Grapevine berry ripening and wine style: How to manage the harvest date?

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From the vineyard to the wine and sensory: how to capture the complexity?

An integrated approach
What will be presented today

• Grapevine Berry Maturation: a proposed model/method
  – Brief discussion around berry sugar and fresh mass evolution

• Shiraz Sequential Harvest
  – 2014 and 2015 results from Griffith (warm-hot) region in NSW Australia
    • Proposed ripening sequence for Shiraz
    • Shiraz berry and wine composition
    • Shiraz sensory analyses

• Take home messages
Red cultivars: Berry Aromatic evolution over ripening. To set the scene…

Ripening levels
and **sugar loading**

Tempo of berry ripening according to a physiological clock and therefore possible style of wine able to be predicted. Not directly linked to Brix/Baume?.
Berry sugar accumulation – berry volume and Brix

**Berry volume evolution**
accumulation of sugar per berry

**Beginning of veraison**
(berry softening)

- sugar
- sugar
- sugar

**Ripening**

- 20 – 22 Brix

**Harvest**

A. Deloire, 2009
When sugar per berry reaches a plateau, the volume of the berry could decrease due to water loss and therefore the Brix will increase.
● **Traditional indicators**: Baume, TA, pH, colour, grape berry sensory evaluation = perception of the wine in the mouth (non volatile matrix).

● **New indicators** related to possible wine aromatic profiles (volatile matrix).
Mechanical pruning – Drip irrigation

Griffith (Riverina, NSW Australia)
Sprawling training system

Griffith (Riverina, NSW Australia)
Light penetration under the canopy: sprawling training system.
Day and night temperature and link to wine styles?

- Hot: Warm
- Warm: Warm
- Temperate: Temperate - Cool
- Cool: Cool
Proposed ripening sequence for Shiraz

Accumulation of sugar per berry

Proposed wine aromatic evolution linked to grape ripening

1. Fresh fruit
2. Pre-mature fruit
3. Mature fruit

Day 0 = when sugar per berry reaches a plateau, preferably at 20-22 Brix (from Deloire, 2013)
Berry sugar accumulation and volume evolution (Shiraz-Griffith)

### Berry Sugar Accumulation and Evolution Graph

- **Sampling date**
  - Sugar/berry
  - 100 berries fresh mass

- **Sugar/berry**
  - 5.6 mg of sugar/berry/day
  - 0.03 mg of sugar/berry/day

- **100 berries fresh mass (g)**

### Harvest Dates

<table>
<thead>
<tr>
<th>Harvest dates</th>
<th>Predicted Date</th>
<th>Harvested Date</th>
<th>Commercial harvest date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plateau</td>
<td>3.2.2015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H1: Fresh fruit</td>
<td>15.2.2015</td>
<td>15.2.2015</td>
<td>6.3.2015</td>
</tr>
<tr>
<td>H2: Intermediate stage</td>
<td>21.2.2015</td>
<td>20.2.2015</td>
<td></td>
</tr>
<tr>
<td>H3: Mature fruit</td>
<td>27.2.2015</td>
<td>27.2.2015</td>
<td></td>
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<td></td>
<td>G1_2015</td>
<td>G1_2014</td>
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<td>---------------------</td>
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<tr>
<td>Juice TSS (°Brix)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H1</td>
<td>23.3b</td>
<td>22.5b</td>
<td></td>
</tr>
<tr>
<td>H3</td>
<td>24.0a</td>
<td>26.8a</td>
<td></td>
</tr>
<tr>
<td>Juice TA (g/L)</td>
<td></td>
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</tr>
<tr>
<td>H1</td>
<td>3.2a</td>
<td>5.37b</td>
<td></td>
</tr>
<tr>
<td>H3</td>
<td>2.9b</td>
<td>3.33c</td>
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<tr>
<td>Wine Ethanol (% w/v)</td>
<td></td>
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<tr>
<td>H1</td>
<td>13.5a</td>
<td>12.8b</td>
<td></td>
</tr>
<tr>
<td>H3</td>
<td>13.6a</td>
<td>15.4a</td>
<td></td>
</tr>
</tbody>
</table>
Clear separation of samples according to the harvest dates in Griffith for 2014 & 2015 vintage

2014 and 2015 Griffith Shiraz; Separation of samples are made according to the harvest date. 1,2, refers to the harvest date 1 and 2, respectively. Ellipses represent 95% confidence interval for each ANOVA explanatory factor. Nine blocks of variables were used: (1) Grape amino acids; (2) Grape sugar and organic acids; (3) Grape anthocyanins; (4) Grape carotenoids; (5) Grape volatiles; (6) Juice analysis (Brix, YAN); (7) Wine colour, alcohols and organic acids; (8) Wine volatiles; (9) Wine sensory attributes

Wine volatiles and sensory attributes contributed at most to the separation of samples
Proposed ripening sequence for Shiraz

Accumulation of sugar per berry

Proposed wine aromatic evolution linked to grape ripening

Day 0 = when sugar per berry reaches a plateau, preferably at 20-22 Brix (from Deloire, 2013)
Wine markers of early harvest

C6-compounds

Hexanol
Trans-2-hexenol
Trans-3-hexenol
Cis-3-hexenol: marker of Fresh Fruit Shiraz

Herbaceous, grassy, fresh aromas

Hexanol
Trans-2-hexenol
Trans-3-hexenol
Cis-3-hexenol

Sensory impact reported in dearomatized wine

Cis-3-hexenol: marker of Fresh Fruit Shiraz
Grape maturity influences yeast ester metabolism

Higher alcohol acetates contents significantly increase with grape maturity in Shiraz wines

Fruity, confectionary aromas
Dimethyl sulphide (DMS): marker of late maturity stage irrespectively of the cultivar

Concentration (µg/L)

Sensory impact reported in dearomatized wine

Dark fruit, stewed fruit, truffle

Dagan, 2006; Bindon et al. 2014
Day 0 = when sugar per berry reaches a plateau

20 – 22 Brix

Beginning of veraison (berry softening)

Day 0 = when sugar per berry reaches a plateau

Vivelys, Deloire 2008, 2012
The value of this research for the wine industry is that:

– i) from a single vineyard and variety, irrespective of:
  • region,
  • associated environment
  • and cultural practices,
  it is possible to produce with consistency different wine styles using sequential harvest;

– ii) there is no clear nexus between berry sugar concentration and flavours from when sugar per berry accumulation reaches a plateau or slows down.
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