



## SENSORY PROFILES OF SHIRAZ WINE FROM SIX BAROSSA SUB-REGIONS: A COMPARISON BETWEEN INDUSTRY SCALE AND STANDARDISED SMALL LOT RESEARCH WINE MAKING

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### Abstract

**Aims:** The Barossa wine region in South Australia comprises six sub-regions and is renowned for its Shiraz wines. However, there is no comprehensive documentation of the distinctive sensory characteristics of wines from these sub-regions.

**Methods and Results:** Shiraz wines from the six Barossa sub-regions (Central Grounds, Eastern Edge, Northern Grounds, Southern Grounds, Western Ridge and Eden Valley) were evaluated blind and in duplicate using descriptive sensory analysis by a highly trained panel of 12 experienced tasters. Evaluated wines were made with either standardised small lot winemaking (40L ferments, 2018 n= 69, 2019 n=72) or commercially produced (2018 n=44, 2019 n=76). Wine samples for sensory analysis were collected directly after completing malolactic fermentation and before maturation in oak or blending. Each vintage, the two sample sets were evaluated consecutively by the same panel, small lot wines followed directly by the commercially produced samples. Results of the canonical variate analysis showed that wines from Eden Valley were consistently characterised as being more savoury (meaty, broth) compared to the other five sub-regions, for both vintages and production methods. Unlike their industry scale counterparts, research wines from the Western Ridge sub-region were characterised as more tannic (astringent, rough) for both vintages. Less consistent separation was observed for the other four sub-regions, with wines generally being described as fruit forward, with intense dark and red fruit.

**Conclusions:** Sensory profiles of Shiraz wines from the six Barossa sub-regions revealed a small number of consistent sub-regional characteristics for both standardised and industry scale wine samples across the two vintages.

**Significance and Impact of the Study:** Detailed sensory profiles for research and industry scale wine can provide valuable information for producers to best showcase wine sub-regional characteristics for marketing/promotional purposes. Next, sensory profile findings will be analysed along with soil, climate, berry and wine composition data as well as information on viticultural practices in an attempt to explain sub-regional differences and identify drivers of regionality.

**Keywords:** Sensory profiling, typicity, descriptive analysis, regionality, red wine

## Introduction

The concepts of typicity and expression of terroir describe how a wine's origin is represented in its sensory characteristics. This differentiates wines that express its regional individuality and makes them identifiable and recognisable (Cadot *et al.*, 2010; Cadot *et al.*, 2012). Grape environment (e.g. climate, soil, slope), viticulture and winemaking practices can influence a wine's expression of terroir (Cadot *et al.*, 2012; Drappier *et al.*, 2019).

The Barossa wine region in South Australia has a long history of winemaking. Its environmental characteristics including climate, soil and topography have previously been characterized in detail and six sub-regions were described, namely Central Grounds, Eastern Edge, Northern Grounds, Southern Grounds, Western Ridge and Eden Valley (Robinson *et al.*, 2014). Over the past decade the Barossa has been a model to investigate numerous aspects of terroir including agronomic practices (Wolf *et al.*, 2013; Xie *et al.*, 2017) and soil microbiome (Zhou *et al.*, 2020). However, there is no comprehensive documentation of the distinctive sensory characteristics of wines from these sub-regions.

To characterise the sensory expression of typicity previous studies have either used commercially available wines (Cadot *et al.*, 2010) or wines produced using standardised winemaking (Niimi *et al.*, 2018; Reynolds *et al.*, 2013). However, as winemaking practices can significantly influence the characteristics of a wine, but at the same time are considered an inherent component of regional expression, this study aimed to compare the regional expression of wines made at industry scale with wines produced under standardised small lot research winemaking conditions across two vintages.

## Material and Methods

Shiraz wines from the six Barossa sub-regions (Central Grounds, Eastern Edge, Northern Grounds, Southern Grounds, Western Ridge and Eden Valley) from 2018 and 2019 were evaluated using descriptive sensory analysis by a highly trained panel of 12 experienced tasters.

### **Wine Samples**

Small lot research wines Shiraz (2018 n= 69, 2019 n=72) were made from 50kg hand harvested fruit (target Baume at harvest 14-14.5) at the University of Adelaide winery by the WIC Winemaking Services under standardised conditions. The must had 50mg/L SO<sub>2</sub> added and was inoculated with 250mg/L Maurivin PDM yeast. Where the Baume was higher than 15°Bé, an acidified water dilution, targeting 14.2°Bé was made. Fermentation took place in a 15°C cool room.

Cap management commenced on the following day, where the must was hand plunged twice daily until pressing using standardised equipment and technique. 48 hours post yeast inoculation, Pinnacle MaloSafe malo-lactic acid bacteria were added at 10mg/L to initiate malo-lactic fermentation (MLF). The ferments remained in the 15°C cool room until the Baume dropped below 3, where the ferments were then moved to a 20°C cool room until the completion of primary and secondary ferment.

Upon confirmed completion of both primary and secondary fermentation, the wines were dosed with 80mg/L SO<sub>2</sub>, acid adjusted to a standardised titratable acidity and moved to a 0°C cool room for a minimum of 4 weeks for cold settling and natural cold stabilisation prior to a series of racking to achieve cellar brightness in preparation for bottling. Final pre-bottling analysis was performed, with additions made to achieve a Free SO<sub>2</sub> of 35-45mg/L, and bottling in 750mL punted claret bottles closed using a standard Stelvin screw cap closure.

Each sub-region was similarly represented in the DA, with an average of 11 wines, ranging from 9 and 12 per sub-region. Commercially produced wine samples (2018 n=44, 2019 n=76) from the same wine subregions were collected after alcoholic fermentation and before blending or maturation in oak. MLF was finalised in laboratory conditions for a small number of samples. After completion of MLF (malic acid < 0.20 g/L) the wines were racked and SO<sub>2</sub> adjusted (50 mg/L of free SO<sub>2</sub>). Wines were stored for 3-6 month after bottling in 750mL bottles under screw cap at 15°C before undergoing sensory analysis. Due to availability, sub-region representation was slightly less balanced for the commercial samples with 44 samples in 2018 (5 to 12 per sub-region) and 76 samples in 2019 (9 to 16 per sub-region), respectively.

### Sensory Analysis

To quantify the subtle sensory differences Descriptive Analysis (DA) (Lawless and Heymann, 2010) was performed by 12 panellists experienced in DA who went through 10 x 2h training sessions involving detection, identification, evaluation, and intensity rating of red wine aromas, flavours and mouthfeel attributes. To determine when formal assessment should commence, data were analysed after each practice evaluation to assess panel and panellist performance. For each vintage, the two sample sets were evaluated consecutively by the same panel, small lot research wines followed directly by the commercially produced samples. Wine aliquots of 30mL were presented at room temperature in covered, black 215mL ISO wine tasting glasses in randomised order. Panellists assessed each sample in duplicate in isolated tasting booths and rated the intensity of 18(2018) and 17(2019) aroma, 18 flavour, 3 taste, 4 mouthfeel plus 2 aftertaste attributes throughout 17 two hour tasting sessions for vintage 2018 and 22 sessions for vintage 2019. The panellists evaluated all samples blind and were not aware of the nature of the study.

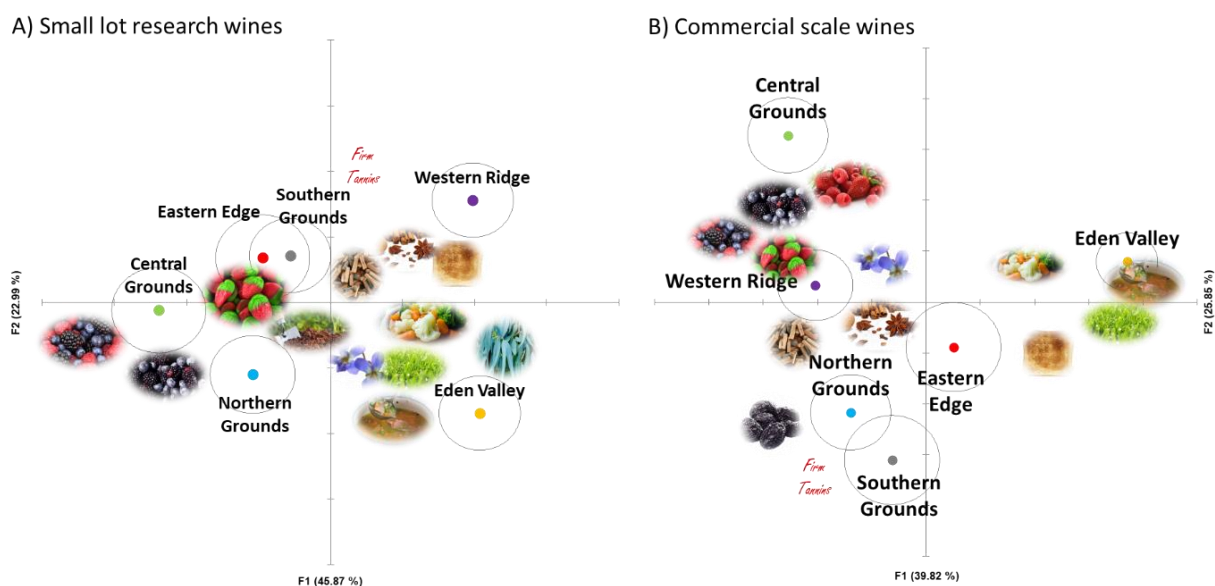
Canonical variate analysis (CVA) using the attributes significantly different between wine samples based on two-way ANOVAs (panellist as random factor and sample as fixed factor) was used to visualise the sub-regional sensory characteristics.

### Results and Discussion

As the project is still ongoing, only preliminary results for the first 2 vintages, 2018 and 2019, are presented. Although the sensorial differences were subtle, the dimensions on which the CVA separated subregions were consistent across vintages and production methods (Figure 1 and Figure 2). With dimension 1 separating wines into more fruit forward (e.g. *dark fruit, red fruit, confectionery*) on the left of the plot to more savoury (e.g. *brothy, cooked vegetables*) on the right. Separation in dimension 2 was more related with texture (tannin structure) and *spice/woody* characteristics.

#### Regional Characteristics Vintage 2018

For the 2018 vintage significant differences were observed for 28 attributes for small lot wines and 33 attributes for the industry scale wines.



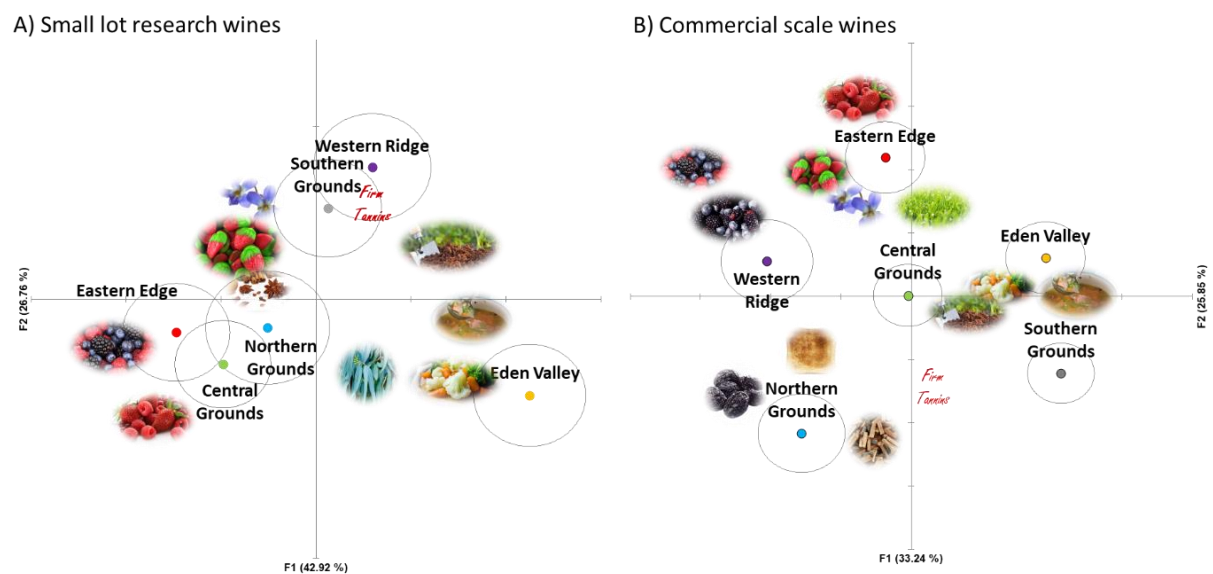
**Figure 1:** CVA biplot (factor 1 and factor 2) for vintage 2018 by sub-region using only significant attributes ( $p < 0.05$ ). A) Small lot wine making centroids (means), B) commercial scale wine making centroids (means), circles indicate pooled confidence intervals for centroids.

The CVA resulted in a good separation between most of the 6 sub-regions. Comparing the CVA plots (Figure 1), it can be seen that for both production scale Eden Valley was associated with more *savoury (brothy, cooked vegetables), green (eucalypt, fresh leaves)* aromas and flavours. On the opposite side of the plots, wines from

the Central Grounds were described as more fruit forward wines with *intense dark berry, red fruit* and *jammy/confectionery*. Although, at different positions on the plot, wines from Western Ridge were associated with *woody* and *spicy* notes. Some agreement between the wine making scales can also be seen for Southern Grounds wines, which were attributed to have *firmer tannins*.

### Regional Characteristics Vintage 2019

ANOVA identified 24 attributes differentiating between small lot wines and 39 attributes between commercial scale wines. In comparison to the 2018 vintage, the CVA plot of the 2019 vintage (Figure 2) shows slightly less agreement in the regional characteristics between the two winemaking scales. As for the 2018 vintage, Eden Valley wines were consistently characterised as being *savoury* and *green* for both winemaking scales. Similarly, wines from the Southern Grounds tended to have slightly *firmer tannins*. Interestingly, Central Grounds wines, characterised as fruit forward wines in 2018 were again for SLW wines but less so for the commercial scale wines. Eastern Edge wines, which did not stand out in 2018, were found to be most intense in fruit characteristic (*red berries* and *confected*) in 2019.



**Figure 2:** CVA biplot (factor 1 and factor 2) for vintage 2019 by sub-region using only significant attributes ( $p < 0.05$ ). A) Small lot winemaking centroids (means), B) commercial scale winemaking centroids (means), circles indicate pooled confidence intervals for centroids.

Across both vintages, Eden Valley, irrespective of winemaking, has been separated most consistently and describe as more *savoury* compared to the other subregions. A possible explanation could be that Eden Valley is the most geographically distinct sub-region with the highest average altitude (approximately 100m higher than the other sub-regions (Robinson and Sandercock, 2014), resulting in slightly more moderate temperatures and therefore slightly less fruit intense wines.

Consistently for both seasons wines from Northern grounds were negatively associated with *firm tannins* for the small lot wines but were positively correlated for commercial wines. Similarly, *woody* and *red berries* were not associated with Northern ground wines in any of the vintages for small lot wines but were positively associated for commercial wines. Indicating a consistent effect of winemaking scale and practices on the sensory profiles. To allow an in-depth discussion and interpretation another season of data will be collected and the sensory results will be analysed with the other data sets of the project including climate and soil measurements, viticulture practices, canopy measurements as well as berry and wine chemistry.

## Conclusions

In summary, the preliminary results revealed that sensory profiles of Shiraz wines from the six Barossa sub-regions show several consistent sub-regional characteristics for both standardised SLW and industry scale wine samples as well as across the two investigated vintages. But at the same time, also significant disparities between vintages and winemaking scales, highlighting the importance of i) considering multiple vintages and ii) winemaking practices when characterising the expression of terroir.

Detailed sensory profiles for research and industry scale wine can provide valuable information for producers to best showcase wine sub-regional characteristics for marketing/promotional purposes. Combining the sensory results with soil, climate, berry and wine composition data as well as information on viticultural practices in the next step, will extend the understanding of the complex interactions between the different aspects of terroir i.e. place (topography, climate, soil), people (tradition, winemaking and viticultural practices) and the resulting product (grape varieties, wines) (Vaudour, 2010). This knowledge can inform growers and winemakers how to manipulate vineyard and winemaking practices to promote regional characters of their wines. Furthermore, the comprehensive data set resulting from this project is a valuable resource to further improve the sub-regional classification in the Barossa based on a data driven approach.

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