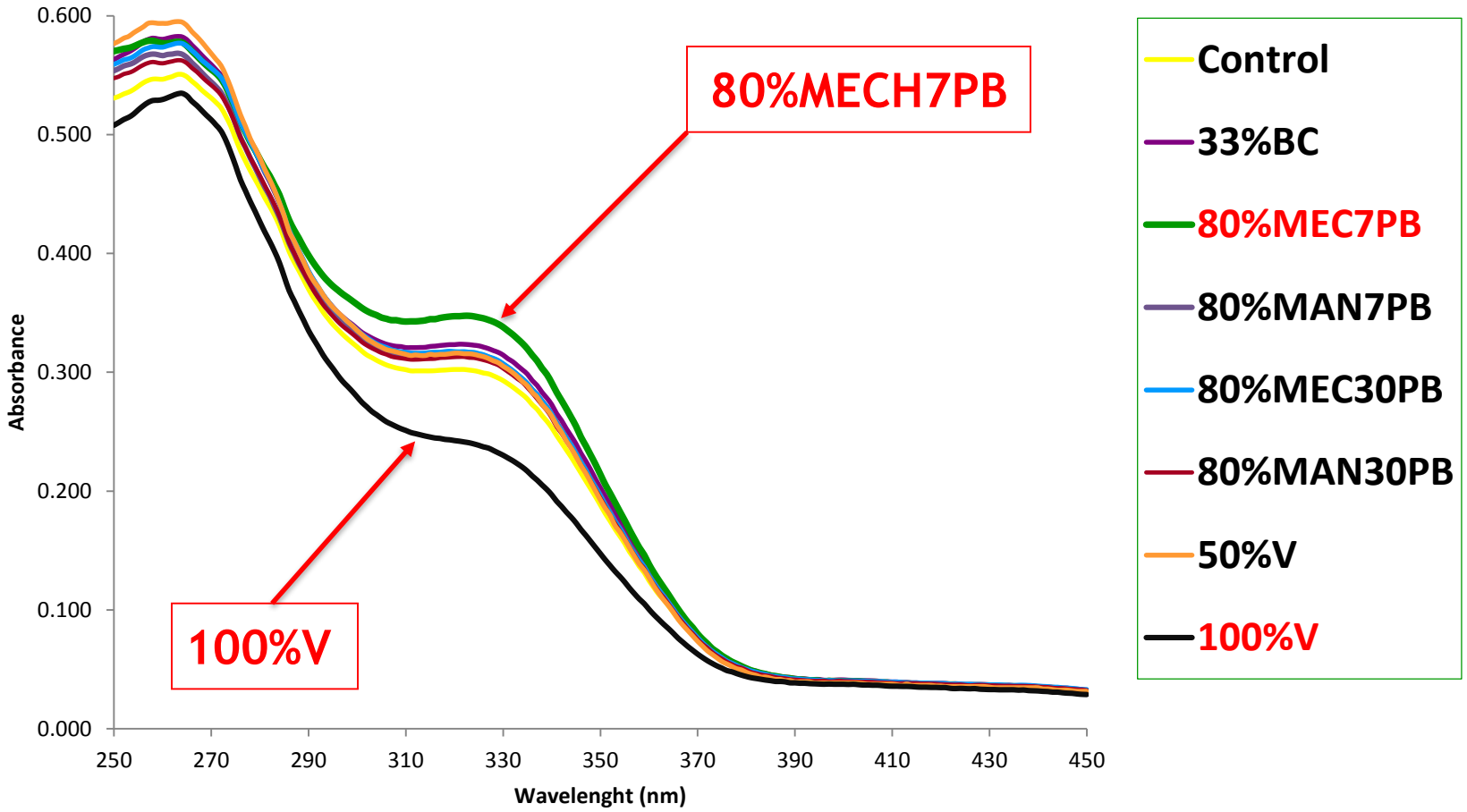


Phenolics (hydroxycinnamic acids) leaf removal Pinot noir base wines 2015



Effect of leaf removal treatment on the absorbance spectrum within the 250nm to 450nm range of base wines (Savard 2016).

2015 finished sparkling wines
(12mths on lees/12mths under cork)
Leaf removal treatments visual colour
(Bernard 2017)

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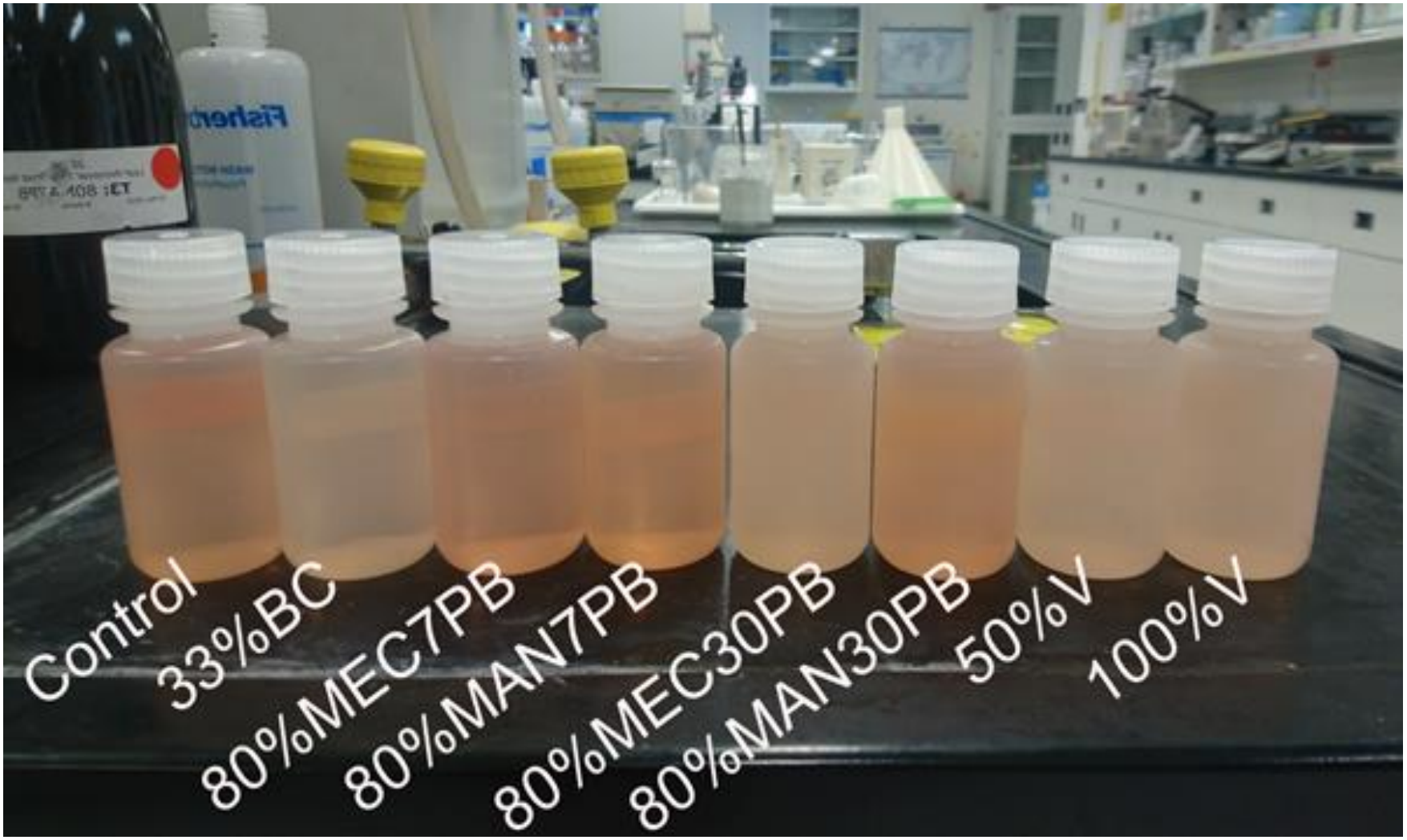
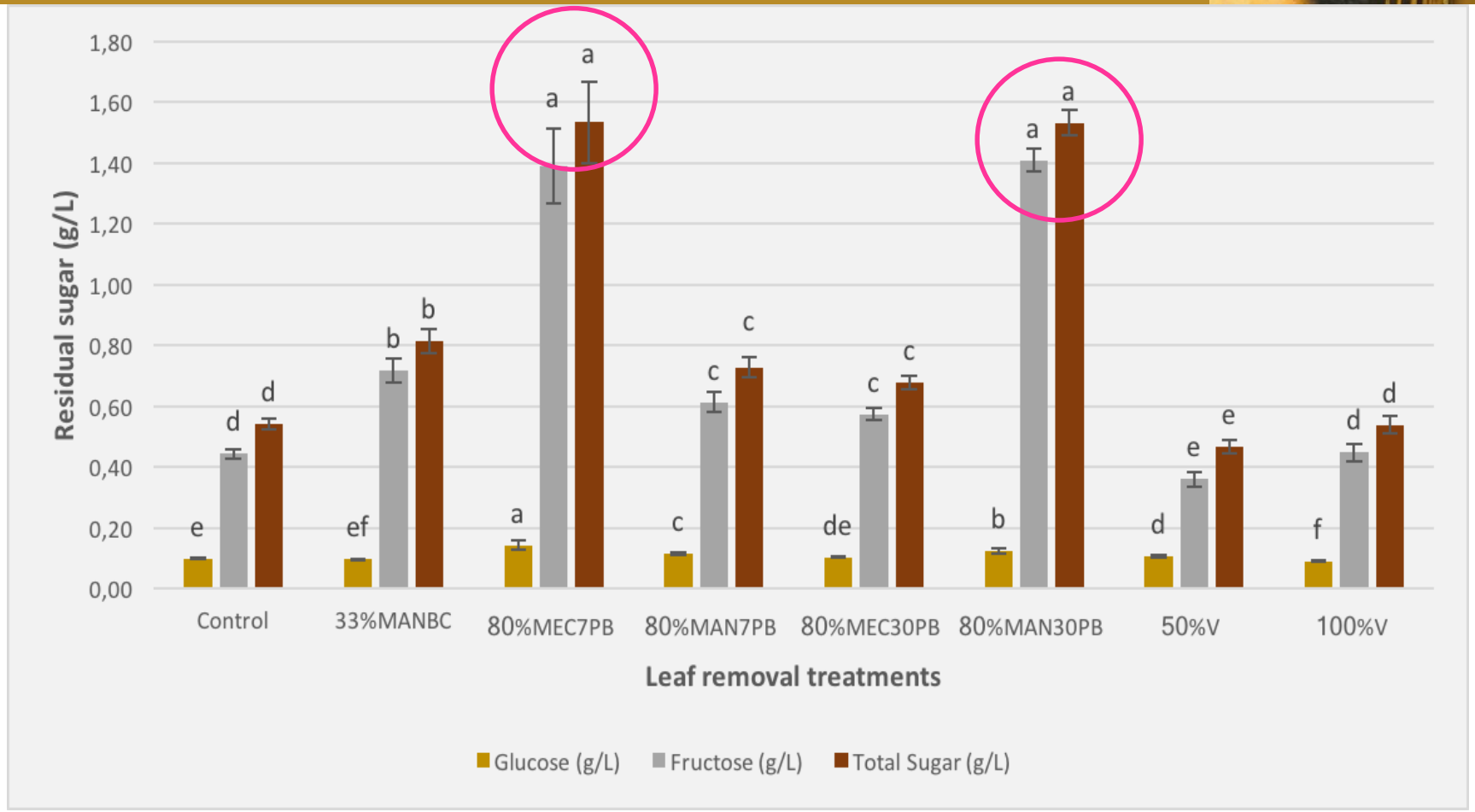
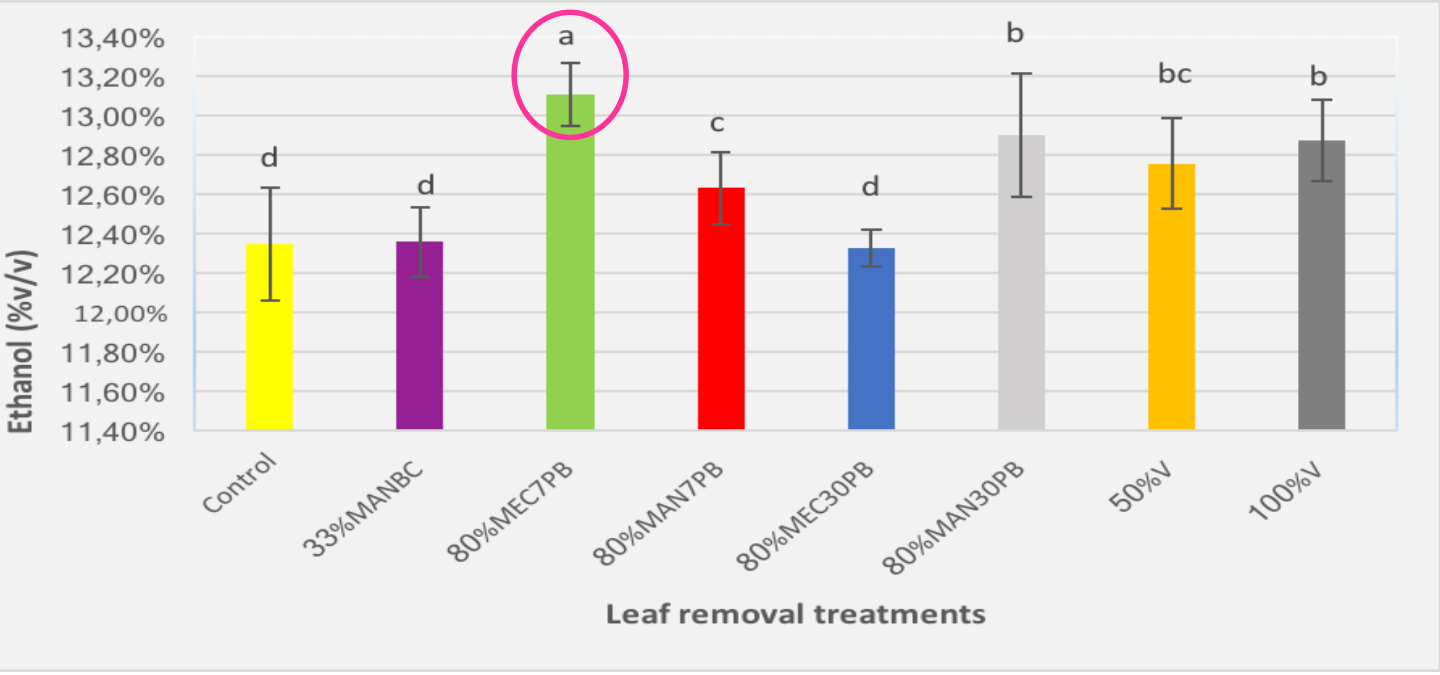


Chemical analyses of leaf removal wines 2015 *(Bernard 2017)*

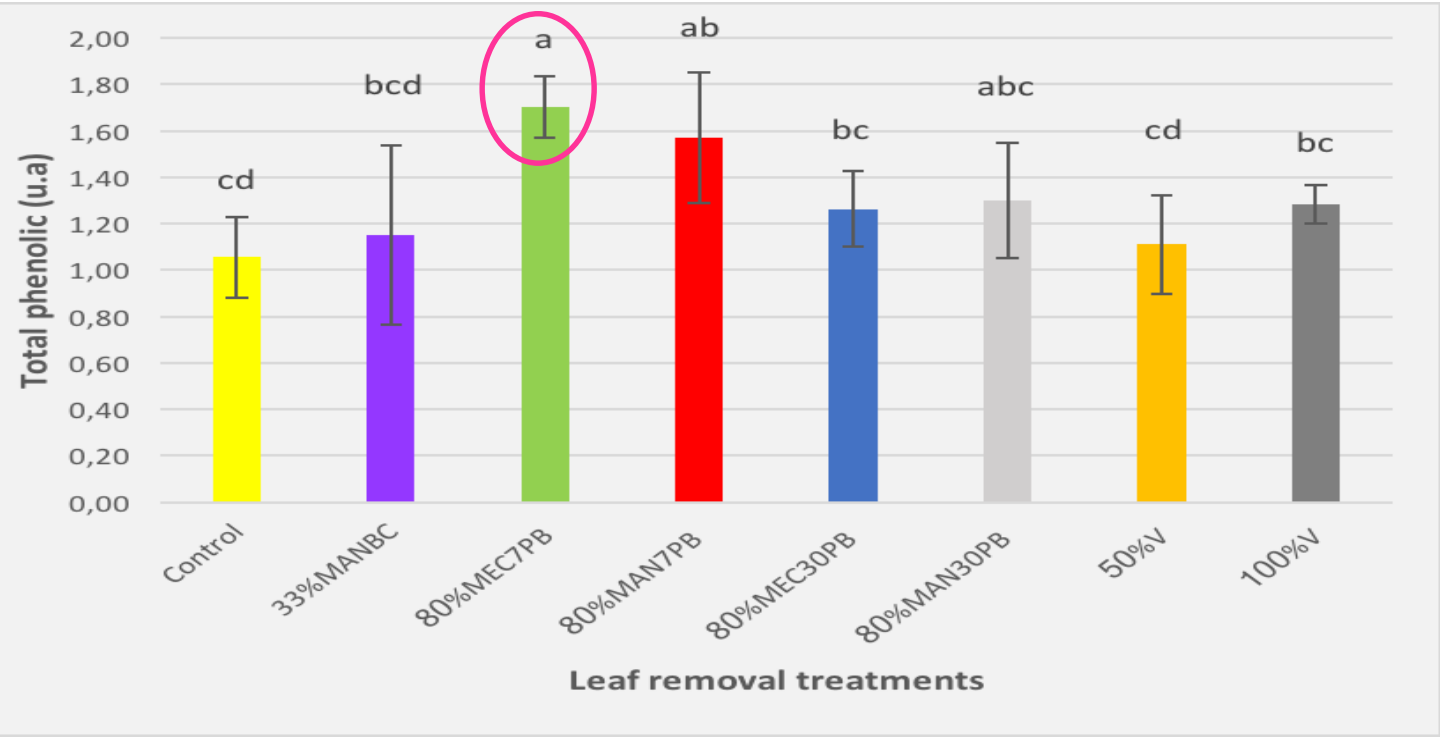


Residual sugar levels (g/L) 2015 sparkling LR wines

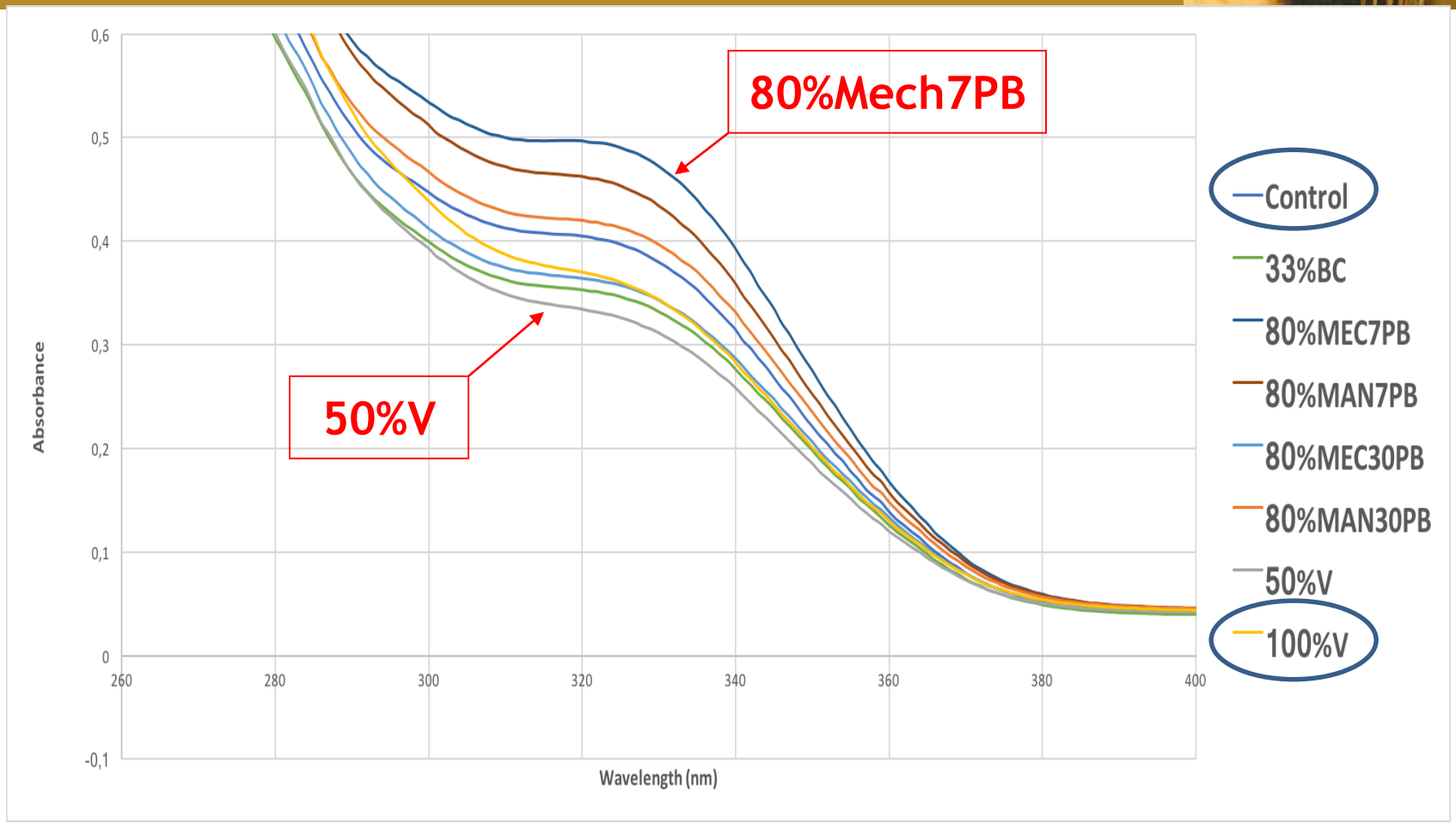
Ethanol in finished sparkling wine 2015 *(Bernard 2017)*



Total phenolics in finished sparkling wine 2015 *(Bernard 2017)*

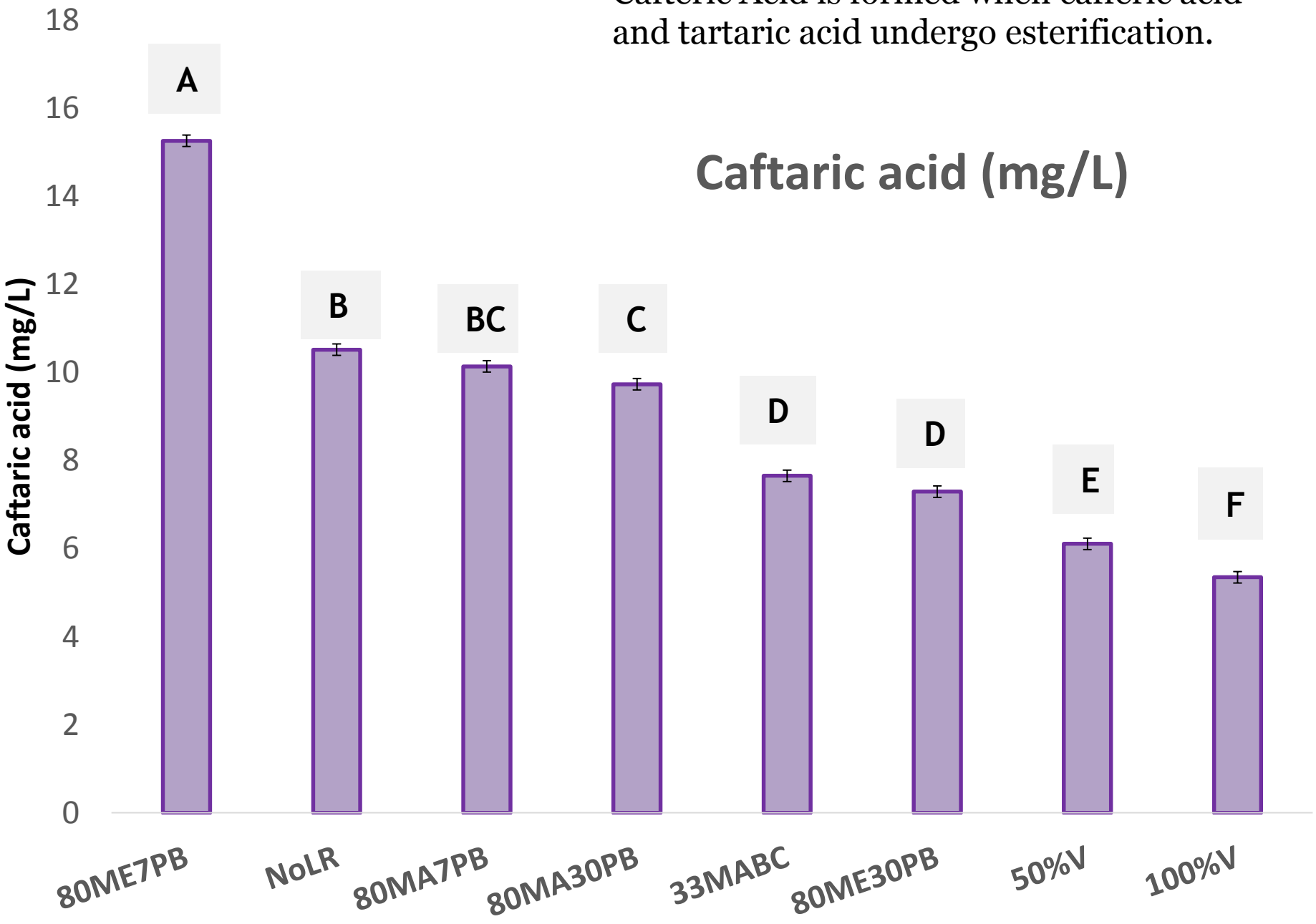


Phenolics (hydroxycinnamic acids) leaf removal Pinot noir sparkling wines 2015



Effect of leaf removal treatment on the absorbance spectrum within the 250nm to 450nm range of sparkling wines (Bernard 2017).

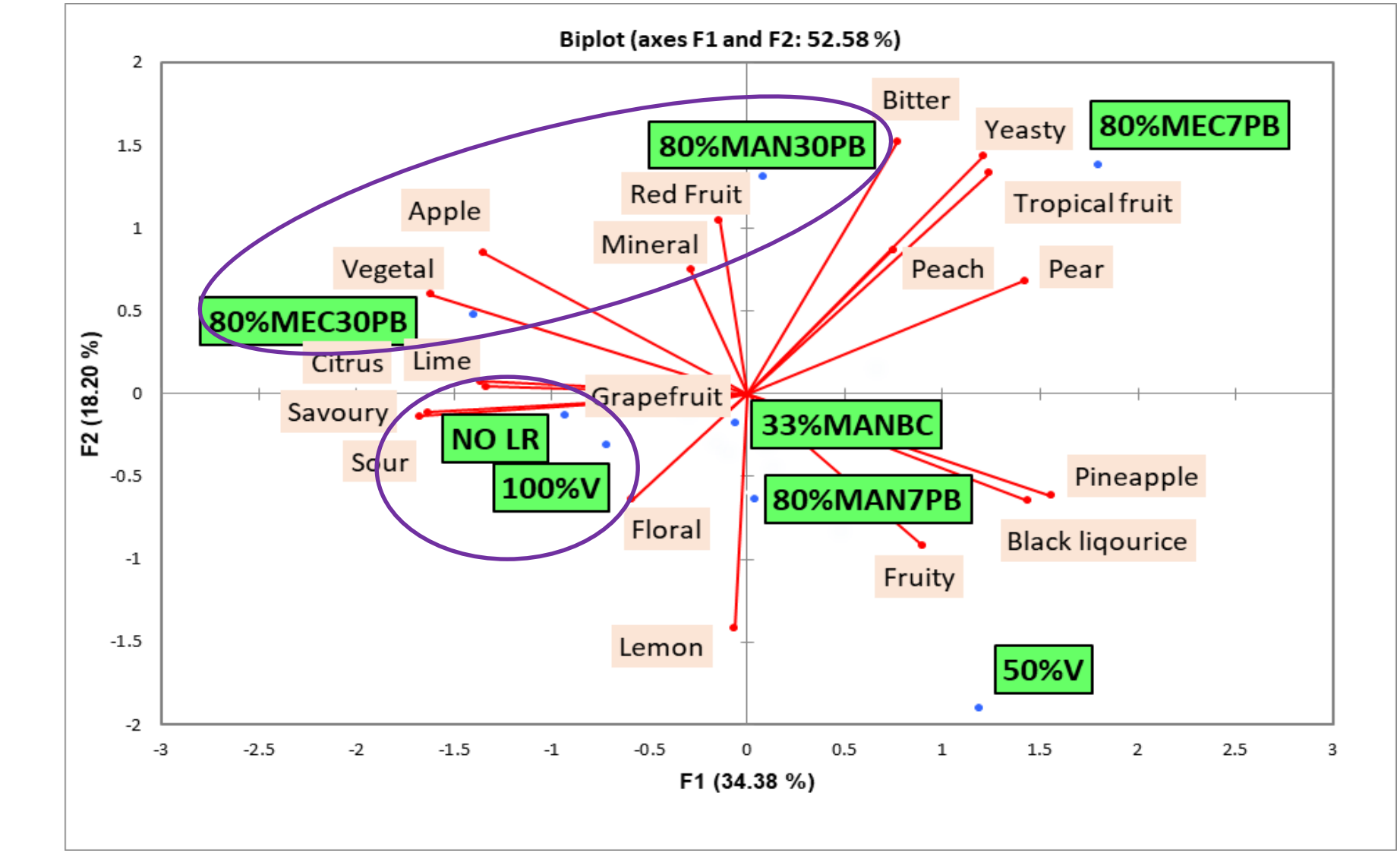
Cafteric Acid is formed when cafferic acid and tartaric acid undergo esterification.



Other hydroxycinnamic acids
Highest & lowest

Compound	Highest	Lowest
Caffeic acid	80%Man**7PB** (6 mg/L)	33%ManBC (4 mg/L)
P-coumaric acid	80%Man**7PB** (2 mg/L)	50%V (0.8 mg/L)
Coutaric acid	**80%Mech7PB (2 mg/L)**	33%ManBC (0.9 mg/L)
Ethyl caffeic acid	**80%Mech7PB (5.6 mg/L)**	33%ManBC (2.3 mg/L)
Ethyl ρ-Coumaric acid	**80%Mech7PB (0.9 mg/L)**	50%V & 100%V (0.5 mg/L)

Sensory analysis
Leaf removal wines 2015 *(Bernard 2017)*



Further research and considerations

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Further research

- Disgorging 2016 in April, bottling 2017 in April & disgorging it in April 2018.
- Full data collection and analysis of sparkling wine from 2016 & 2017

Further considerations

- Carry over effects i.e. yield
- LR according to style aim?
- Financial implications for vineyards
- Manual/machine requirements ($)
- Mixed LR treatments - i.e. early + at véraison, early machine with low %LR + manual later
- Assess impact longer lees aging &longer post disgorging time

NOW TO press fractioning considerations

Considerations

- ✓ Wine style *(fruity, lees aging/barrel, non-vintage blend or vintage)*
- ✓ Press type *(traditional 4000kg or pneumatic press)*
- ✓ Press size
- ✓ Press cycles
- ✓ Pressure level used per fraction
- ✓ Grape variety
- ✓ Health of grapes
- ✓ Mechanical or manual harvesting
- ✓ SO_2 addition level at press
- ✓ Initial grape ripeness
- ✓ Whole bunch pressing
- ✓ Grape temperature at picking & pressing

Bit of history of press fractions

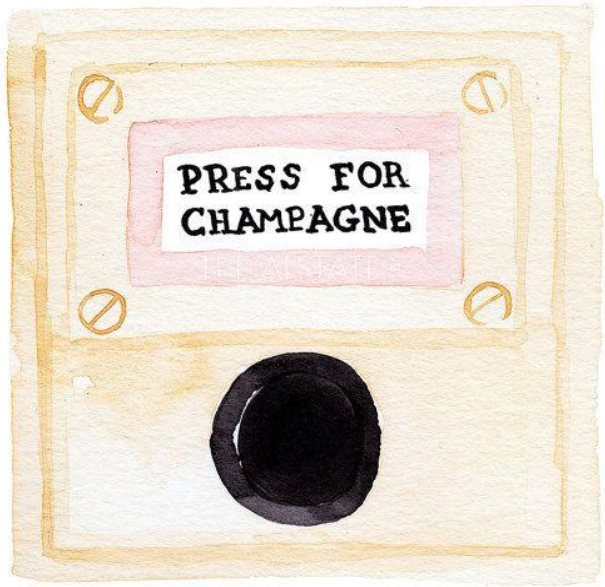
- A book published in Reims in 1718 attributed to the priest Jean Godinot lays the foundation for press fractioning of Pinot noir juices from practical observations!
- He described the colour and grape juice quality during the pressing cycle of whole bunches.
- He noted more delicate wines from the 1st & 2nd squeezes! Squeezes 4-7 = coarse, stained and sold at lower prices!

BUT WHAT ABOUT AGING ABILITY, FOAM HEIGHT & STABILITY!

COLOUR – FRESHNESS – QUALITY – VARIETY

Making white sparkling wine from red grapes

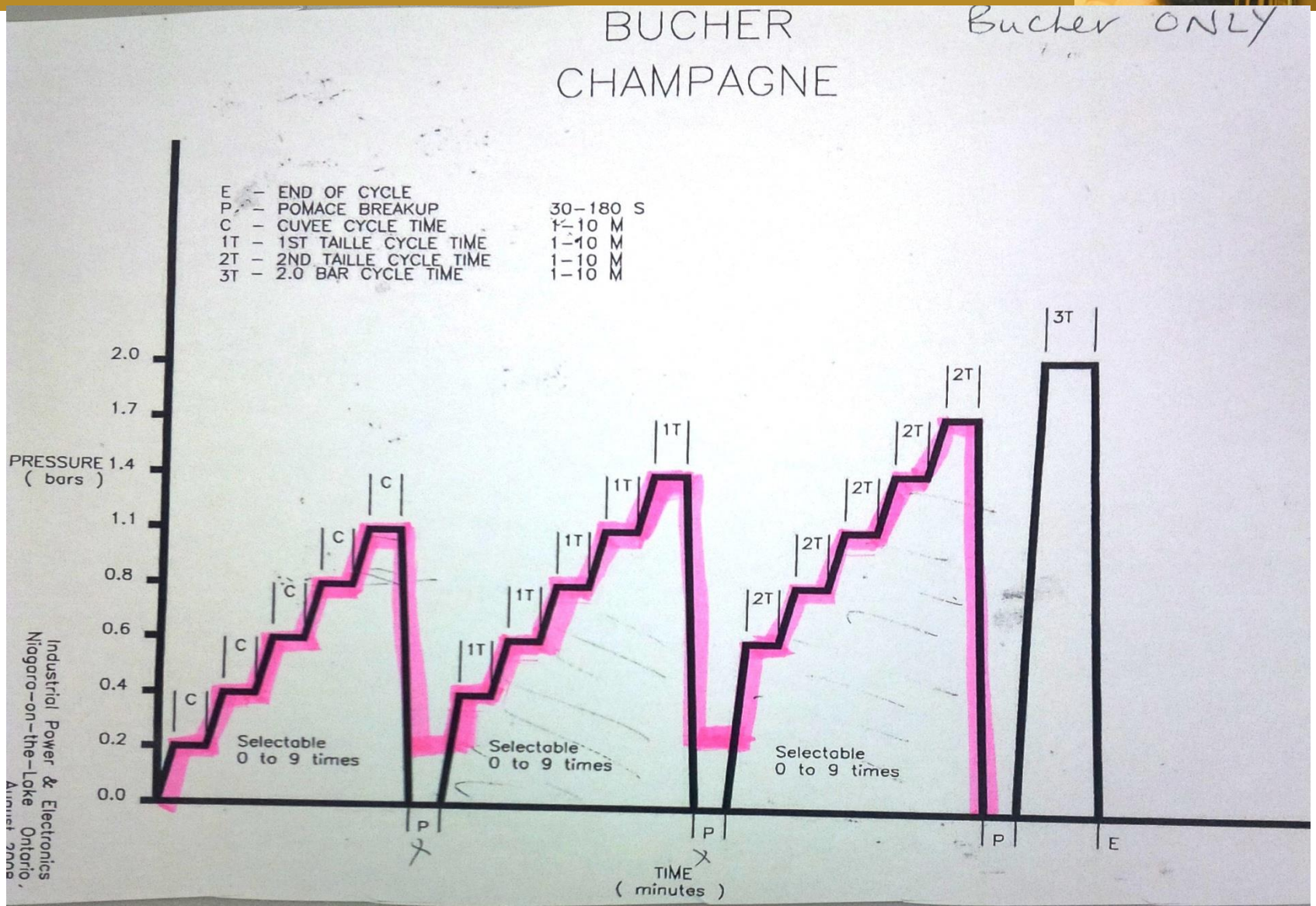
- Cool grape temp
- Whole bunch pressing
- Gentle, gradual increase in pressure
- Low juice extraction
- Press fractioning



Champagne pressing (based on 4000kg grapes)

- Cuvee = 20.5hL (541 gallons)
- Tailles = 5hL (1st taille -3hL + 2nd taille 2hL)/132 gallons
- 3rd taille 1-2hL distillation

Press fractions
CLONE 115 (Dijon clone)



Optimising press fractions (Clone 115)

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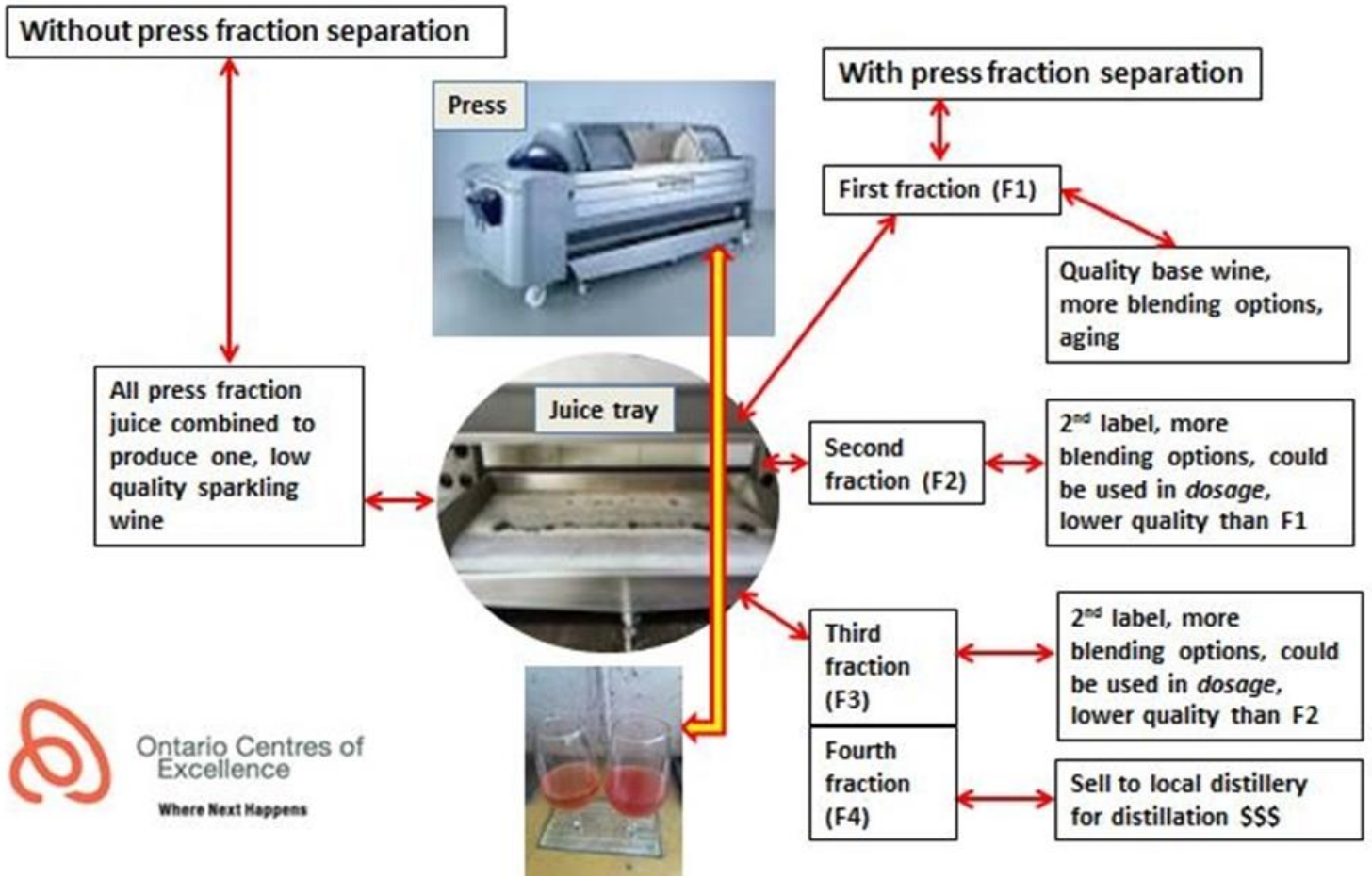
Press fractioning options



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, free & 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 composition

Press fraction juice analysis

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

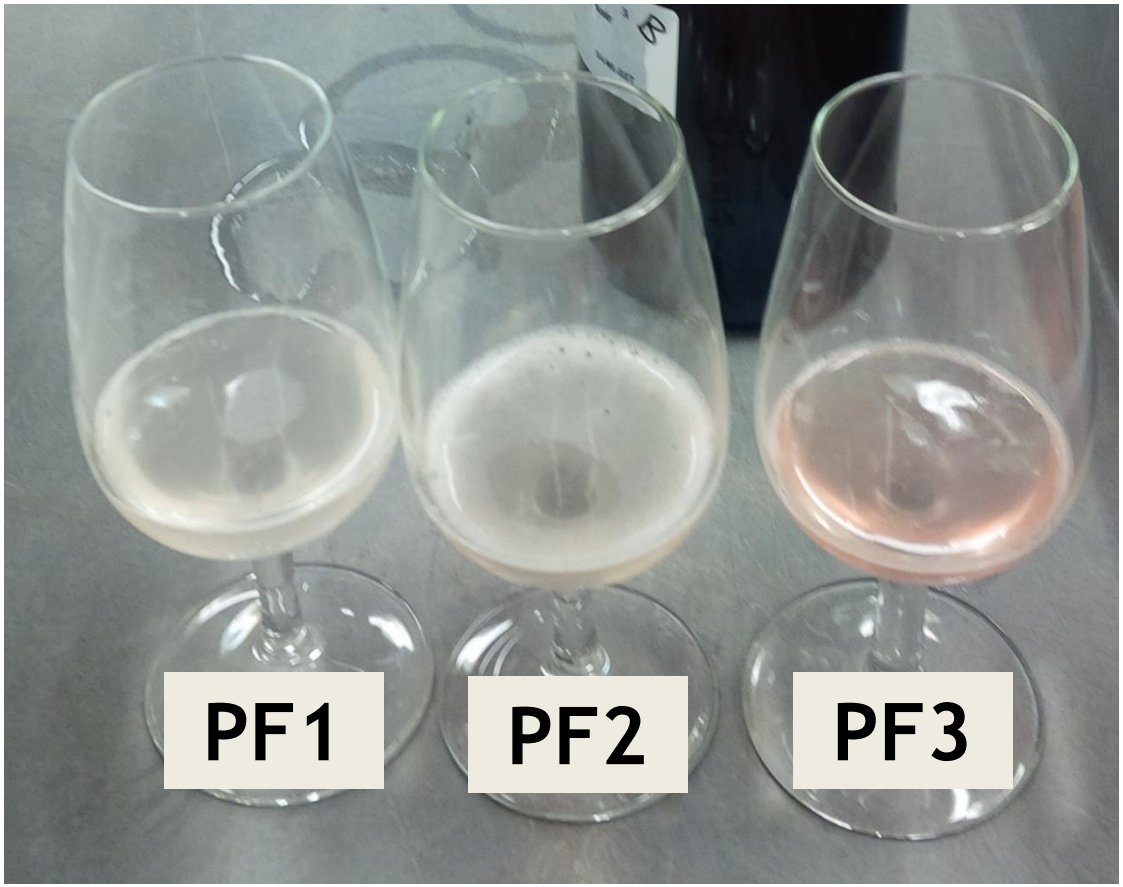
Press fraction juice and wine composition

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

Press fraction base wine analysis (prior to bottling)

Press fraction	Alcohol (% v/v)	TA (g/L)	pH	Residual sugar (mg/L)	Malic acid (g/L)
PF1	10.6	7.7	2.9	0.12	3
PF2	10.6	6.8	3.1	0.12	3
PF3	10.7	6.0	3.4	0.23	3
Significance	NS	< 0.0001	< 0.0001	< 0.0001	NS

Visual effect *(9 months lees aging)*



PRESS FRACTIONING:
Sparkling wine research at CCOVI

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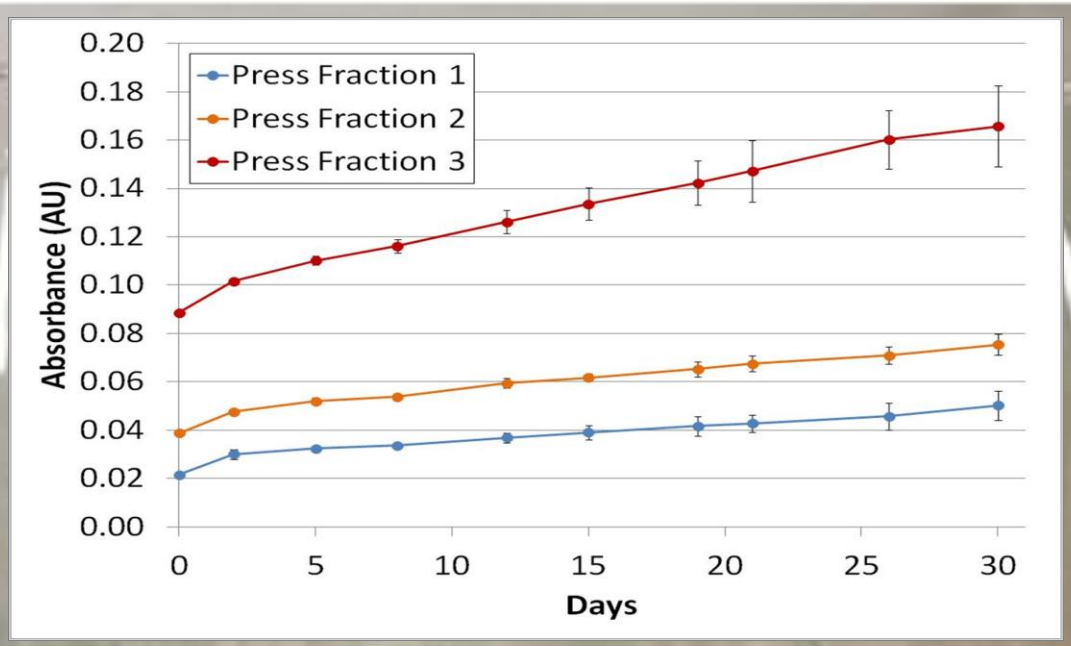

Accelerated oxidation analysis of base wines (2014).
The absorbance at 420nm was measured over the course of 30 days.

Phenolic compounds in press fractions(Pinot noir clone 115)

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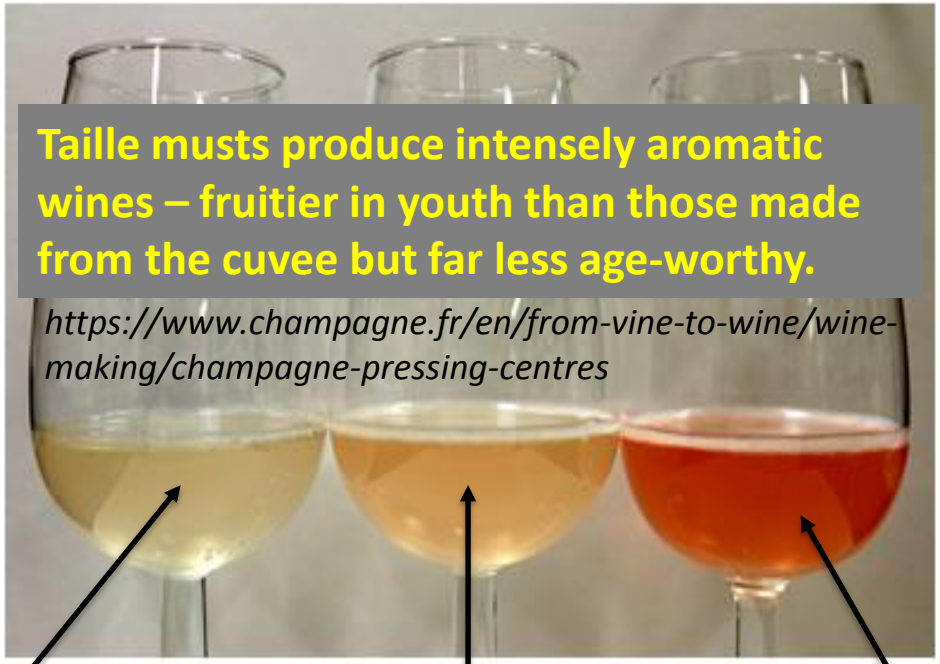
Ontario Centres of Excellence
Where Next Happens

Trius WINERY



Taille musts produce intensely aromatic wines – fruitier in youth than those made from the cuvee but far less age-worthy.

https://www.champagne.fr/en/from-vine-to-wine/wine-making/champagne-pressing-centres

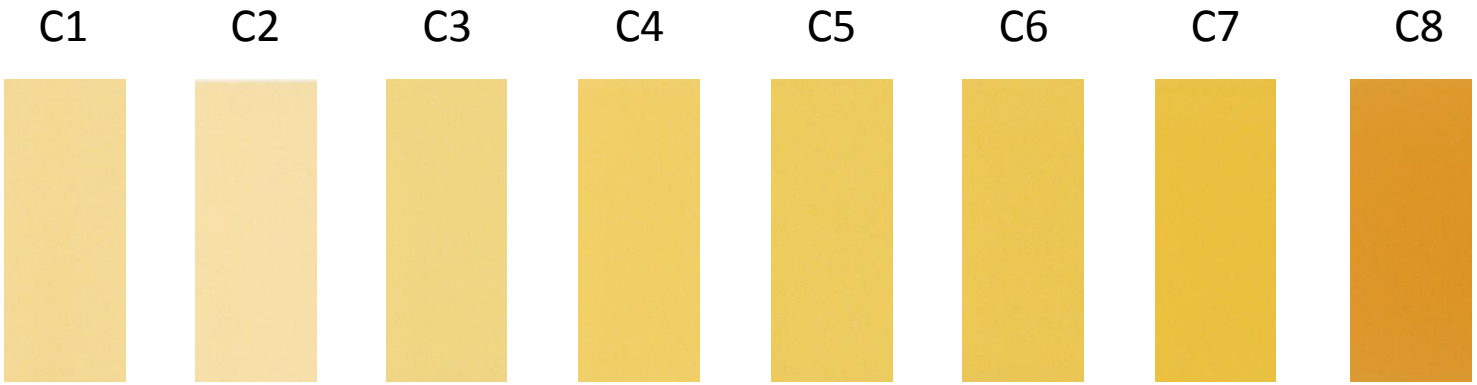
Press fraction 1: Sparkling wine with highest acidity, lowest pH, light colour and highest foam stability

Press fraction 2: Sparkling wine with medium acidity, medium pH and medium colour

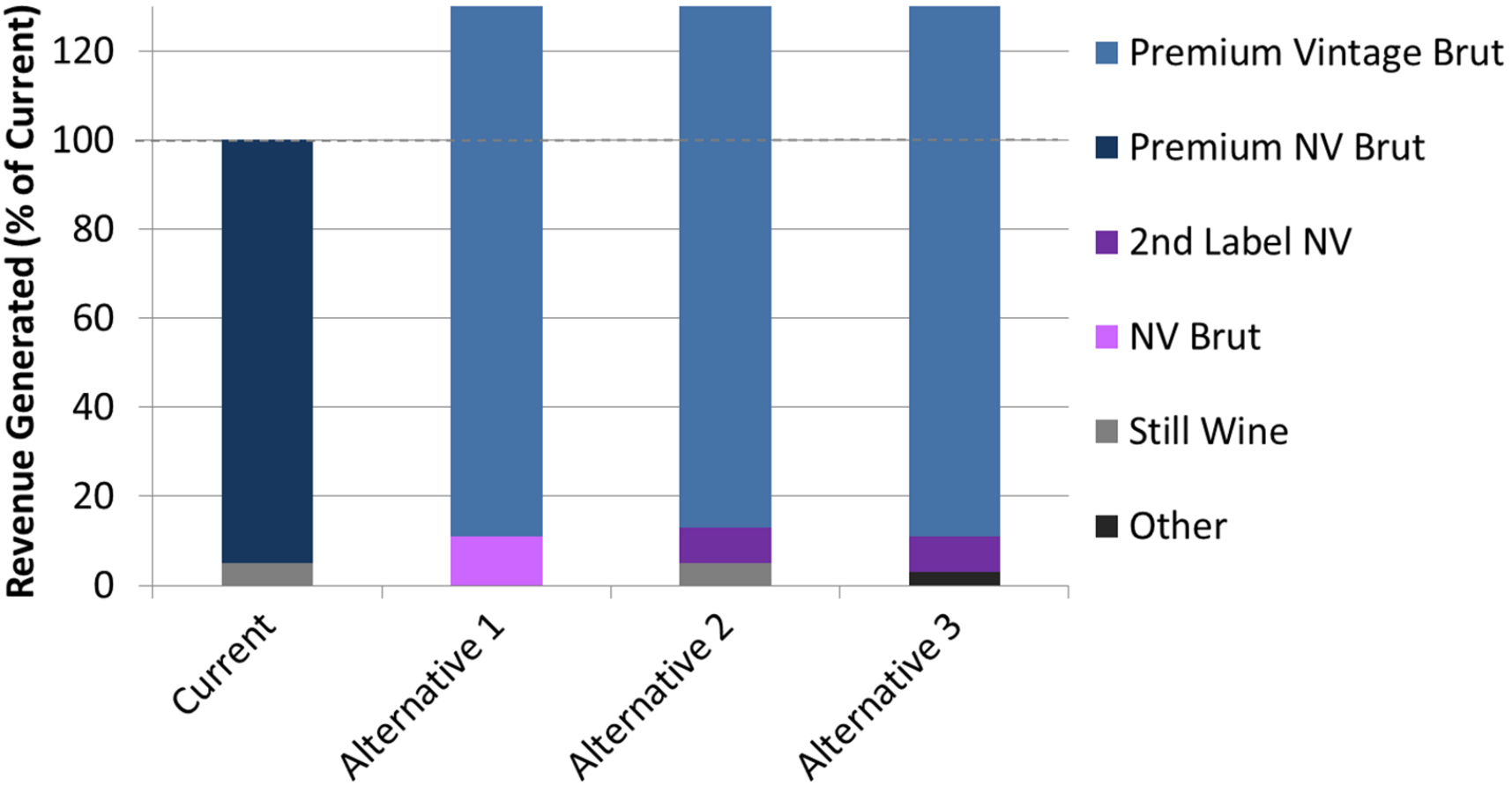
Press fraction 3: Sparkling wine with lowest acidity, highest pH and darkest colour

Grape must colour change during pressing

South of England, Chardonnay – 09/2010



Kemp et al. 2012



Projected revenue generated by alternative press fractioning and tier system decisions, shown in comparison to the estimated revenue generated by the current scheme.

Press fraction composition & considerations

- Aging ability
- Oxidation ability
- Calcium (tartrate potential)
- Potassium (K)/conductivity
- Quality potential

COMPOSITIONAL IMPACT ON FOAM QUALITY

- Proteins
- Polysaccharides during pressing
- Tartaric acid
- Phenolic compounds

Acknowledgements
Leaf removal project

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- Winery assistants/grape pickers/sensory helpers: Stephanie Van Dyke, Mary Jasinski, Jen Kelly, Tom Willwerth, Mark Willwerth, Andrea Barker, Tony Wang, Shufen Xu, Lisa Dowling, Andreanne Hebert-Hache
- Industry partners: Laurie Vineyard, Thomas & Matthias Oppenlander, Trius Winery, OGWRI, Fielding Estate and Millesime.
- Funded by NSERC CRD, Ontario Centres of Excellence (OCE) and Ontario Grape & Wine Research (OGWRI)

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Thank you for your attention.
Any questions?