Berry sensory workshops: tracking flavour development (Cabernet Sauvignon)

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Stonehaven Winery was built as the Limestone Coast regional winery by the Hardy Wine Company in 1998, now part of Constellation Wines. The winery sources fruit from across the Limestone Coast, primarily Padthaway, Wrattonbully and Coonawarra. The most significant variety by crush is Cabernet Sauvignon. The winemaking and viticultural team have observed a high degree of variation in the ripening of Cabernet from season to season due to the nature and difficulties encountered with cool climate regions.

Cabernet Sauvignon is the classic grape variety from Bordeaux. It produces wines of good colour with high tannins and a pronounced varietal character, which is very intense when the vines are grown in cooler regions (Kerridge 1999). Typically, good Cabernet Sauvignon should display blackcurrant aroma and flavour with firm tannin, good colour and it should maintain good acidity. Cabernet is often blended with other varieties to fill in the tannin structure and create a round mouthfilling yet long and persistent palate.

In the field, Cabernet has an erect upright growth that lends itself well to a sprawling canopy if row spacing is adequate, otherwise extensive canopy management and manipulation is required. Cabernet can be a vigorous but small producer of grapes that often ripen later than most other grape varieties. The late budburst can be advantageous in frost prone areas, but it's late ripening also poses a risk in reaching full physiological maturity if the season breaks early. Cabernet is susceptible to poor fruit set though not quite as bad as Merlot, and some seasonal variation is due to large differences in potential vine yield after fruitset. The bunches typically have a cylindrical open bunch habit with small round berries and therefore are usually highly disease resistant, although they can be susceptible to powdery mildew. Cabernet does not respond well to water stress; it performs at its best when the canopy is maintained and functioning to ensure all parts of the berry ripen, particularly the tannins in the skin and seeds. Ripe tannins are an essential part of good Cabernet Sauvignon. To make great Cabernet it seems that vine age is quite important, since the best wines are often produced from vines which are at least 15–20 years old.

Cabernet Sauvignon is a challenging variety. When grown in a cool climate, Cabernet can sometimes struggle to ripen, with green astringent tannins and intense green fruit flavours whereas overripe Cabernet or Cabernet grown in a warm climate lacks varietal definition, colour and structure.

The Limestone Coast

As Stonehaven sources Cabernet Sauvignon from Padthaway, Wrattonbully and Coonawarra it is important to give some background on the physical characteristics of these individual regions within the zone and a description of the typical characters observed from Cabernet in each region. Every year is quite different so generalisations can be dangerous, and of course within each region there is diversity of aspect, soil type, soil depth, rainfall patterns and subtle variation in site temperature or to borrow the term from the French terroir.

Padthaway (Figure 1)
- Altitude ~ 50 m
- Annual rainfall ~ 502 mm
- Heat Degree Days (HDD) ~ 1503
- Spring frost risk
- Gentle slope off the Naracoorte Range, an ancient coastline, vineyards more predominant on the ‘flats’
- Red-brown loamy sands, patches of Terra Rossa – calcareous soils.
- Moderate climate

Characters of Padthaway Cabernet Sauvignon

Padthaway Cabernet can best be described as ‘big shouldered Cabernet’. Many of the older vines were planted in the 1970s from non-clonal, yield selections, and tend to have big chunky tannins providing good backbone material for blending. The fruit tends to reach good varietal expression ahead of full tannin ripeness. Clones selected for good flavour from more recently planted vineyards show promise exhibiting more front palate sweetness.

Wrattonbully (Figure 2)
- Altitude ~ 75-105 m
- Annual rainfall ~ 578 mm
- Heat Degree Days (HDD) ~ 1490
- Spring frost risk in low-lying areas
- Elevated undulating slopes off the back of the Naracoorte Range, most vineyards planted on ridges
- Vineyards often over limestone caves
- Terra Rossa ridges
- Cool, slightly continental climate

Characters of Wrattonbully Cabernet Sauvignon

Wrattonbully Cabernet has intense aromas of blackcurrant fruit with hints of florals and tar. The tannins can be quite chalky and
gritty, almost particulate and not unlike some Italian wines. After two years the wine produced from this fruit often develops tannins that become more round and mouth-coating, filling the outer edge of the palate. There are frequently hints of eucalypt character.

Coonawarra (Figure 3)
- Altitude ~ 57 m
- Spring frost risk – fruitset often poor
- Annual rainfall ~ 585 mm
- HDD ~ 1365
- Flat – soil depth varies over limestone
- Site selection is very important and is usually based on soil type.
- Terra Rossa (red soil – sub plastic medium clay, extremely friable and well drained over a limestone base) these are the first to ripen
- Black cracking clays western side of ‘cigar strip’ – prone to water logging, later ripening
- Duplex sandy soils eastern side of the strip produces fruit with good aromas.

Coonawarra is cool-climate viticulture, especially for Cabernet Sauvignon. It does not always ripen in difficult years but when it does it is amongst the best Cabernet produced in Australia with strong regional typicity.

Characters of Coonawarra Cabernet Sauvignon
Coonawarra Cabernet exhibits extremely powerful fruit flavours displaying classic cassis and hints of choc-mint. In the best examples it is a very ‘pure’ expression of varietal Cabernet Sauvignon. Coonawarra Cabernets have a very long, fine-grained tannin structure and the fruit ripens slowly and evenly. The Stonehaven philosophy is to avoid early season watering. Coonawarra has a very high frost risk, so many vineyards use overhead sprinklers for frost protection. This is generally at a time when the vines do not need excess water in the profile, and therefore Stonehaven prefers the use of frost fans instead. Irrigation can be useful and necessary later in the growing season to maintain a growing canopy, to ensure the ripening of the fruit and tannins continues until maturity is reached. There is sometimes a risk in Coonawarra that the season may break before Cabernet ripens: in these years the wines from unripe fruit can be strongly vegetative with green tannins.

Winemaking critical control points
Whilst the making of wine is a simple and ancient process, it must be remembered that the final quality of the wine in the bottle and its ultimate enjoyment by the consumer starts in the vineyard, first with site selection and matching of suitable varieties, then the critical decisions made during the annual events as outlined below.

- Pruning
- Growing season manipulation
- Climate
- Harvest date
- Ferment
- Maturation
- Blending
- Bottling
- Selling
- Drinking

The first three points are vineyard controlled, harvest date is a shared decision between viticulture and winemaking, the next four points are winemaking controlled and the last two marketing and consumer driven.

The winemaker is asked to decide when the fruit is ripe and ready to pick. In making this decision the winemaker needs to take into consideration the desired wine style, price point and the seasonal climate and individual vineyard’s maximum potential. You may well ask how a winemaker has this talent of ‘knowing’ when fruit is ripe. To become a winemaker a person can study to obtain a Degree in Oenology, Viticulture, Agriculture or Food Sciences or work their way into the position with experience on the job. If the study option is taken subjects like winemaking and viticultural science, wine assessment (sensory evaluation of wine), wine styles, grape vine physiology, statistics etc. will be covered, but currently you do not learn how to taste grapes! Yet there is an expectation that the winemaker magically ‘knows’ ripe fruit. Most winemakers have learnt on the job, often making such critical decisions under pressure of weather, capacity logistics or growers and vineyard managers eager to harvest.

Berry sensory analysis (BSA) is an excellent introduction to understanding and recognising ripe fruit, based on a disciplined methodology of tasting grapes. Regular tasting of grapes throughout the season allows the winemaker and vineyard manager to learn
about ripening: tasting the same blocks from year to year teaches them about seasonal variation. Collectively a tasting memory and history of quality is built over time. If tastings are not occasionally conducted blind, unusual or unpredictable seasonal trends can be missed by following historical trends and perceptions.

The Roseworthy scorecard for wine tasting has assisted winemakers and wine show judges to make comparative assessments of wines in Australia for many years. Some people would suggest it has also assisted in the improvement of the quality of Australian wines. Whilst a scoring system can be regimented it does help provide a foundation for comparison and discussion. As seen historically it has not halted the evolution of style, a topic hotly debated and evolving at wine shows across the country.

**The Roseworthy 20 point wine scale:**

<table>
<thead>
<tr>
<th>Colour and Clarity</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aroma/Bouquet</td>
<td>(7)</td>
</tr>
<tr>
<td>Palate/Taste</td>
<td>(10)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>(20)</td>
</tr>
</tbody>
</table>

Berry sensory analysis also follows a simple scale. The decision of when to pick fruit is possibly the biggest decision that will affect the final quality of the wine made from that fruit. The best way to make this onerous decision is to share the load among the experts, as a shared decision between winemaking and viticulture. It is therefore useful to have people trained together using a common language.

**Berry sensory analysis (BSA)**

Jacques Rousseau (Institute Cooperatif du Vin, Montpellier, France) introduced the BSA technique through a series of workshops conducted by John Whiting (Department of Primary Industries (Victoria)) and Dr Erica Winter (formerly of the Department of Primary Industries (Victoria)) around wine regions of Australia. These workshops were funded by the Grape and Wine Research and Development Corporation with support from the Cooperative Research Centre of Viticulture. The technique follows a standardised set of 20 descriptors assessing the ripeness of wine grapes by judging the berry stalk, skin, pulp and seeds separately. It uses a simple four point scoring system and has the option of a formalised laboratory technique or a simpler field assessment. A book describing the process in detail *Winegrape Berry Sensory Assessment in Australia* was published and launched at the Australian Wine Industry Technical Conference in Melbourne in 2004.

BSA is complementary to the standard ripening analysis of sugar concentration measure (Baumé/Brix), acidity, colour and the all-important vineyard assessment.

All scores use a simple four point scale, though many tasters find the need to stretch the scale by adopting half scores. Starting at 1 (unripe fruit) through to 4 (ripe fruit) gives an indication of the increasing ripeness of the berry. Ideally berries will get a complete score of 4 or close before picking, although this ideal is rarely achieved due to limitations of the terroir or season.

The BSA method of tasting grapes and determining their relative ripeness was introduced to Stonehaven in the 2003 vintage, initially with winemakers and vineyard managers doing weekly tastings of indicator blocks to follow ripening. A quantum leap in communication and understanding of ‘ripe fruit’ was gained and a common language developed within the team. In 2004 the weekly tastings included all viticultural and winemaking staff and introduced growers, with similar results seen and a further understanding developed of the ripening patterns of different regions, clones, soil types and canopies within blocks. The weekly tastings now continue each vintage and this gives the winemakers a chance to discuss the season and ripening patterns with vineyard managers and growers on a regular basis.

Using a plastic laminated copy, individuals complete the tasting grid at the weekly BSA tasting sessions. Individual scores are tabled and differences and trends discussed. The Senior Winemaker uses the trends observed to back up what is tasted in the field, thus providing more confidence in planning harvest dates and planning for fermentation and pressing programs to harness the best from the fruit. The BSA tastings give a much better understanding of the desired qualities of tannin and fruit flavour sought by the winemakers, particularly in a region where measures like colour or Baumé are too simplistic.

Initially the method seems an arduous task and many would question the need to bother with it. The main benefits are the development of a common language, assistance in the assessment of harvest date and a reduction in bias as the laboratory method is used blind. The method can therefore prove useful as a research tool. It also helps when selecting better parcels out of large patches, or poor sections that may taint otherwise good parcels of fruit.
Table 2. Visual and tactile examination of grape berries (2006 Stonehaven version adapted from Winter et al 2004)

<table>
<thead>
<tr>
<th>BERRIES</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Softness</strong></td>
<td>squeeze the grape between the fingers</td>
<td>hard berry, bursts under strong pressure</td>
<td>elastic berry, changes shape slightly under pressure but goes back to its original form</td>
<td>berry changes shape easily, plastic, takes a while to go back to its original shape</td>
</tr>
<tr>
<td><strong>Ease with which grape is removed from the stalk</strong></td>
<td>grape strongly attached, stalk tears the skin, takes pulp and skin out of berry</td>
<td>grape attached, stalk comes off with a good part of the pulp</td>
<td>grape comes off fairly easily, the stalk takes off a little of the uncoloured pulp</td>
<td>grape comes off easily, stalk comes off with very little pulp, just a few fibres with some pulp stuck to them</td>
</tr>
<tr>
<td><strong>Colour</strong></td>
<td>black grape look at the stalk side</td>
<td>pink, pale red</td>
<td>red</td>
<td>dark red</td>
</tr>
<tr>
<td>(review also when chewing skins)</td>
<td>white grape observe the bulk of the grape</td>
<td>green (just beginning to ripen), pale yellow. Not translucent</td>
<td>straw green, partial translucent</td>
<td>straw yellow, mostly translucent</td>
</tr>
</tbody>
</table>

Table 3. Pulp characteristics of grape berries (2006 Stonehaven version adapted from as above)

<table>
<thead>
<tr>
<th>PULP</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Detachment of the pulp from the skin</strong></td>
<td>pulp adheres strongly to the skin and seeds</td>
<td>a film of pulp adheres to the skin</td>
<td>pulp film only slightly visible but juice is released when chewed</td>
<td>no film of pulp on skin and seeds and no release of juice when chewed</td>
</tr>
<tr>
<td><strong>Juiciness of pulp</strong></td>
<td>firm gelatine</td>
<td>gelatinous</td>
<td>liquid</td>
<td>very liquid</td>
</tr>
<tr>
<td>melting properties of juice in the mouth</td>
<td>very acidic pulp</td>
<td>acidic pulp</td>
<td>moderately acidic pulp</td>
<td>not very acidic pulp</td>
</tr>
<tr>
<td><strong>Sweetness</strong></td>
<td>not very sweet pulp</td>
<td>moderately sweet pulp</td>
<td>sweet pulp</td>
<td>very sweet pulp</td>
</tr>
<tr>
<td>move juice over tongue</td>
<td>very intense</td>
<td>intense</td>
<td>weak</td>
<td>absent</td>
</tr>
<tr>
<td><strong>Acidity</strong></td>
<td>very intense</td>
<td>intense</td>
<td>weak</td>
<td>absent</td>
</tr>
<tr>
<td>feeling on the tongue</td>
<td>very intense</td>
<td>intense</td>
<td>weak</td>
<td>absent</td>
</tr>
<tr>
<td><strong>Herbaceous flavours</strong></td>
<td>absent</td>
<td>weak</td>
<td>strong fruit</td>
<td>intense fruit</td>
</tr>
<tr>
<td>analysis in the mouth</td>
<td>very intense</td>
<td>intense</td>
<td>weak</td>
<td>absent</td>
</tr>
<tr>
<td><strong>Fruity flavours</strong></td>
<td>absent</td>
<td>weak</td>
<td>strong fruit</td>
<td>intense fruit</td>
</tr>
<tr>
<td>analysis in the mouth</td>
<td>very intense</td>
<td>intense</td>
<td>weak</td>
<td>absent</td>
</tr>
</tbody>
</table>

Table 4. Skin characteristics of grape berries (2006 Stonehaven version adapted from as above)

<table>
<thead>
<tr>
<th>SKIN</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disintegration</strong></td>
<td>chew the skins 10 to 15 times</td>
<td>very difficult (big pieces)</td>
<td>difficult (small pieces)</td>
<td>fairly easy (mixture almost homogeneous)</td>
</tr>
<tr>
<td><strong>Tannic intensity</strong></td>
<td>run the tongue over the palate, after removing skins from mouth</td>
<td>tongue slides over palate with great difficulty, difficult to resalivate from more than 5 seconds</td>
<td>tongue slides over palate with difficulty, difficult to re-salivate for a few seconds</td>
<td>tongue sticks slightly to gums</td>
</tr>
<tr>
<td><strong>Dryness of the tannins</strong></td>
<td>run the tongue over the palate and evaluate the time necessary to resalivate</td>
<td>lip slides with great difficulty over the gums grippy, rough, aggressive</td>
<td>lip slides with difficulty over gums coarse texture</td>
<td>lip sticks slightly to the gums; medium texture</td>
</tr>
<tr>
<td><strong>Acidity</strong></td>
<td>of crushed chewed skins</td>
<td>very acidic</td>
<td>acidic</td>
<td>moderately acidic</td>
</tr>
<tr>
<td><strong>Fruity flavours</strong></td>
<td>of crushed chewed skins</td>
<td>absent</td>
<td>weak</td>
<td>strong fruit</td>
</tr>
</tbody>
</table>

Table 5. Seed characteristics of grape berries (2006 Stonehaven version adapted from as above)

<table>
<thead>
<tr>
<th>SEEDS</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Colour</strong></td>
<td>white, yellow-green</td>
<td>brown-green</td>
<td>greyish brown, no green traces</td>
<td>dark brown</td>
</tr>
<tr>
<td><strong>Crushability</strong></td>
<td>chew the seeds between the front teeth</td>
<td>moist outside layer is soft, seed crushes under strong pressure</td>
<td>moist outside layer is fine, seed crushes under pressure like a fresh almond</td>
<td>almost no moist outside layer, seed is hard, slightly crisp</td>
</tr>
<tr>
<td><strong>Flavours</strong></td>
<td>of crushed chewed seeds</td>
<td>presence of green traces - Do Not Taste</td>
<td>herbaceous, bitter when licked</td>
<td>grilled, only slightly herbaceous when chewed</td>
</tr>
<tr>
<td><strong>Tannic intensity</strong></td>
<td>run the tongue over palate</td>
<td>did not taste</td>
<td>tongue slides with difficulty</td>
<td>tongue sticks slightly</td>
</tr>
<tr>
<td><strong>Tannic dryness</strong></td>
<td>put crushed seeds between lip and gum</td>
<td>did not taste</td>
<td>lip slides with difficulty, astringent when licked</td>
<td>lip sticks slightly, astringent when chewed</td>
</tr>
</tbody>
</table>
Like most methods it is a tool to be used in balance with vineyard visits and standard maturity analysis. It is essential to still walk the vineyards to assess the ability of the canopy to continue ripening. Disease pressure or canopy health cannot be assessed by laboratory tasting, nor the isolation of areas of variability that may affect overall quality. However blind tasting of samples from these areas can determine whether in fact it is necessary to harvest separately.

Stonehaven has also used the method as a tool for viticultural research trials including an extensive trial of Limestone Coast Cabernet Sauvignon tannins with The Australian Wine Research Institute. So far the initial results from berry sensory analysis show that the quality of fruit by taste correlates strongly with wine quality and final wine allocation in ways that as yet cannot be explained or measured reliably by chemistry.

Stonehaven 2003:
- Weekly tastings with winemakers, assistant winemakers and vineyard managers of indicator blocks
- Tasting and scoring of all reds – Laboratory style tasting, summarised to the field score for grower feedback
- NB: None reached technological maturity

Stonehaven 2004:
- Weekly tastings with winemakers, assistant winemakers, viticultural technical officer, vineyard managers, vineyard supervisors and growers (see Figure 7)
- Used for trial block tastings
- Used in Coonawarra short shoot trial

Stonehaven 2005:
- Weekly tastings with winemakers, viticultural technical officer, vineyard managers, and growers
- Used for trial block tastings, assist with split picking decisions
- Used for shoot thinning and crop thinning trials (Figure 8)
- Used for research with AWRI Tannin trial
- Used in AWRI Tannin research project
- Used in public relations workshops with the public at ‘Coonawarra After Dark’
- Used to illustrate style, philosophy and the winemaking process to international trade and media visitors

The BSA method is a great training tool and should be introduced to tertiary studies of Viticulture and Oenology. Any method that aids the improvement in communication between vineyard and winery and an understanding of a common goal of ripeness will improve wine quality.

The winemaking and viticulture team at Stonehaven believe the use of the method has already assisted in training, communication, viticultural research and a better understanding of sometimes unpredictable ripening trends. Ultimately the improvement in wine quality through more informed picking decisions has far outweighed the investment of time and energy in conducting the tastings.

The use of berry sensory analysis has now been adopted as a tool for communication and training at Hardy Wine Company sites in Clare, McLaren Vale, the Adelaide Hills and Langhorne Creek.

BSA is a simple but rigorous method: most winemakers already basically understand the need to closely monitor the progress of ripening grapes.

References