Regionality effect in South Australian Chardonnay and its relationship to quality

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Introduction

Chardonnay is the most important white wine grape variety in Australia and is grown in each of the different wine producing regions.
- Wine composition, aroma and quality are affected by terroir variables e.g. temperature, rain, soil composition, etc., which is why winemakers routinely use origin as a proxy for quality.
- Fruit quality and decisions about harvest timing will affect the composition of the juice, thereby impacting on wine style and quality.
- This study analyses the differences in composition between berries sourced from different vineyards across South Australia and relates these differences to the potential quality of the ensuing wines.

Results and Discussion

- ADL, EV and RVL wines were discriminated by DA panellists based on sensory attributes (Table 1).[5]
- Positive correlations (Table 1) were found between the desirable wine volatiles and higher heat degree day (HDD) summations as well as the content of Cu, Zn, linalool, vitispirane, 5-MF, guaiacol and 2,6-dimethoxypyrimidine and other fatty acids. Higher HDD had a significant effect on 1-hexanol and 2-hexanone (Fig. 2).
- Small-scale wines showed higher amounts of desirable and ethyl esters and monoterpenoids in ADL and EV and higher concentrations of higher alcohols, 2-hexanol and 2-methylbutanoate.
- Discrimination between ADL, EV and BV wines (Fig. 2) was possible based solely on their chemical composition (concentration of compounds such as vitispirane, C6-compounds, 5-methylfurfural (5MF), C6-C10 acids, guaiacol and "Brix".
- Warmer weather in CV and BV (higher heat degree day (HDD) summations) meant grapes were more mature, which related to higher quantities of hydrolytically-released β-ionone, vitispirane, guaiacol and 2,6-dimethoxypyrimidine and certain fatty acids. Higher HDD had a significant effect on 1-hexanol and 2-hexanone (Fig. 2).
- Small-scale wines showed higher amounts of desirable and ethyl esters and monoterpenoids in ADL and EV and higher concentrations of higher alcohols in BV and CV (data not shown).
- Positive correlations (Table 1) were found between the desirable wine volatiles and higher heat degree day (HDD) summations as well as the content of Cu, Zn, linalool, vitispirane, 3-hexen-1-ol, 1-hexanol, behenic acid and decanoic acid in the berries, as well as negative correlations with "Brix and pH through Partial Least Squares Regression (PLS).

Conclusions

- Wines from different regions (ADL, EV, RVL) possessed distinct sensory profiles, identifiable by a trained sensory panel.
- Climate and environment modulate ripening dates and the composition of grapes originating in different areas of South Australia.
- Key compounds related to each region (ADL, EV, BV, CV) were identified and can serve to discriminate grapes and wines from each region and quality level.
- Modelled grape compositional parameters may serve as predictors of wine quality in the vineyard and will be confirmed in results from 2015 and 2016 vintages.

Materials and Methods

- Chardonnay berries were collected during the 2014 vintage from multiple commercial vineyards in the Barossa Valley (BV, n=5), Eden Valley (EV, n=9), Clare Valley (CV, n=9), Adelaide Hills (ADL, n=8), and the Riverland (RV, n=2).
- Samples were vinified in triplicate for sensory (5-L ferments; ADL, EV, RVL) and chemical analysis (500-ml ferments; ADL, EV, BV, CV).
- Descriptive analyses (DA) were carried out on two samples each from BV, EV and ADL chosen to span the most distinct quality levels using a panel of 12 trained assessors.
- Basic chemical analysis of berries and wine included °Brix, ethanol content (% v/v), titratable acidity (TA), pH and residual sugars.
- Free volatiles of all berry and wine samples were screened by HS-SPME-GC-MS1.
- Hydrolysed grape glycosides, element and amino acid composition of berries were also measured.
- Basic chemical analysis of berries and wine included °Brix, ethanol content (% v/v), pH, TA, Zn, °Brix, Cu, Zn, linalool, vitispirane, 5-MF, guaiacol and 2,6-dimethoxypyrimidine and certain fatty acids. Higher HDD had a significant effect on 1-hexanol and 2-hexanone (Fig. 2).
- Small-scale wines showed higher amounts of desirable and ethyl esters and monoterpenoids in ADL and EV and higher concentrations of higher alcohols in BV and CV (data not shown).
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Table 1. Prediction parameters for wine aroma compounds in small-scale Chardonnay wines using juice compositional parameters as predictors using PLS regression

<table>
<thead>
<tr>
<th>Wine compound/Loading</th>
<th>Mean (μg/L)</th>
<th>SD</th>
<th>R2</th>
<th>SECV (μg/L)</th>
<th>RPD</th>
<th>Juice compositional data (K-loadings)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hexyl acetate</td>
<td>159</td>
<td>100</td>
<td>0.73</td>
<td>54</td>
<td>1.8</td>
<td>pH, (Z)-3-hexen-1-ol, Cu, Zn, (Z)-3-hexen-1-ol</td>
</tr>
<tr>
<td>Linalool</td>
<td>0.063</td>
<td>0.047</td>
<td>0.79</td>
<td>0.022</td>
<td>2.1</td>
<td>linalool, vitispirane, guaiacol, C10 acid, 18:0, 22:0, 18:1n-9</td>
</tr>
<tr>
<td>2-Phenyloxyacetate</td>
<td>12577</td>
<td>72</td>
<td>0.64</td>
<td>46</td>
<td>1.6</td>
<td>(Z)-3-hexen-1-ol, Na, 2,6-DMP, SM, Brix</td>
</tr>
<tr>
<td>2-Hexanol</td>
<td>12577</td>
<td>72</td>
<td>0.64</td>
<td>46</td>
<td>1.6</td>
<td>(Z)-3-hexen-1-ol, Na, 2,6-DMP, SM, Brix</td>
</tr>
<tr>
<td>2-Phenylethanol</td>
<td>12577</td>
<td>72</td>
<td>0.64</td>
<td>46</td>
<td>1.6</td>
<td>(Z)-3-hexen-1-ol, Na, 2,6-DMP, SM, Brix</td>
</tr>
<tr>
<td>2-Hexanone</td>
<td>12577</td>
<td>72</td>
<td>0.64</td>
<td>46</td>
<td>1.6</td>
<td>(Z)-3-hexen-1-ol, Na, 2,6-DMP, SM, Brix</td>
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</tbody>
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References


Further Information

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