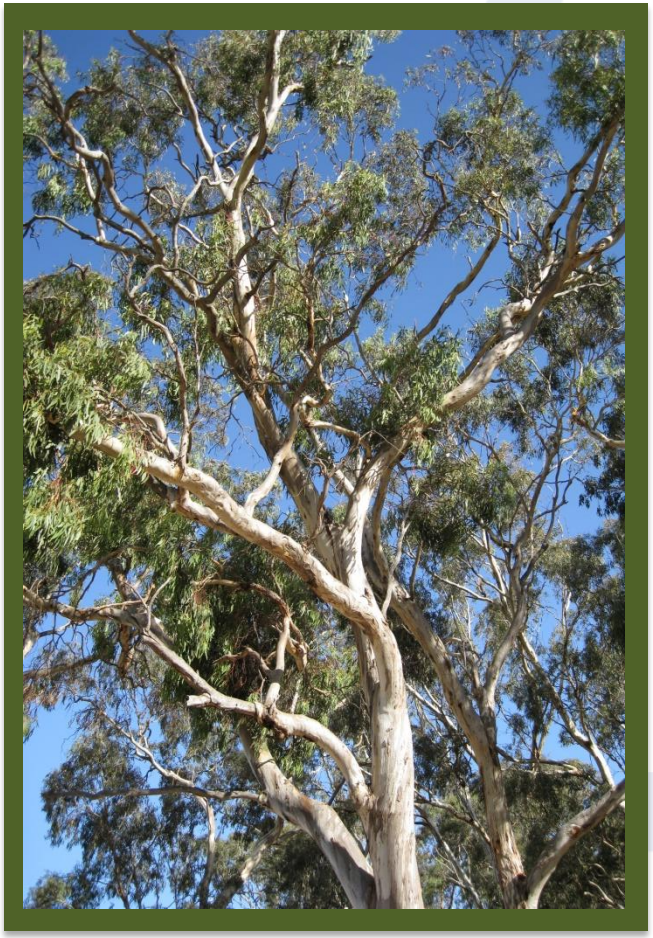
Eucalyptol (1,8-cineole) in wine

Dimitra L. Capone

1,8 – Cineole (eucalyptol)

The Australian Wine Research Institute

The characteristic aroma is ‘eucalyptus’, ‘fresh’, ‘cool’, ‘medicinal’ and ‘camphorous’



Aroma detection threshold in a Californian Merlot is 1.1 µg/L

(ETS Laboratory)

Study by the AWRI sensory team found consumers preferred a wine spiked (4 & 30 µg/L) over the unspiked wine. With a cluster (38%) strongly preferring the wine spiked at 30 µg/L.

(AWRI Tech Rev. #189)

Background on 1,8-cineole

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The origin of 1,8-cineole in wine is unclear

- Herve et al reported that the ‘eucalypt’ character in wines occurs when vineyards are surrounded by *Eucalyptus* trees

- Farina et al proposed that terpene compounds such as α-terpineol and limonene are possible precursors of 1,8-cineole

We wanted to identify the source of 1,8-cineole in wine and study factors which affect its concentration

Developed a method for measuring 1,8-cineole in wine

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Solid phase micro-extraction (SPME) + stable isotope dilution analysis (SIDA – with d_6-1,8-cineole) combined with gas chromatography/mass spectrometry (GC/MS)

- This has been used to determine the origin of 1,8-cineole in Australian wines
- Initially examined how widespread this character is in Australian wines

How wide spread is 1,8-cineole in commercial Australian red wines?

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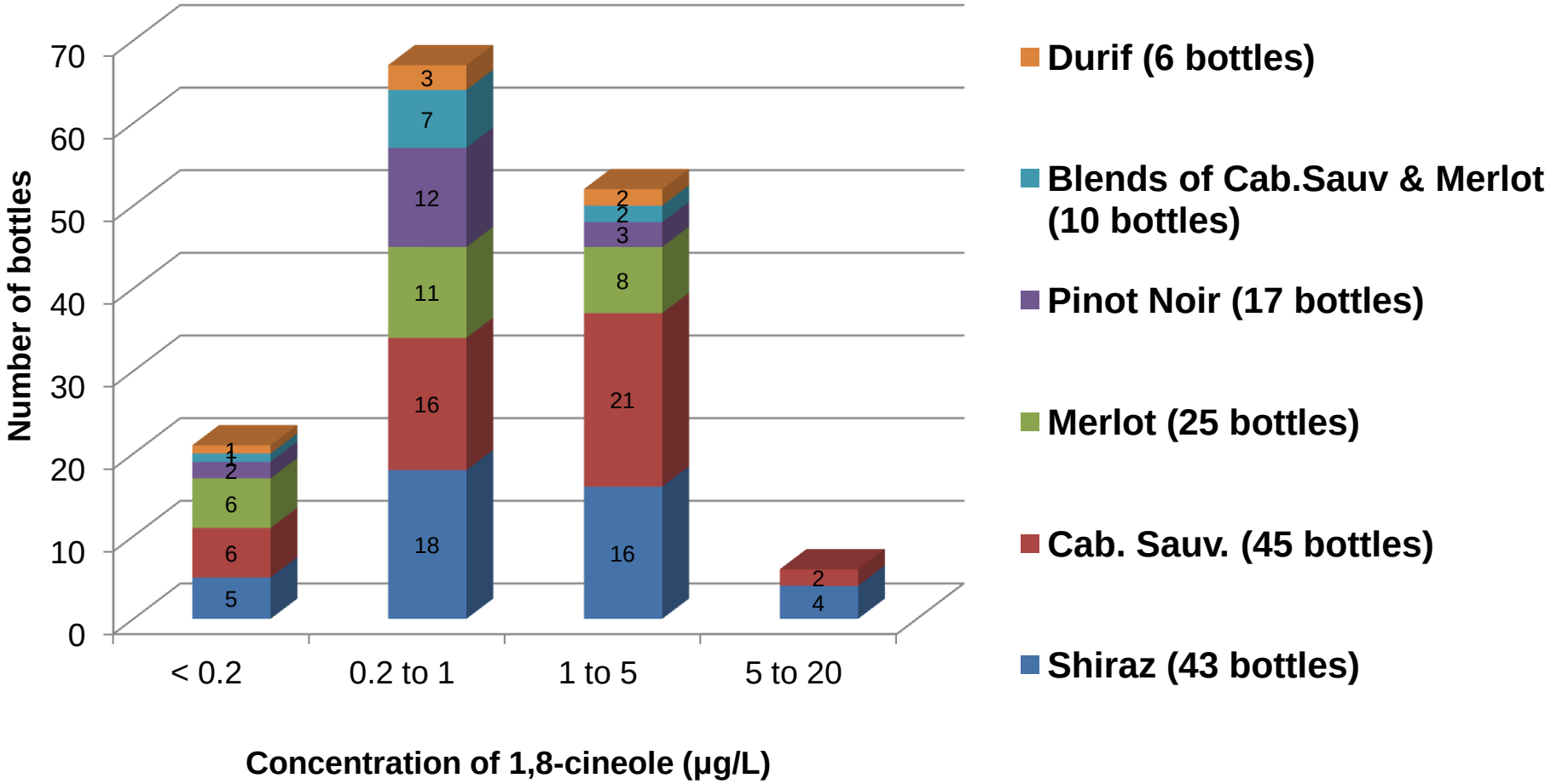

40% contained 1,8-cineole above reported detection threshold.

The highest level of 1,8-cineole found was 19.6 µg/L

1,8-cineole concentration in a New Pinot Noir Wine survey

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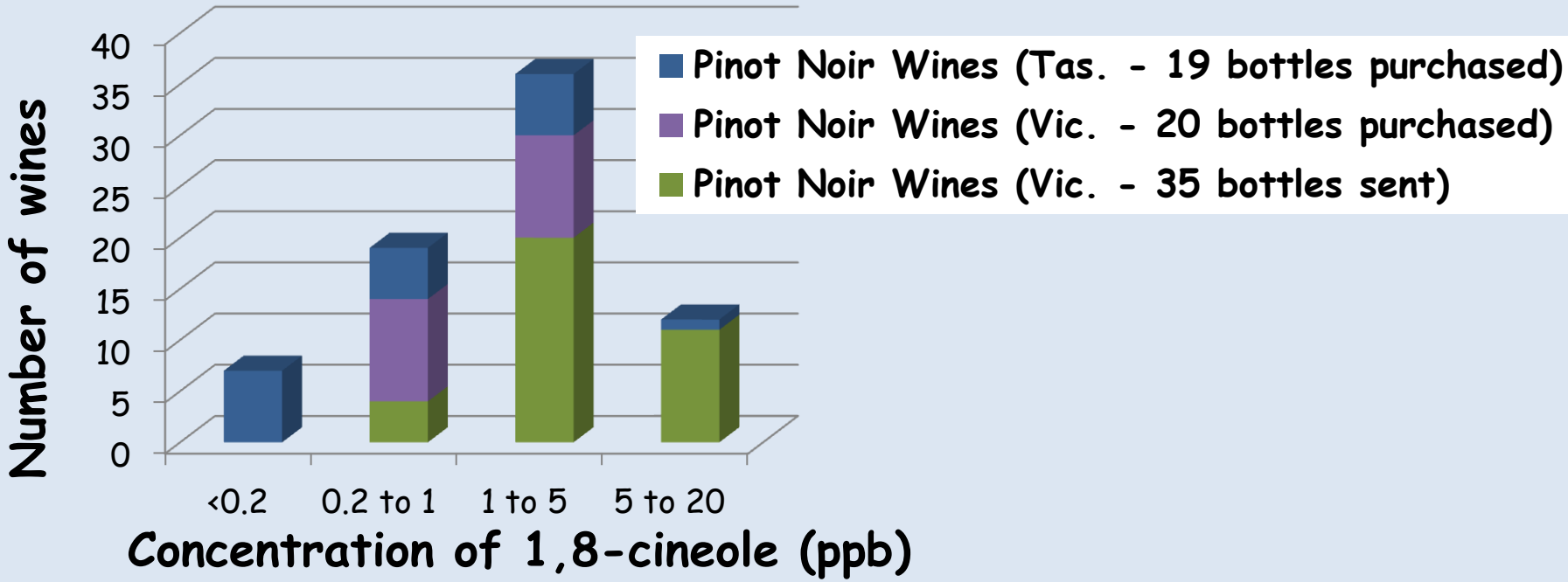

65% of the current Pinot Noir wines analysed contained 1,8-Cineole at or above its aroma detection threshold

50% of the purchased Victorian, 89% of Victorian commercial sent in by industry & 37% of the Tasmanian Pinot Noir wines analysed had 1,8-Cineole at or above its aroma detection threshold

1,8-cineole in commercial Australian Coonawarra Cabernet Sauvignons

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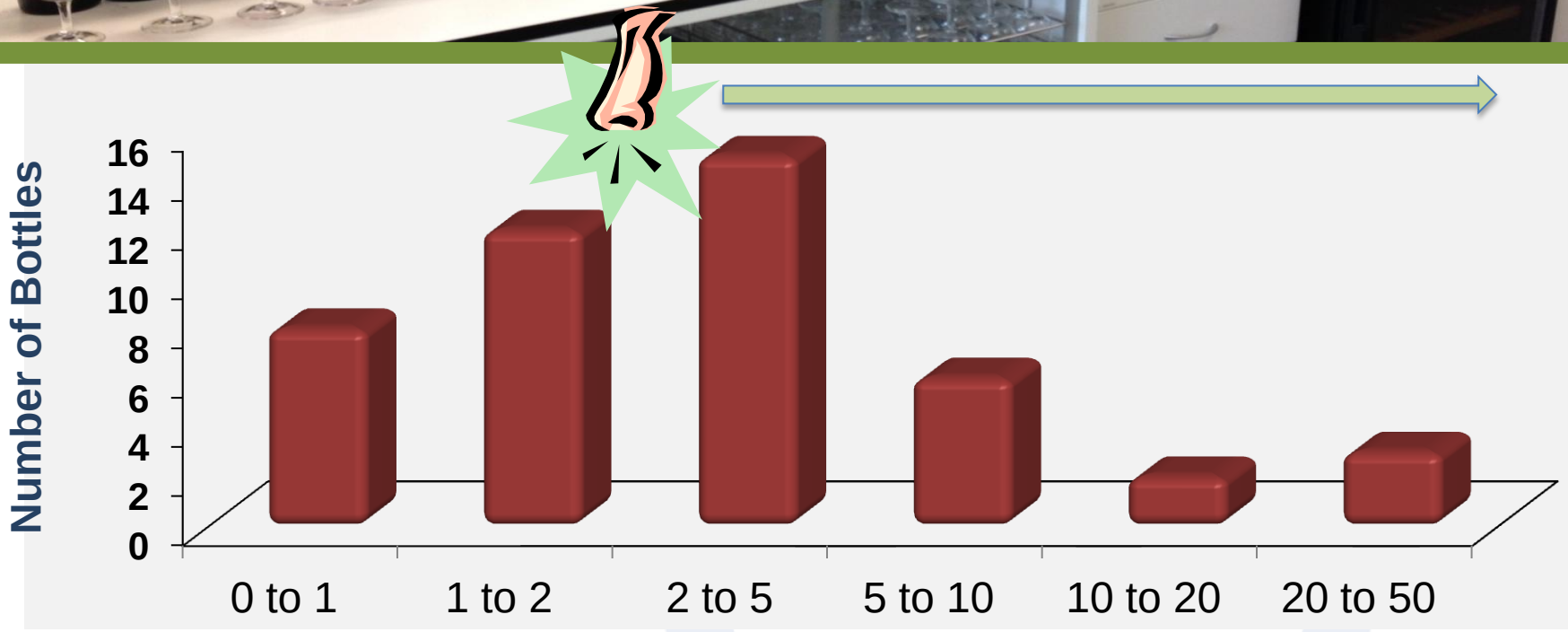

Is 1,8-cineole found in significant concentrations in Australian white wine?

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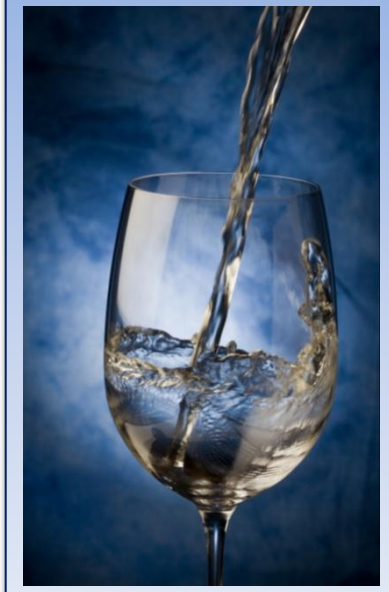
NO!

Out of 44 white wines
(12 Rieslings, 10 Sauvignon Blancs, 10 Semillons and 12 Chardonnays)
1,8-cineole was not detected above 0.8 µg/L in any wine



Formation of 1,8-cineole from precursors?

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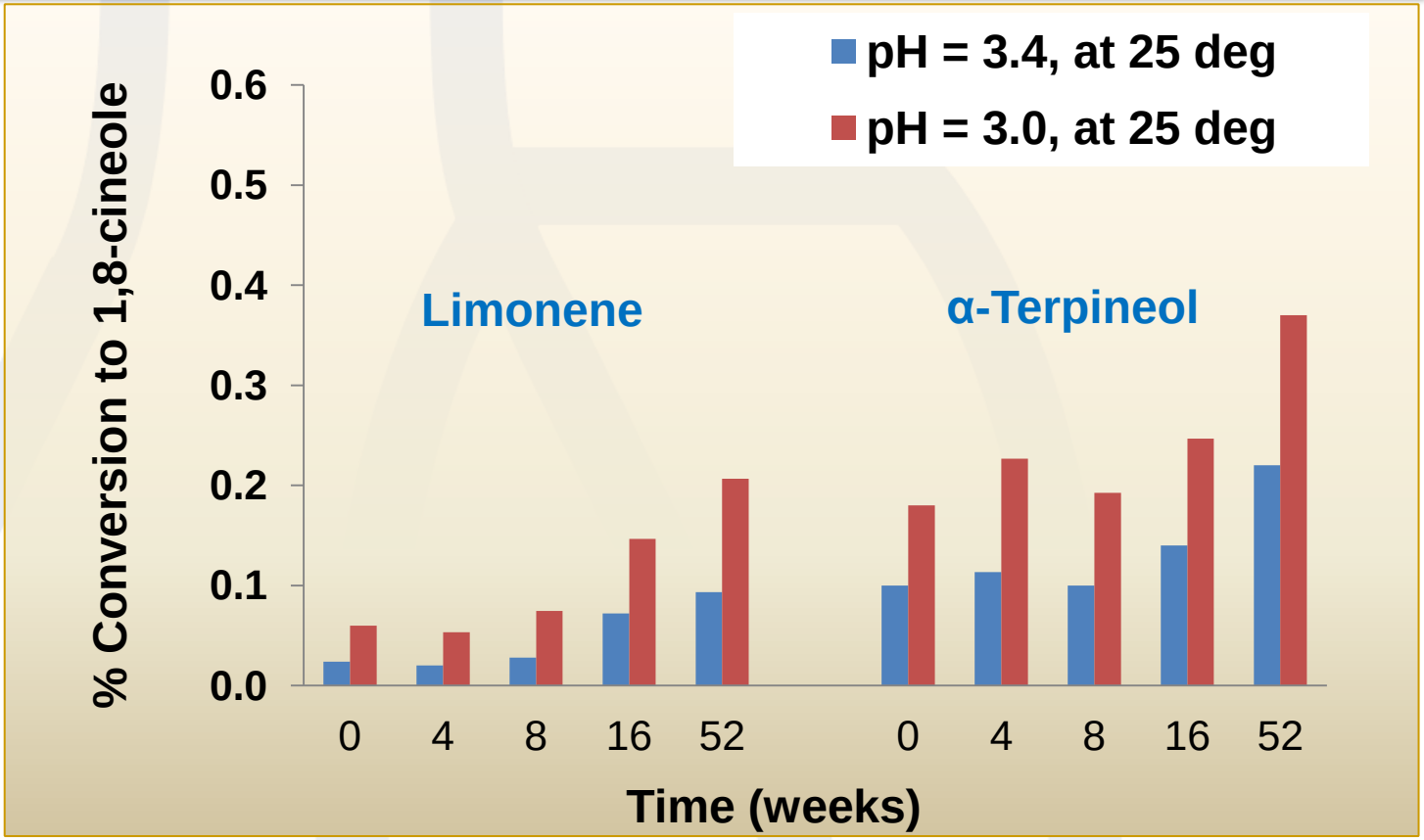
% Conversion to 1,8-Cineole from terpenoid precursors



limonene and α-terpineol not significant precursors

After 12 months of storing model wine spiked with unnaturally high amounts of terpenoid there was less than 0.4% conversion to 1,8-cineole (i.e. sub-threshold formation) at two different pH

Wines obtained from a single vineyard in Western Australia & the Yarra Valley

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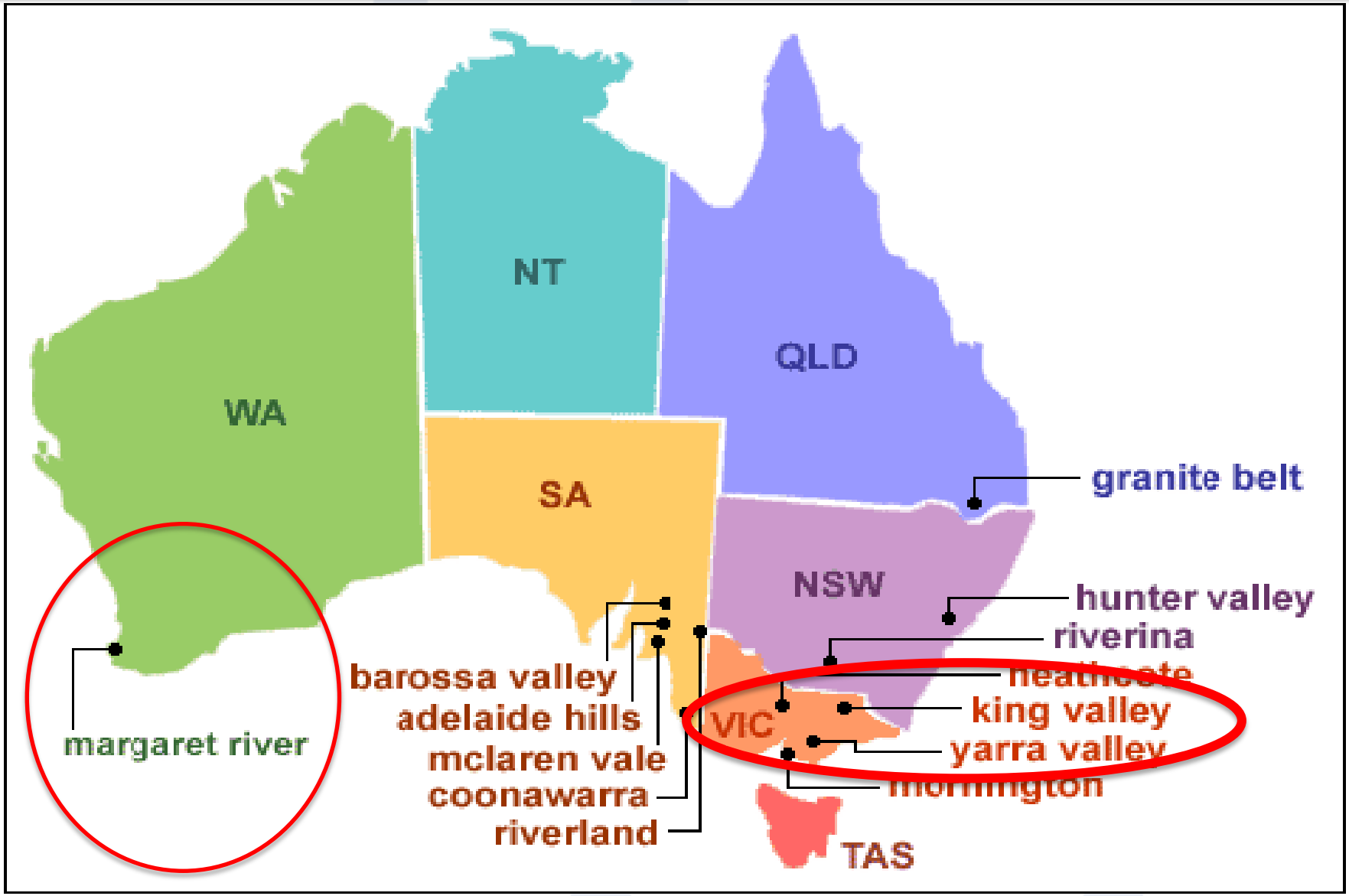
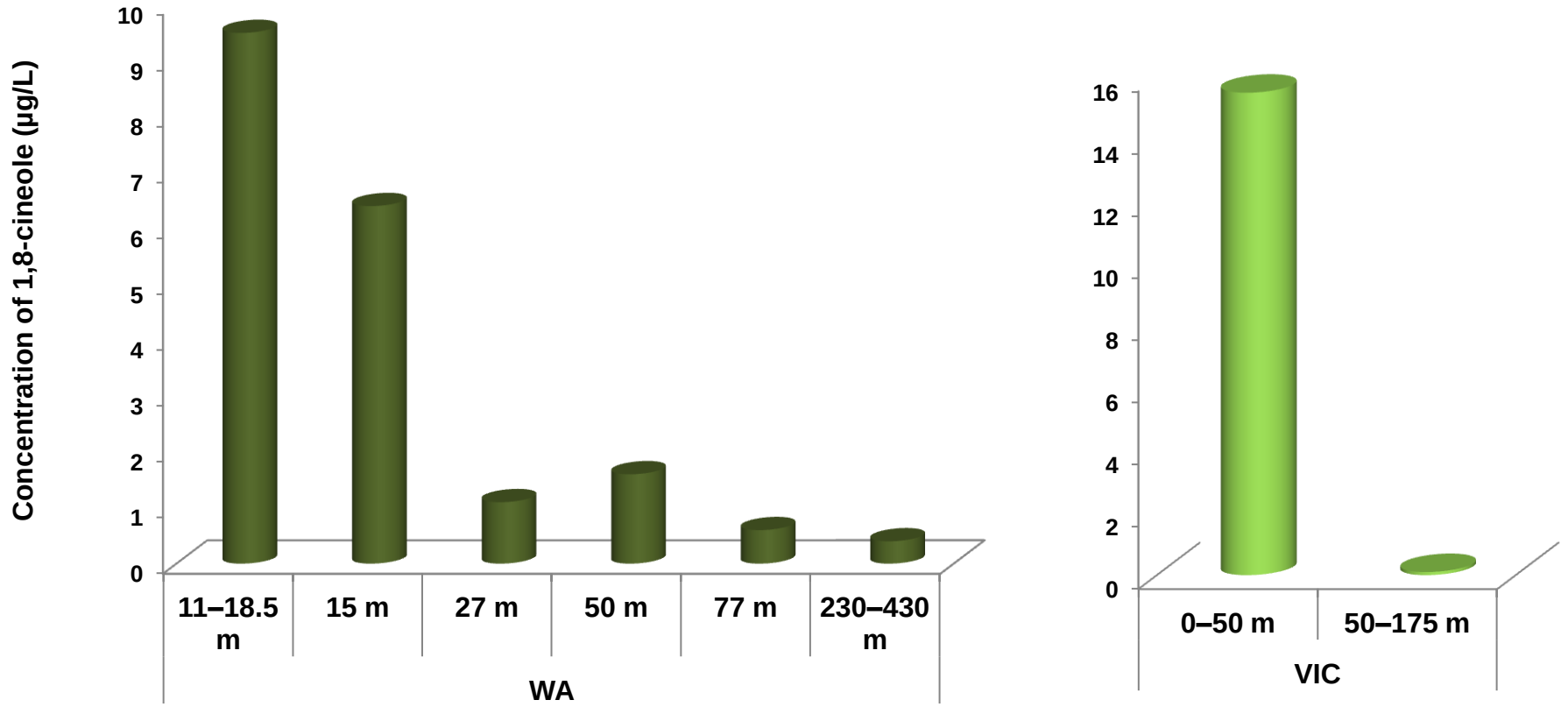


1,8-Cineole concentration decreases

further away from Eucalyptus trees



Commercial ferments

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- Low concentration found in all white wines – is compound accumulated in the skins and extracted during extended maceration?
  - Therefore two commercial ferments were monitored each day throughout fermentation for 1,8-cineole concentration

Cineole increases during fermentation – with skin contact

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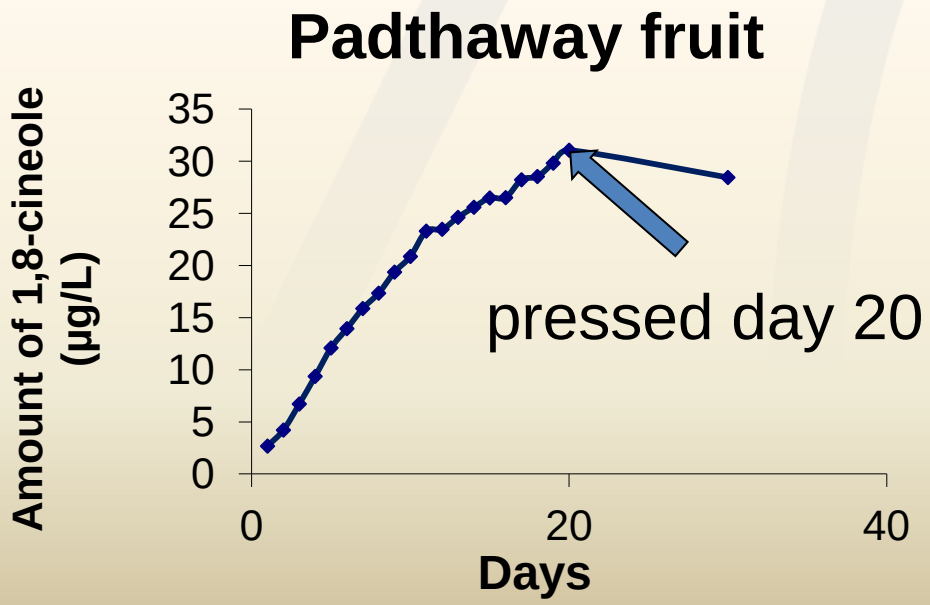
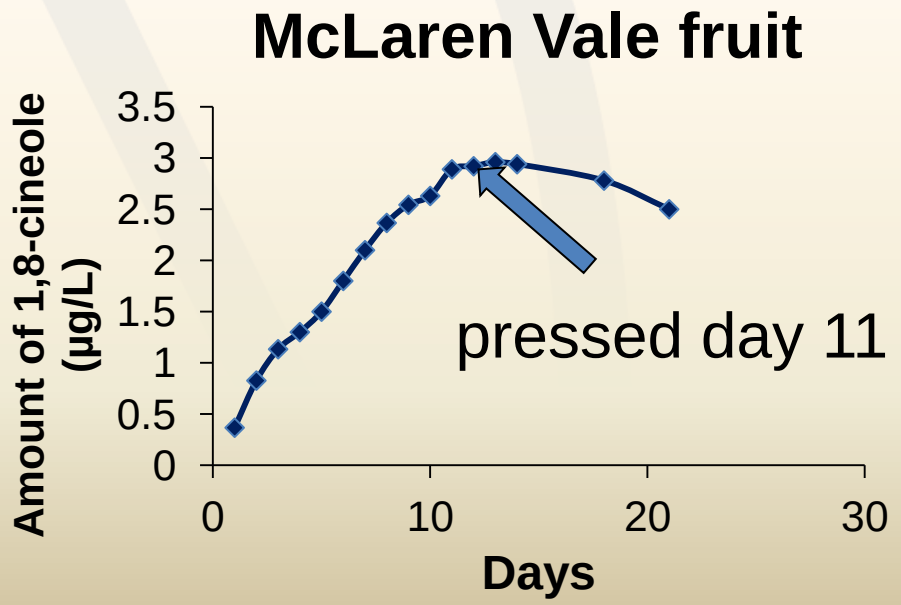
Changes of 1,8-cineole during fermentation

Two commercial shiraz fermentations - Samples were collected and analysed daily

Ferment (1) 20 tonne closed fermentor with Padthaway fruit and

(2) 10 tonne open fermentor with McLaren Vale fruit





Continuous increase in 1,8-cineole concentration, which ceased at pressing off of the skins. This indicated to us that the compound was extracted from the skins and/or MOG

Vineyard studies

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A more detailed study of the relationship between grape composition and proximity to *Eucalyptus* trees was conducted over three vintages.

Grape bunches

Grape stems

Grape Leaves

Eucalyptus trees

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Effect of distance to *Eucalyptus* trees

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Vineyard Study

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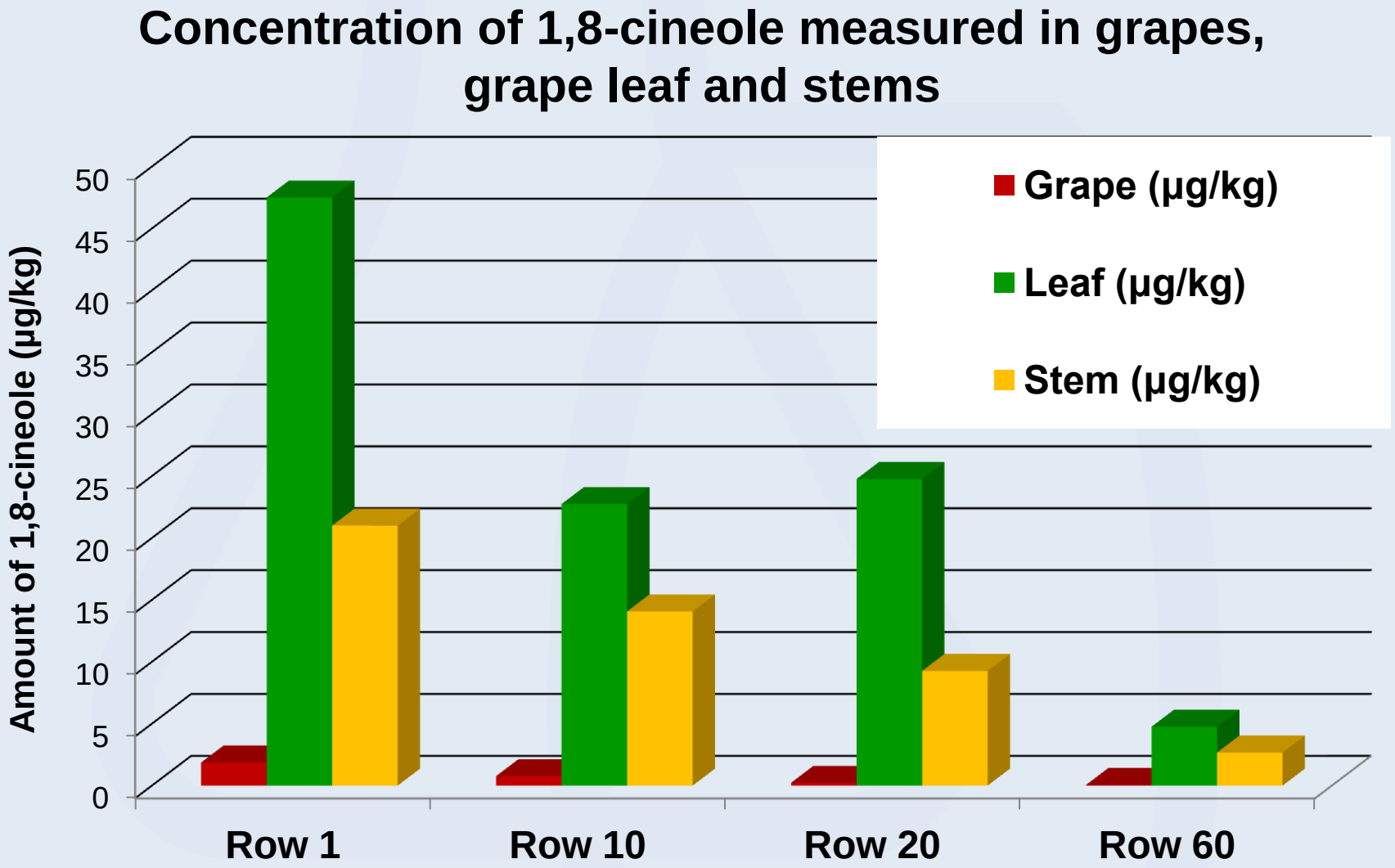

Concentration of 1,8-cineole in grape skins & grape pulp

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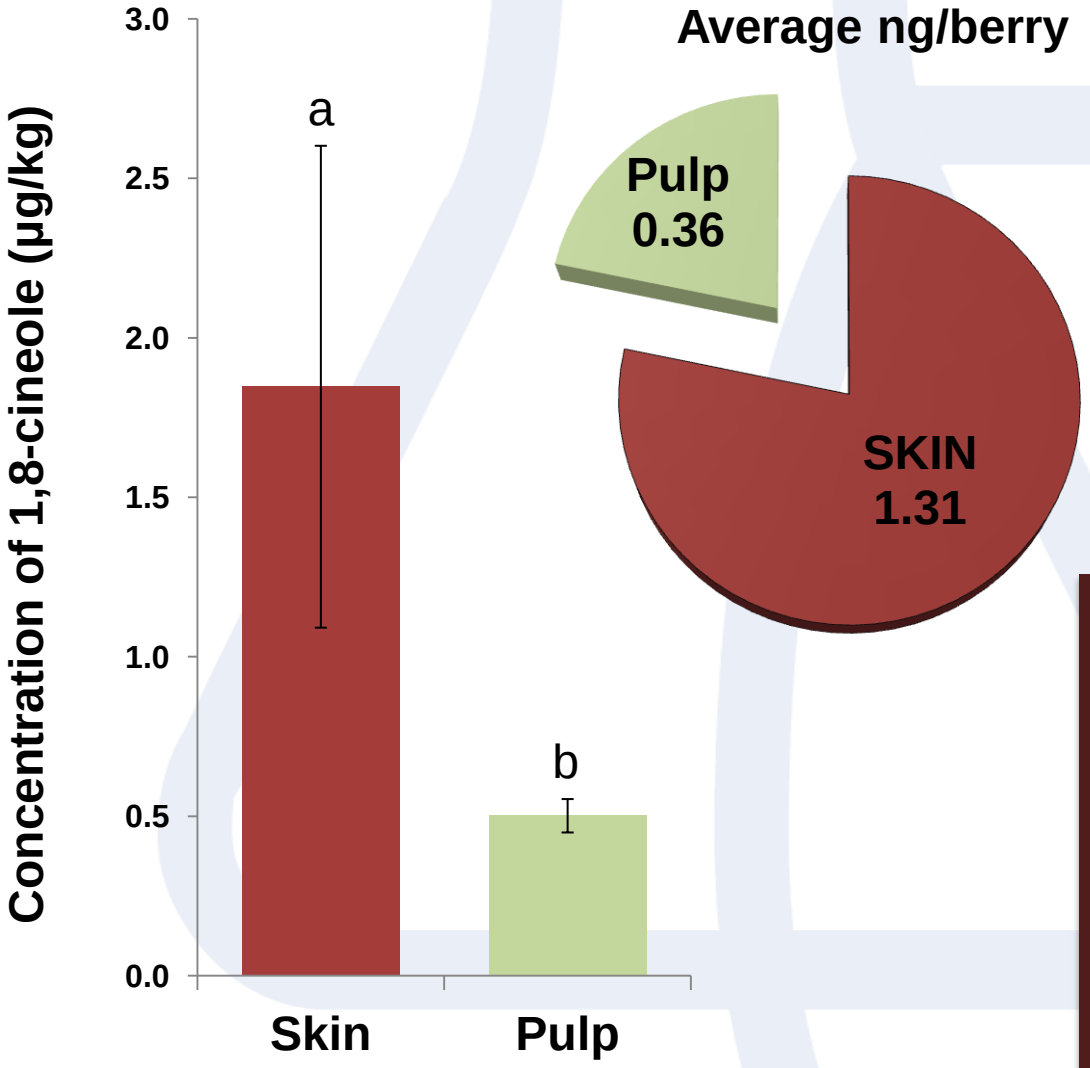

Airborne transmission

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To confirm that airborne transmission plausible:

Traps were designed to absorb eucalyptol from the atmosphere

Polyethylene sheets sewn between wire mesh installed again in

Row 1

Row 10

Row 20

Row 60

Traps installed in both vertical and horizontal configurations

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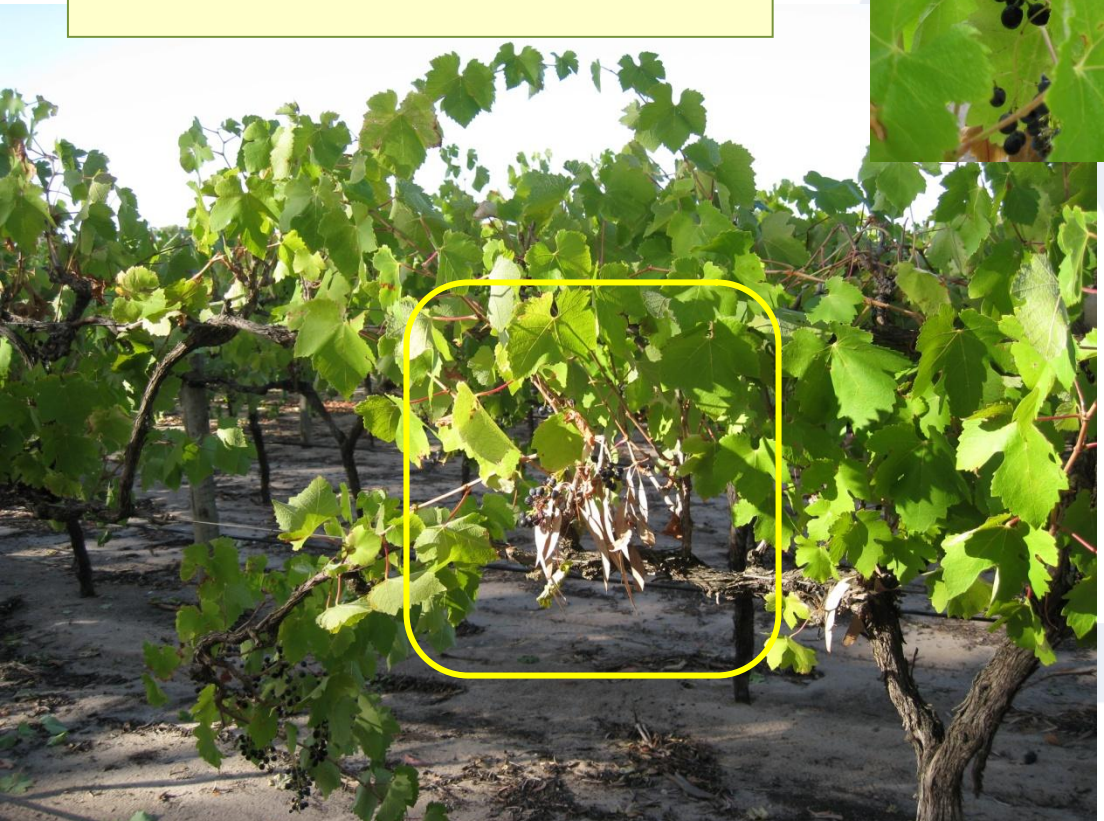
The traps reaffirm the results obtained for the grape, leaf and stem data i.e. greater amounts of 1,8-cineole are found closest to the *Eucalyptus* trees.

Effect of MOG

In Row 1

Found a bunch of *Eucalyptus* leaves and bark in canopy



Total MOG 67.5 gm

in 1 tonne fermenter + with 100% extraction

= 213 µg/L of 1,8-cineole

To determine the effect of MOG on 1,8-cineole concentration

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Block with a history of high 1,8-cineole was chosen

Only the first 3 Rows picked

Rows 1 to 3

- 550 kg of Shiraz Fruit
- Hand picked & randomised
- Duplicate 50 kg lots
- Then Crushed

Fermentation design

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Treatment 1

Rosé
Pressed
Immediately

Treatment 3

Grape Leaves & Stem

Treatment 2

Control
Hand
Plucked

Treatment 4

Eucalyptus
Mix

Fermentation curves: Influence of MOG

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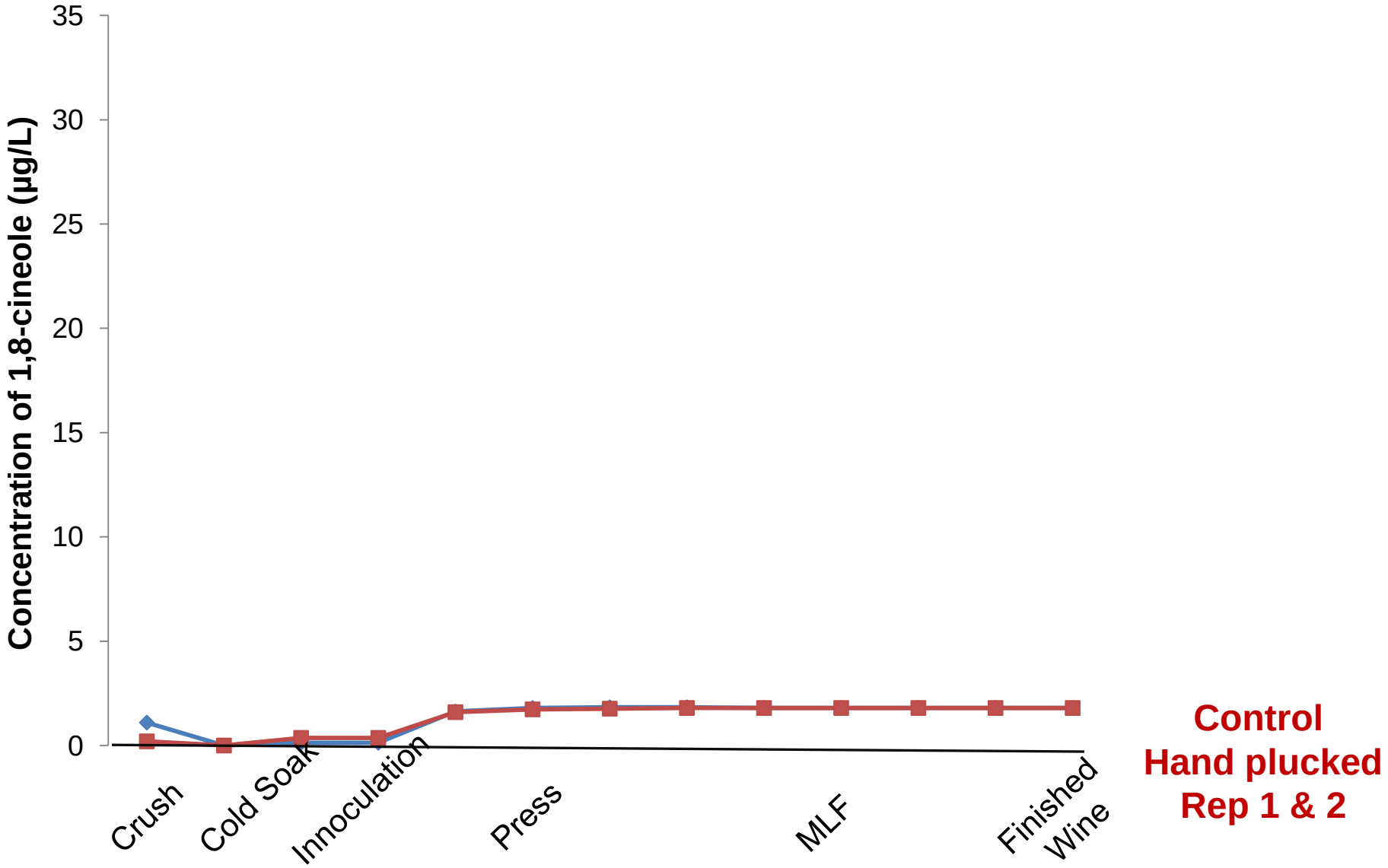

Fermentation curves: Influence of MOG

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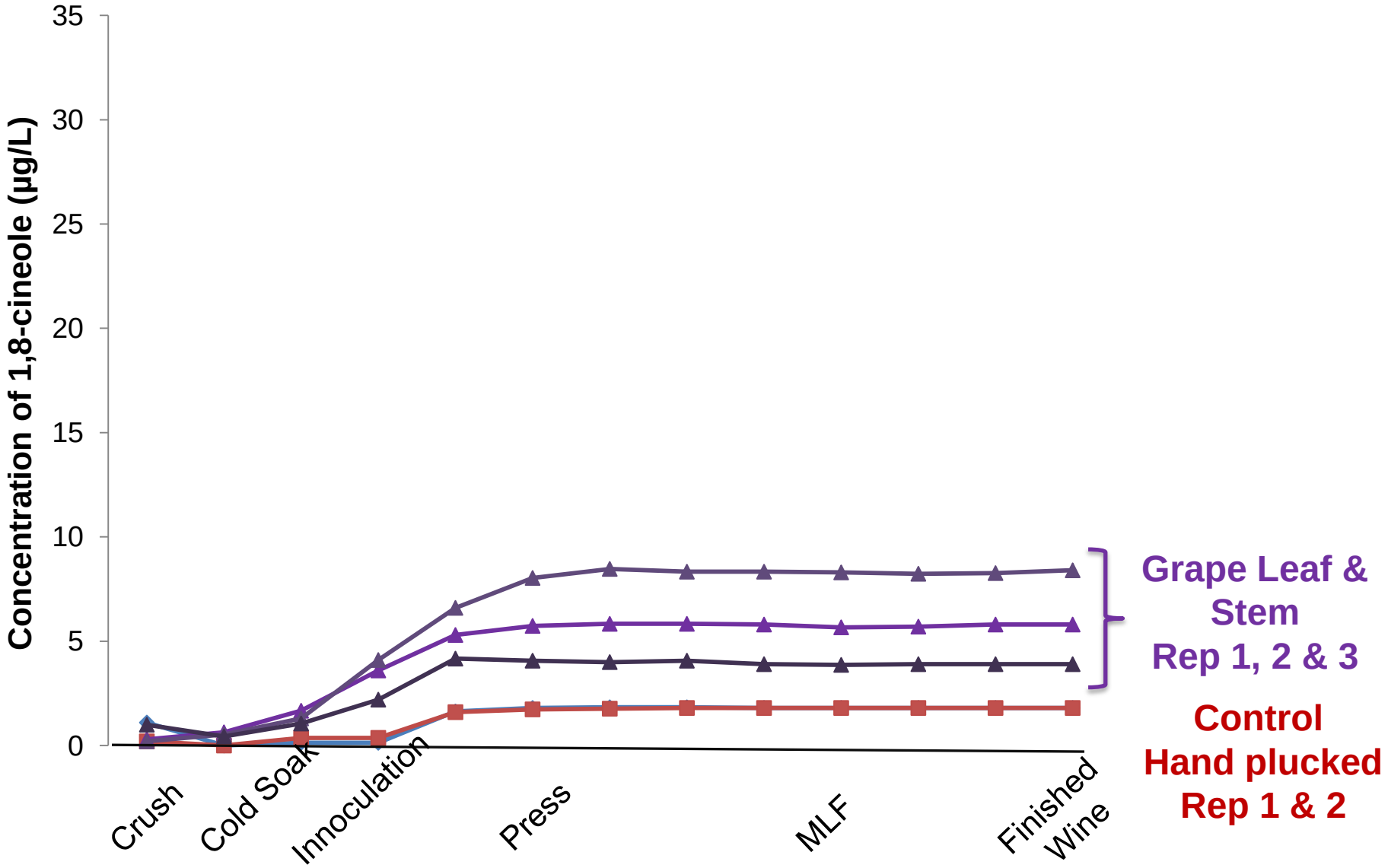

Fermentation curves: Influence of MOG

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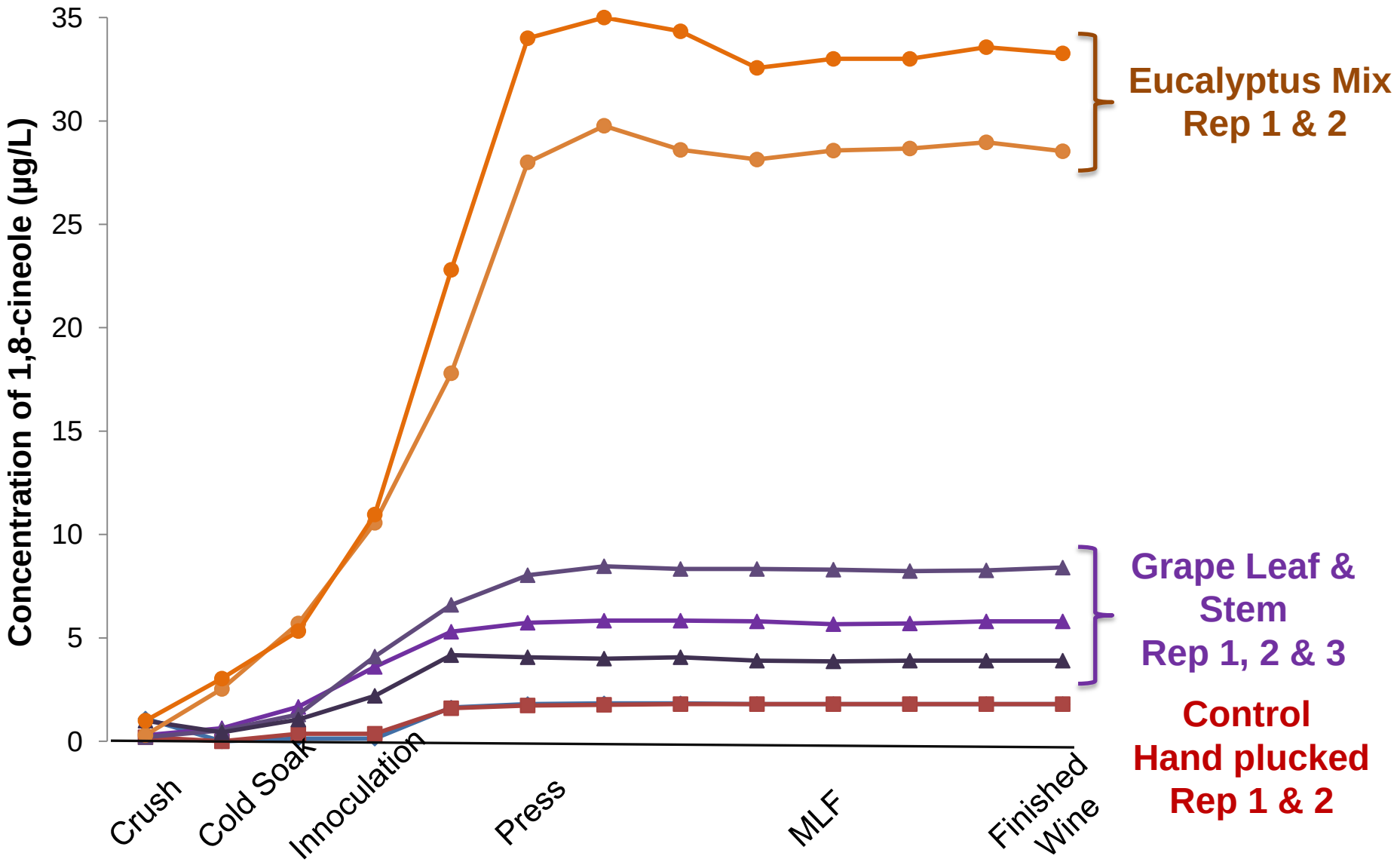

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33 *Eucalyptus* leaves found –

In 550 kg of hand picked fruit

Imagine what a machine harvester might do!

Additional Experiments

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- Translocation is not occurring from the roots of the vine or the grape leaves to the grapes.
- 1,8-Cineole is extremely stable in wine
- Minimal scalping observed for natural cork or screw cap closures and a 14% reduction of 1,8-cineole under synthetic closure over a 12 month period

Conclusions

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- Limonene and α-terpineol do not contribute significantly to the 1,8-cineole concentration in young wines
- The greatest amount of 1,8-cineole in grapes, grape leaf and stem is found in the samples closest to the *Eucalyptus* trees
- The amount of 1,8-cineole increases during fermentation with skin contact
- The presence of *Eucalyptus* leaves, and to a lesser extent grape vine leaves and stems can be a major contributor to 1,8-cineole concentration in some wine

Tips to modulate 1,8-cineole in wine

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- Keep fruit harvested close to trees separate from the rest and blend if desired

To decrease concentrations of 1,8-cineole if desired you could-

- Remove *Eucalyptus* leaves & twigs from canopy close to trees before machine-harvesting
- Eliminate other MOG (especially from rows close to trees) from ferments i.e. sorting fruit on a conveyer belt

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Evolution and Occurrence of 1,8-Cineole (Eucalyptol) in Australian Wine

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Vineyard and Fermentation Studies To Elucidate the Origin of 1,8-Cineole in Australian Red Wine

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Thank you – come visit us in Adelaide

Wine Innovation Cluster, Urrbrae SA

1,8-Cineole (eucalyptol)

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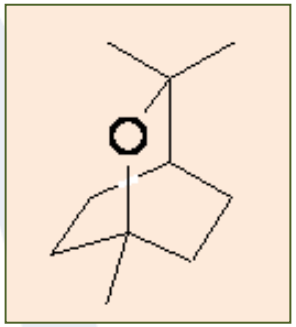
- The characteristic aroma is ‘eucalyptus’, ‘fresh’, ‘cool’, ‘minty’, ‘medicinal’ and ‘camphorous



- Aroma detection threshold in a Californian Merlot is 1.1 µg/L (ETS Laboratory)
- Found only in red wines
- Lower concentration: 5 µg/L
- Higher concentration: 40 µg/L