Cool Climate Oenology & Viticulture Institute

Brock University

A comparison of clones from Champagne and Burgundy grown in Ontario for sparkling wine production

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Contents

- Background information
- What is a clone?
- The research project
- Juice & base wine results
- What does it all mean?
- Is it meaningful?

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Aims & objectives of the study

- ❖ Part of large, long term clonal study
- ❖ Investigate varieties & clones used for sparkling wines in Ontario
- ➢ Vineyard performance - Cold hardiness clones, yields…..
- ➢ Proteins in a variety of grapes destined for sparkling wine
- ➢ Effect of soil type on variety/clonal performance & sparkling wine flavour?
- ➢ Do the flavour differences observed in base wines made from single clones appear in the final sparkling wines?

What is a clone?

Parent grapevine

Cutting

Grafted onto rootstock

Definition of a clone in a viticultural context

(Richard Smart in Robinson & Harding (2015))

A single vine or a population of vines all derived by vegetative propagation from cuttings or buds from a single "mother vine".

Importance of clones

- Allows for “selection” to address a specific issue i.e. disease resistance, yield etc.
- A distinguishing quality in vineyard specifically for wine style (still vs. sparkling wine)
- Climatic differences

- **Chardonnay**

Early bud break, susceptible to spring frosts, susceptibility to botrytis & powdery mildew.

- **Pinot noir**

Genetically unstable, more clones than any other grape variety, susceptibility to Botrytis & powdery mildew

Overview
Sparkling wine clones

- **Pinot Noir clones for sparkling wines** = higher acidity, higher yield & lower anthocyanin & tannin content than their table wine counterparts. *(Jones et al. 2014).*

- **Chardonnay for sparkling wines** = larger berries, higher acidity, low pH, sugar:acid

There are clear implications of clonal selection for adequate yields and sugar:acid for sparkling wine, although impacts on fruit quality have largely been ignored.
(Jones et al. 2014).

Importance of sparkling wine clones

Clone considerations for Ontario
Cold hardiness
Disease resistance Skin breakdown Sour rot Botrytis
Yield
Composition: acid, pH, °Brix, low phenolics

2016 Chardonnay clones from NOTL

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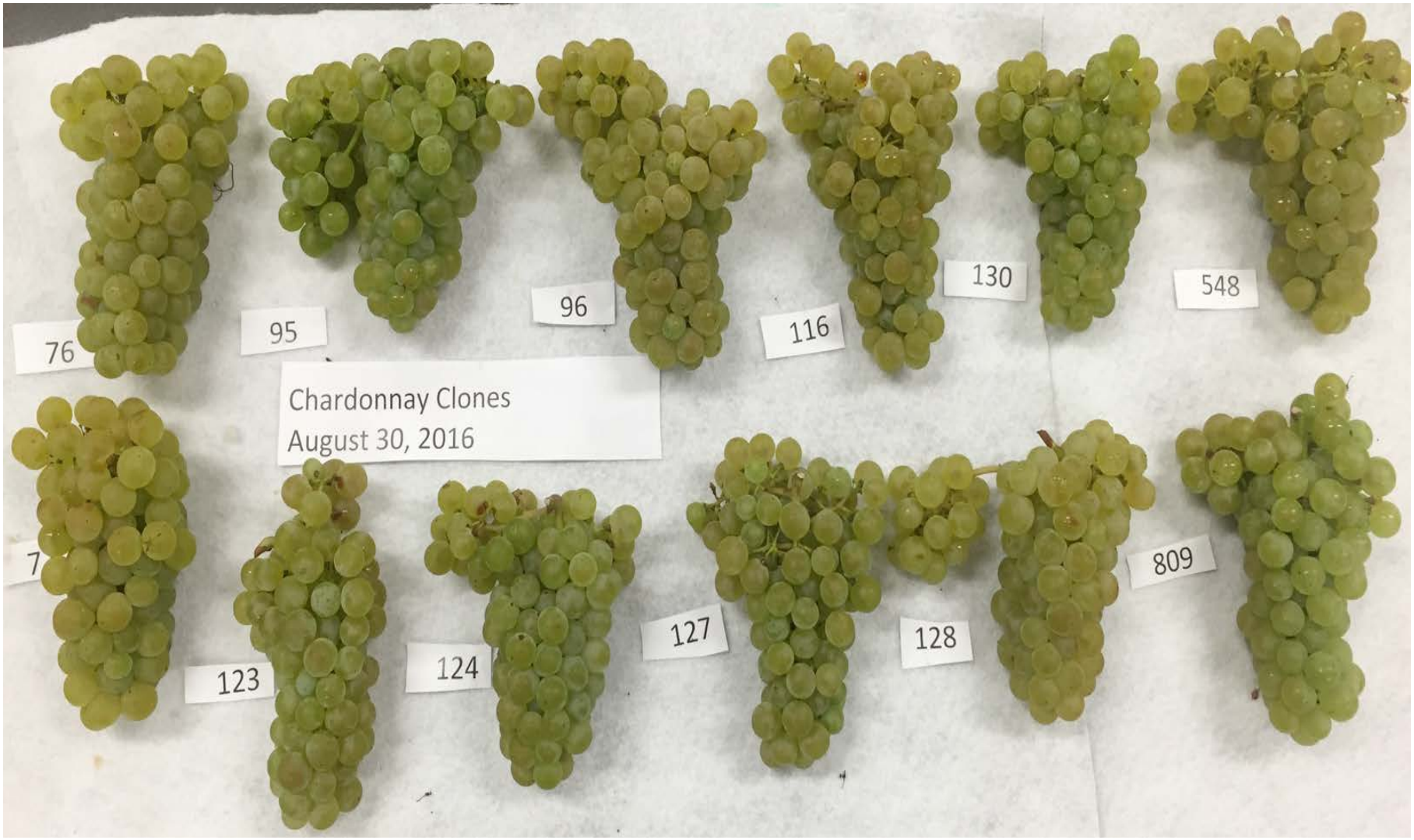

2016 Pinot noir clones NOTL

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Chardonnay and Pinot noir Clones

(Diagram by Esther Onguta)

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Chardonnay	Pinot Noir
cl 95	cl 459
cl 548	cl 386
cl 127	
cl 128	

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How did we choose the final clones for further study?

Chardonnay clones

548

ENTAV-INRA®

Small berries

High sugar

High acid

Light crop

Early ripening

95

ENTAV-INRA®

Low – med berries

Med bunch weight

Med yield

High sugar

Low-med acidity

Med-high vigour

***127**

FPS 74 is known in Italy as SMA 127?

Originally from Italy via California?

High acid

High sugar

Med cluster weight

For sparkling wine in Italy

128

ENTAV-INRA®

Med – high berry size

Med-high fertility

Med-high cluster weight

Med – high acidity

Pl@nt Grape Project http://plantgrape.plantnet-project.org/en/cepage/Chardonnay%20B#128

*Foundation Plant Sciences (FPS) http://iv.ucdavis.edu/files/24489.pdf

Pinot noir clones – Origins & characteristics

- **Pinot noir clones from Champagne are capable of larger yields.**
- **Burgundy Pinot noir clones often have smaller bunches, generally higher sugars & lower yields than Champagne clones.**

- **459** ENTAV-INRA®
- **High cluster weight**
- **Med-high fertility**
- **Med-high berry size**
- **Med sugar**
- **Med acidity**
- **Med-high colour**

- **386** ENTAV-INRA®
- **Botrytis tolerance in Champagne study**
- **Adapted to sparkling wine if yields controlled**
- **High fertility**
- **Med-high cluster weight**
- **Low-med sugar**
- **Med to high acidity**
- **Med colour**

Contrasting but consecutive years - weather

- **2015 was cooler and wetter than the hot and dry 2016!**
- **Captured weather data includes: Rain (mm), Relative Humidity, average temperature (°C) & solar radiation**

Virgil, NOTL	
Year	GDD
2016	1666
2015	1375

Growing seasons
Willwerth Lab

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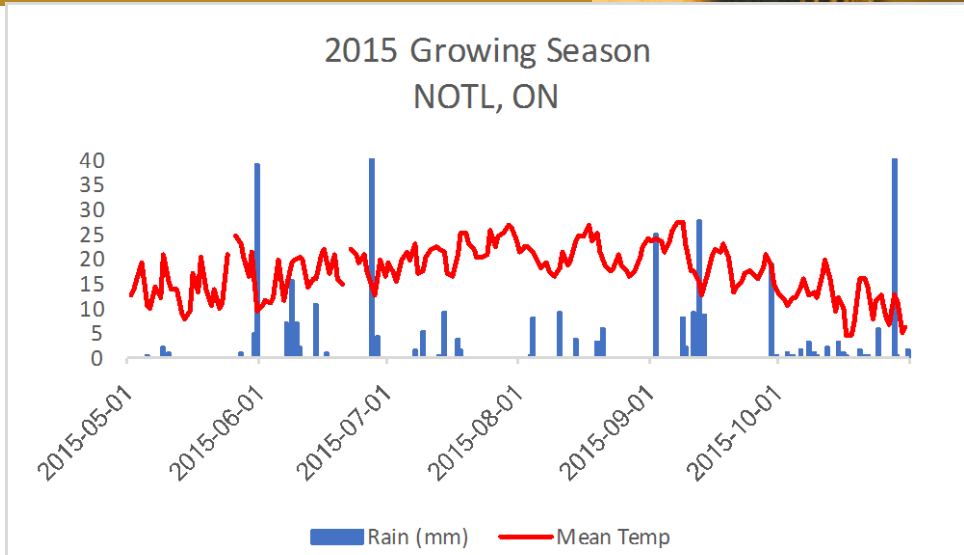
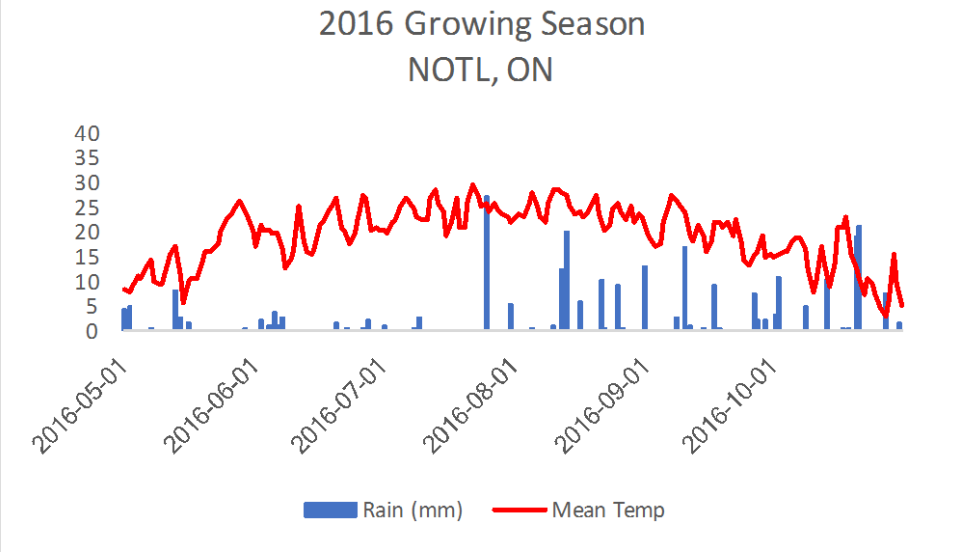
2015: cooler and wetter vintage



2016: very warm vintage with very dry periods from May to August



Vineyard and planting information

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Location	St Davids
VQA Sub-appellation	St David's Bench
Soil series	TLD7; B>B
Parent materials	Mainly lacustrine silty clay
Rootstock	SO4
Vine spacing (row X vine)	2.5m X 0.9m
Number of rows; vines per row	4 rows/clone 376v/row
Training system	Double Guyot –
Floor management	Clean cultivation

**Pinot noir was planted in 1993 so 22 years old at initiation of study.

**Chardonnay planted in 1997 so 18 years at the start of the study.

Harvest

- **Hand picked into 15kg bins**
- **Harvest dates:**
  - **2015: Chardonnay Sept 2nd; Pinot noir Sept 3rd**
  - **2016: Chardonnay Sept 2nd ; Pinot noir Sept 6th**
- **Each variety picked on same day & processed on same day.**
- **Target ˚Brix was 18-19 each year**

Yield components – Pinot noir clones used for sparkling wine trials Willwerth Lab

- **Large vintage variation in yields**
  - **Likely due to weather in both winter and growing season**
  - **Both clones are higher yielding with large cluster size for Pinot noir**

Vintage	Clone	# clusters/vine	Yield/vine (kg)	Cluster wt (g)
2015	386	23.7	2.1	92.7
	459	24.3	2.6	108.3
	Sig	*	*	**
2016	386	29.2	4.3	146.3
	459	29.1	4.2	145.2
	Sig	NS	NS	NS

*,**, NS represent $p<0.05$, $p<0.01$ and non significant respectfully

Yield comparisons for P. noir 2015 Willwerth Lab

- **Yield comparison of clones 386, 459 vs commonly planted clones (115, 667, 777)**
- **Generally greater production with larger clusters and berries**

clone	#clusters/vine	cluster wt (g)	yield/vine (kg)	Berry wt (g)
115	17	109.2	1.9	1.23
386	23	92.7	2.1	1.36
459	24	108.3	2.6	1.36
667	14	92.8	1.3	1.30
777	16	84.0	1.4	1.27

Yield components – Chardonnay Willwerth Lab

- Seasonal differences in terms of yields
- **95** is the generally the most productive clone of these four clones

2015			
clone	clusters/vine	cluster weight (g)	yield/vine (kg)
95	23.3^{ab}	103.9^{a}	2.4^{a}
127	23.4^{ab}	96.4^{ab}	2.2^{ab}
548	25.3^{a}	83.5^{b}	2.0^{b}
128	21.0^{b}	89.9^{b}	1.9^{b}
2016			
clone	clusters/vine	cluster weight (g)	yield/vine (kg)
95	37.3^{a}	102^{a}	3.8^{a}
127	32.7^{b}	101^{a}	3.3^{ab}
548	32.9^{b}	92^{a}	3.3^{ab}
128	32.7^{b}	103^{a}	3.0^{b}

Winemaking

Gentle pressing. Triplicate wines fermented with EC1118 for both fermentations

1st fermentation at 16ºC

- **Juice analysis: pH, TA (g/L), malic acid (g/L),ºBrix, YAN (mg N/L), proteins.**
- **Base wine analysis: pH, TA (g/L), malic acid (g/L), YAN (mg N/L), proteins, residual sugar (g/L), free & total SO_2, alcohol (% v/v).**
- **Sparkling wines analysis: pH, TA (g/L), malic acid (g/L), proteins, phenolics, alcohol (% v/v), residual sugar (g/L), free & total SO_2, alcohol (% v/v).**
- **Sensory analysis of sparkling wines**

Initial pressed Chardonnay & Pinot noir °Brix levels

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Chardonnay Clone	°Brix 2015	°Brix 2016
95	19.9 ± 0.0	19.0 ± 0.0
548	19.8 ± 0.1	20.7 ± 0.0
127	18.6 ± 0.1	20.0 ± 0.1
128	18.8 ± 0.6	19.7 ± 0.0

Pinot noir Clone	°Brix 2015	°Brix 2016
459	18.8 ± 0.0	17.8 ± 0.0
386	19.3 ± 0.1	17.1 ± 0.0

Initial Chardonnay pressed juice [pH & TA (g/L)]

Chardonnay acidity and pH levels

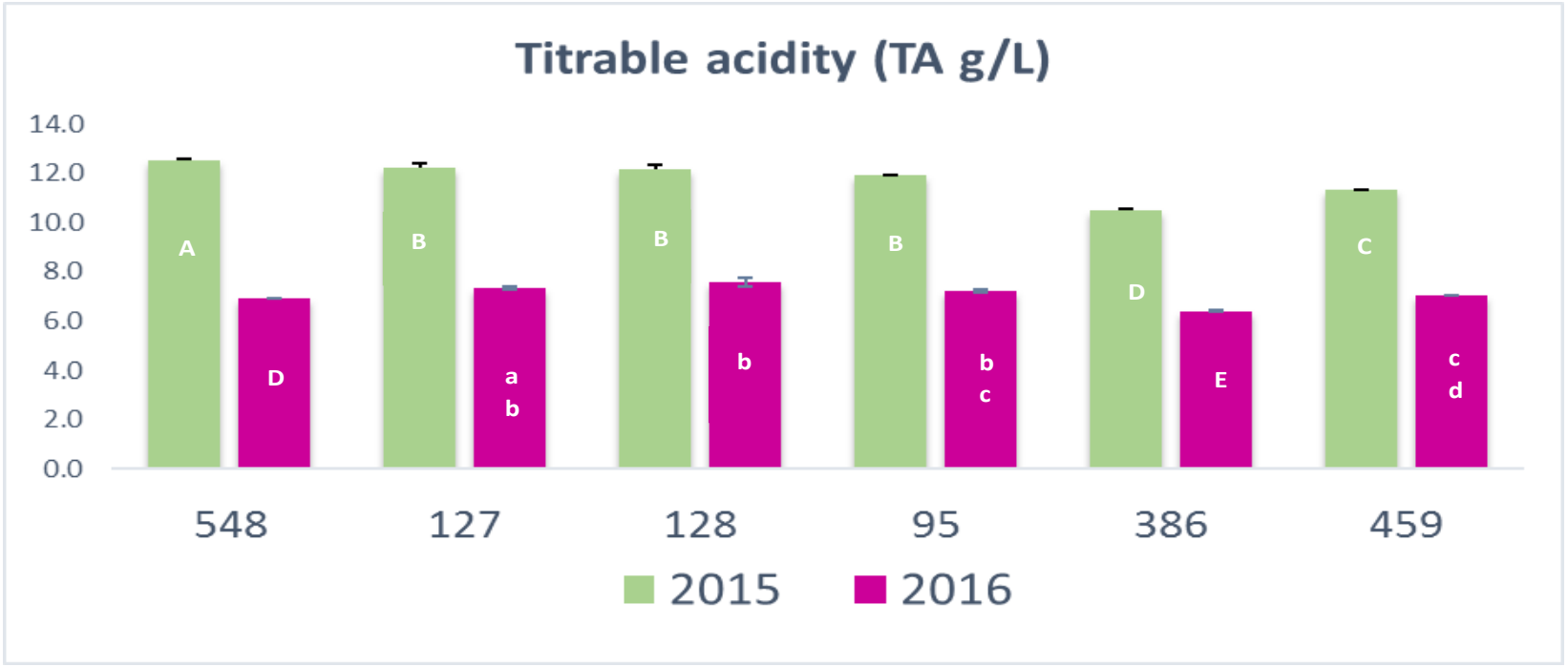
Chardonnay Clone	pH 2015	TA (g/L) 2015	pH 2016	TA (g/L) 2016
95	3.0 ± 0.0	12.3 ± 0.3	3.3 ± 0.0	7.5 ± 0.0
548	3.1 ± 0.0	12.4 ± 0.3	3.3 ± 0.0	7.8 ± 0.4
127	3.0 ± 0.0	12.5 ± 0.4	3.2 ± 0.0	8.1 ± 0.1
128	3.1 ± 0.0	12.5 ± 0.3	3.3 ± 0.0	8.3 ± 0.1

Initial Pinot noir pressed juice

Pinot noir acidity (TA g/L) and pH levels

Pinot noir Clone	pH 2015	TA (g/L) 2015	pH 2016	TA (g/L) 2016
459	3.1 ± 0.00	10.3 ± 0.0	3.2 ± 0.0	7.6 ± 0.1
386	3.1 ± 0.01	9.4 ± 0.1	3.2 ± 0.0	7.1 ± 0.0

Base wine acidity (TA g/L)



Chardonnay & Pinot noir base wine pH Range in 2015: 2.9 - 3.0

Chardonnay & Pinot noir base wine pH Range in 2016: 2.8 - 3.1

Metabolomic analysis of base wines by NMR analysis using a 600 MHz spectrometer

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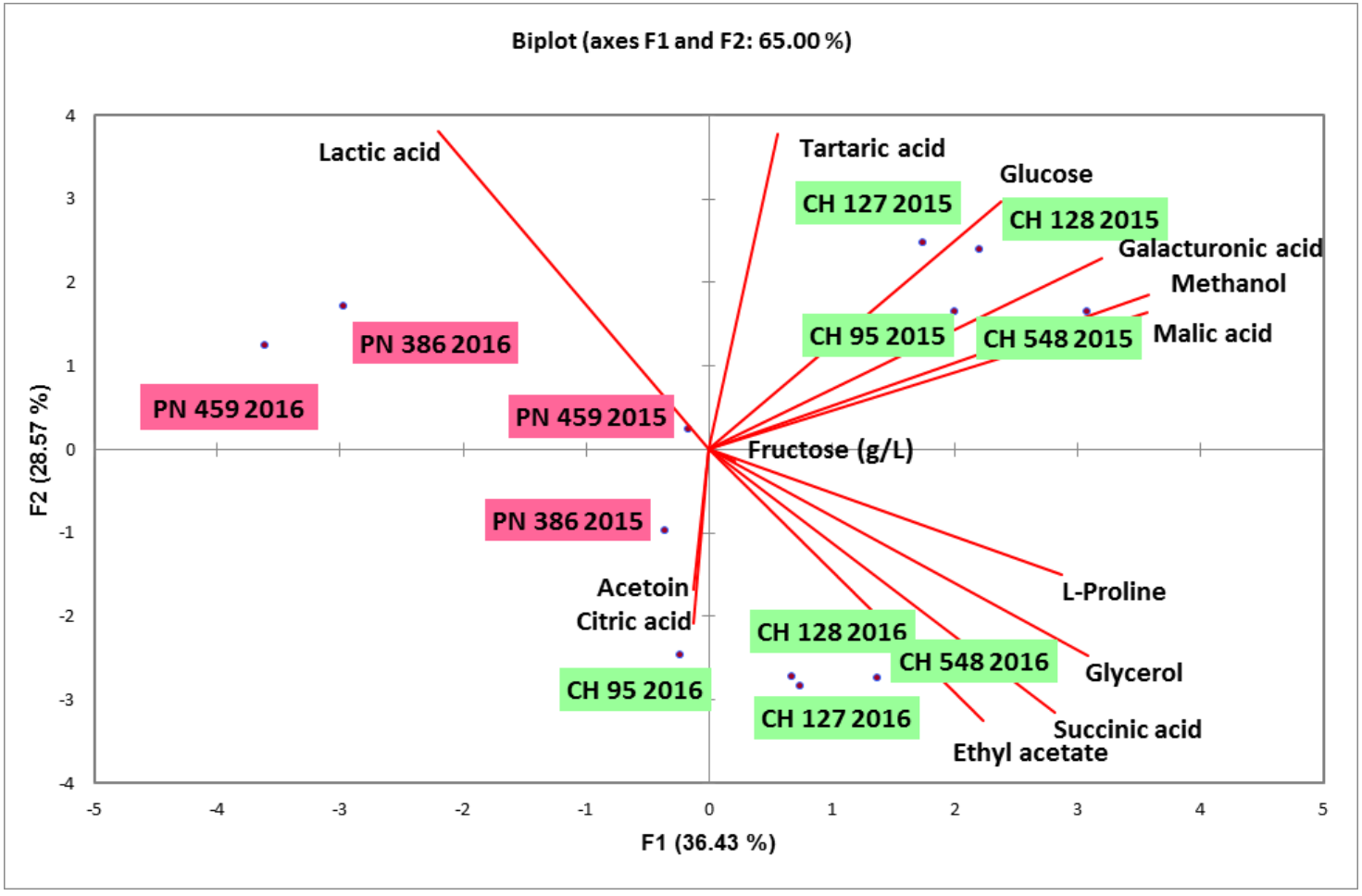
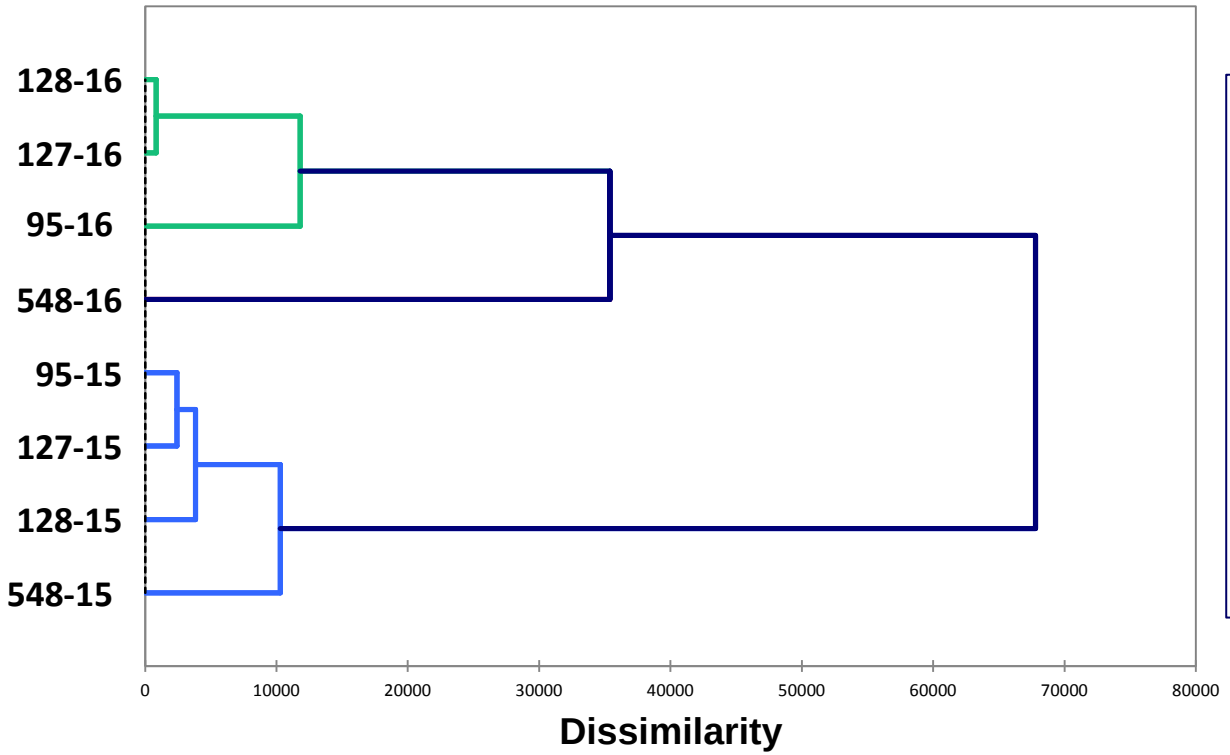


Metabolomic analyses by Institut Heidger, Germany.

INSTITUT HEIDGER

Dissimilarity between base wines of Chardonnay clones

The longer the position the later the object links with the other



Agglomerative: This is a "bottom up" approach: each observation starts in its own cluster, and pairs of clusters are merged as one moves up the hierarchy.

Dendogram from Agglomerative Hierarchical Clustering (AHC) of Chardonnay clones from 2 years.

Cold hardiness - Chardonnay Willwerth Lab

Chardonnay clone	LTE10	LTE50	LTE90
76	-13.98	-15.82	-17.11
77	-15.71	-16.78	-17.59
95	-16.09	-17.9	-19.42
96	-15.97	-16.94	-18.03
116	-14.77	-16.51	-18.05
123	-12.58	-15.62	-16.98
124	-15.07	-16.59	-17.82
127	-14.79	-16.09	-17.4
128	-14.58	-16.13	-16.85
130	-14.04	-16.09	-17.4
548	-13.99	-16.58	-17.08
809	-15.82	-16.37	-17.83

- **Predicted temp at which 10, 50 or 90% of buds will die.**
- **Consistent from yr to yr over 4 yrs.**

Chardonnay 95 is one of the most cold hardy Chardonnay clones.

Cold hardiness – Pinot noir
Willwerth Lab

- Pinot noir clone 459 is slightly less hardy than 386.
- 115 is generally the hardiest.

Pinot noir clone	LTE10	LTE50	LTE90
115	-15.86	-18.97	-19.84
386	-15.92	-17.42	-19.66
459	-14.58	-16.95	-18.15
667	-15.31	-18.05	-20.61
777	-15.99	-18.09	-19.17

Comparison to performance in other regions

- **Clonal evaluations have been reported by research teams in Burgundy, Champagne, Bulgaria, Switzerland, Italy, Australia, Canada, New York, Oregon, Michigan & California….etc…Diff clones**

(Anderson et al. 2008, Jones et al. 2014).

- **Sparkling Pinot noir clones in California 3 yr study (1992-1994) differences in yield & veg growth. Diff clones & climate to Ontario though.**

Mercado-Martín, Wolpert & Smith (2006) & Anderson et al. (2008).

- American clones had higher acid at harvest in a Californian study than Champagne clones

Comparison to results in other regions

- **A sparkling wine clone trial in Australia found that Clone 386 had the greatest yield of all the clones studied = highest bunch number per vine, highest bunch weight & highest berry weight.**
- **Correlates with French experience 386 = superior fertility.**

(Cowham & Anna Hurn 2001)

Summary of clones in Ontario to date..

- **Cold hardiness differences between clones?**

  Even within a variety cold hardiness differences do exist that may impact bud survival
- **No consistent trends in terms of rot/disease observed**
- **Yield?**
  - **Yield components vary among different clone in terms of cluster size/weight and yields/vine**
  - **Seasonal relationships do exist and impact yields among clones**
- **Fruit chemical composition?**

Vintage differences, acid differences..

Further analysis……..

Further research

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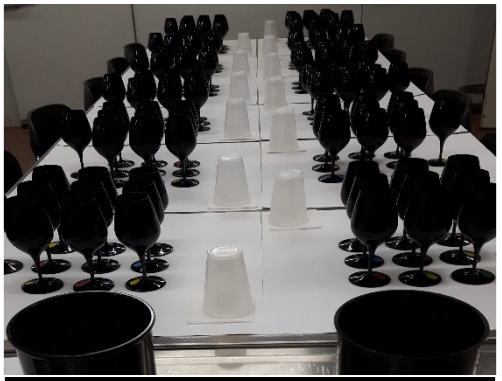
Sparkling wines 2015

- ✓ Chemical analysis of finished sparkling wines
- ✓ Sensory analysis
- ✓ Viticulture data analysis

Sparkling wines 2016

- ✓ Viticulture data analysis
- ✓ Bottled in early January 2017
- ✓ Disgorging & *dosage* in 2018
- ✓ Chemical analysis of finished sparkling wines
- ✓ Sensory analysis



Sensory

Bottling & disgorging

Acknowledgements

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- Institut Heidger, Germany.
- Fielding Estate Winery & Millesime Sparkling Wine Processing Inc.

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Any questions?