Manipulating Pinot Noir expression in the winery through novel wine making practices

Bob Dambergs

“Perfecting Pinot Noir”

15th AWITC Workshop 1
Understanding grape and wine tannins

Grape tannins
- colourless polymeric polyphenols
- precipitate proteins $\Rightarrow$ astringent

Red wine tannins
- grape tannins & modified tannins
- plus oak-derived hydrolysable tannins & oenotannins
- include also pigmented tannins (pigmented polymers)
Anthocyanins
• Colour in grapes and young wine
• Unstable
• Do not last long in wine

Pigmented polymers
• Colour in wine
• Tannins with anthocyanin
• Important for long-term colour stability

Grape to wine colour conversion
Winemaking and Aging
Tannin and Anthocyanins
No free anthocyanins in old wines - pigmented tannins dominate colour

- **Vintage 2004**
  - col dens: 11.17
  - hue: 0.70

- **Vintage 1954**
  - col dens: 5.50
  - hue: 1.32

anthocyanins:

- M3G
- M3A
- M3C

pigmented tannins:

- Peo-C-G or Pinotin A
- PP

Other compounds:

- Del-3-G
- Cya-3-G
- Pet-3-G
- Peo-3-G
- M-3-G
- Vitisin A
- Del-A-G
- Pet-A-G
- M-A-G
- Pet-C-G
- Peo-C-G
Predicting wine pigmented tannin potential

\[ [PP] = 0.06 \times [M3G] + 0.04 \times [T] - 2.88 \]

\[ R^2 = 0.92 \]

PP: pigmented polymers
M3G: malvidin 3-glucoside
T: tannins

Can we compensate for low anthocyanins by boosting tannin to promote pigmented tannin formation?
Tannins – so what?

Seeds, skins and stalks of red grapes contain tannins that control:

- Browning
- Colour
- Astringency
- Mouth-feel
- Bitterness
- Protection against oxidation
- Quality
Tannin correlates with commercial quality grading

2005-2007 Hardy Shiraz - but also applied to Fosters and Orlando wines
Tannin and pigment correlate with “quality”

“One of the ultimate quality indicators is price”
- Jancis Robinson, ICCS Hobart
Tannin, pigment and quality: wine show performance – cluster analysis

Class 18, 2 yo Pinot, Tasmanian Wineshow

Best wines have an ideal combination of tannin and pigment

The judges got it wrong!

See also: Poster 107, Chittendon & Dambergs, NZ Syrah
Tannin and pigment analysis correlates with sensory

**Bi-plot**

- **PC-1 (35%)**
- **PC-2 (21%)**

**Labels:**
- Whole bunch
- Destemmed
- Hue
- Cherry
- Herbal
- Stalky/sappy
- Spice

**Circles:**
- Tannin taste
- Tannin analysis
- Total phenolics
- Visual Colour
- Plum
- Pigmented tannin
- Colour density
- Total Pigment

**Samples:**
- Pinot Massif
- Destemmed whole bunch
- Destemmed

**Dimensions:**
- 720.0x540.0
“Bob’s modified Somers analysis”

Samples are diluted in a wine-like buffer with

— no additions
— with acetaldehyde added
— with high SO₂ added

- provides control of pH, ethanol to minimise their effects on colour
- samples can be read in 10 mm cuvettes instead of 1 mm
- can be adapted for use in a plate reader spectrophotometer
Simplified wine analysis

Modified Somers and tannin analysis

• Colour density
• Hue
  • Anthocyanin*
  • Total pigment*
  • Total phenolics*
  • Pigmented tannin*
  • Total tannin*

*can be analysed with the
AWRI Tannin Portal
0.2 mL wine

After incubation period, transfer to a cuvette

10 mL 1M HCl

Read at 6 wavelengths in a UV-Vis spectrophotometer, using 1M HCl blank

Calculate
- Tannin
- Total phenolics
- Total Pigment

Additional calculations
- Requires an extra sample prep (dilution in high SO₂ buffer)
- Free anthocyanin
- Pigmented tannin
The problem with Pinot phenolics

Low total anthocyanins
No acylated or coumarylated anthocyanins
Grapes have high tannin but it’s mostly seed tannin
Wines have relatively low tannin and colour
Optimising phenolic development during red wine maceration

Need to synchronise

- extraction of anthocyanin
- extraction of tannin (skin, seeds and stems?)
- availability of active yeast metabolites
- promotion of anthocyanin/tannin reactions to form stable pigments
Small-lot winemaking

- The weighbridge
- The tank farm
- The crusher/destemmer
- Fermentation monitoring
- The Bodum fermenter/filter/press
Experimental winemaking treatments

- Control
- Cold macerate 4 days at 4 °C
- Extended post-ferment maceration (45 days)
- 20% juice runoff before fermentation
- 20% juice runoff, returned in 2 stages near end of ferment
- Stems added back
- Oak powder added
- all inoculated with RC212
- submerged cap ferments, 28° C
Tannin can be manipulated during fermentation

Not equivalent to tannin !!
An example of rapid colour stabilisation

**ANTHOCYANIN**

**PIGMENTED TANNIN**

more stabilised colour!!
Cluster analysis (PCA) - all samples

- Tannin
- Hue
- Pigmented tannin
- Colour density
- Anthocyanin
- Total pigment
- Phenolics
- Tannin

Scores

PC-1 (68%)

PC-2 (21%)

Legend:
- cold_macer
- control
- ExtMac45
- ExtMac45
- run_return
- runoff
- stems
- oak
RC 212 control
EC1118
Bayanus: AWRI 1176, AWRI 1375
Hybrids: AWRI Fusion, AWRI 1503
TD+ 1118
Carbonic maceration
White skins
Cold soak, then wild ferment
Cold soak, wild primary, delayed wild malo
Co-fermentation with Pinot Gris or GT
Stalks
Transfusion (run off juice and return near end of ferment)

ICCS Workshop 2-
“Taming the Pinot noir terroir”
with Nick Glaetzer and Jenny Bellon

15th AWITC
Poster 111, Glaetzer et al
Poster 110, Magyar et al
Taming tannin

- White skins or stalks added had the highest tannin
- Alternative yeasts lower than RC212
- Transfusion higher than control
Cold soak/delayed malo had highest but it was an unusual plummy colour (Hue_SO₂ !)

- Elevated with most alternative yeasts except for 1176
- Elevated when white skins and stalks added
- Elevated with transfusion
The ratio of pigmented tannin and total tannin

Highest were alternative yeasts and cold soak/delayed malo

Does it affect mouth-feel?
Colour density

- Corrected for SO₂
- High colour density = high visual colour

- Cold soak/delayed malo had highest
- Next were white skins and stalks!!
- Most alternative yeast higher than control but not 1176
Anna Carew: microwave maceration and yeast treatments

15th AWITC Posters 106, 108, 109
Yeast strain and total tannin

*Means with the same letter are not significantly different at the $p \leq 0.05$ level according to Tukey’s Test.
Microwave maceration

TIA/AWRI have conducted 30+ replicated trials of microwave maceration for since 2010.

Compared with control fermented on skins for 8 days, microwave wines showed more rapid and effective extraction of phenolics.

Thus far, applied to Pinot noir and Shiraz musts, at laboratory scale (1kg).

1. Intermittent microwave & stirring
2. Monitor for peak temperature (70°C)
3. Hold time in 70°C waterbath
4. Cool to ~24°C, inoculate with ADY for AF
Options for winemakers

Rapid extraction by microwave of phenolics offers two options:

- EARLY PRESS-OFF: Press-off, cool and ferment juice (‘mpr’)

- FERMENT ON SKINS: Cool the must and conduct alcoholic ferment on skins (‘msk’)

## Wine phenolics

Different letter denotes significant among treatments within trial (P<0.05)

<table>
<thead>
<tr>
<th></th>
<th>CTL</th>
<th>MSK</th>
<th>MPR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anthocyanins</strong></td>
<td>292 a</td>
<td>412 b</td>
<td>272 a</td>
</tr>
<tr>
<td>(mg/L)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pigmented</strong></td>
<td>0.31 a</td>
<td>0.50 b</td>
<td>0.45 b</td>
</tr>
<tr>
<td><strong>tannin (AU)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total tannin</strong></td>
<td>0.25 a</td>
<td>0.72 b</td>
<td>0.27 a</td>
</tr>
<tr>
<td>(g/L)</td>
<td></td>
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</tbody>
</table>

On skins

Early press off
Their are also aroma differences

- PCA scores plot based on 18 volatile aroma compounds measured by GC-MS
- (informal) sensory appraisal suggests mpr wines are intensely fruity and aromatic
Selective skin maceration to enhance extraction

Angela Sparrow: Poster 101
The influence of seeds

Angela Sparrow: Poster 102

1: Compare seeded & seedless clone
2: Add extra grape seed (GS) tannin
3: Remove released seeds

(a) % Non-bleachable pigment
(b) Non-bleachable pigment (AU)
(c) Non-bleachable pigment (AU)

Day seeds removed: Nil 1 3 5
Adding fresh white pomace

1. Pinot grapes
2. Add 20% CH pomace
3. Co-ferment

![Graphs showing Tannin g/L, Pigmented Tannin (AU), and Colour Density (AU) for PN control, PN + fresh CH pomace, PN + 4°C stored CH pomace, and PN + frozen CH pomace.](image)
The winemaking control points

- Extended maceration wines have high tannin and a high degree of colour stabilisation
- Cold maceration favours colour extraction
- Juice runoff (saignee) results in higher tannin and colour but favours colour more
- Running off juice and returning it later during ferment (transfusion) increases tannin and stable colour
- The selection of yeast strain has dramatic effects on tannin and colour
- Boosting tannin with a non-pigmented source (eg stems, white skins) can also increase colour but is it stable long-term?
- Is there a place for microwave maceration? Can this create a new winemaking paradigm?
- Do we really want seed tannin? How can we enhance skin tannin extraction?
Pinot noir tannin, total colour and colour stabilisation can be strongly influenced by maceration/vinification methods, including the choice of yeast.

For a given parcel of grapes, tannin in particular, can be **doubled** through manipulating vinification:

“turning on the tap”
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Modified Somers method

Tannin method

Tannin and wine quality

Pinot Maceration

Microwave maceration

Yeast effects

Coffee plunger ferments