The influence of yeast strain on Shiraz wine composition and sensory properties

It is already common practice for winemakers to choose their favourite yeast to achieve a desired wine style, particularly for white grape varieties. This is evident through the growing number of yeast strains used across the Australian wine industry each vintage. Ongoing research at the AWRI aims to characterise readily available commercial yeast strains for their impacts on wine style, and develop novel strains that impart diverse flavour profiles or accentuate specific varietal characters. The overall aim is to provide winemakers with greater stylistic flexibility.

In recently published work (Holt et al. 2013), laboratory-scale experiments showed that yeast strain had a significant influence on the composition of Shiraz wines across two vintages. Of note, several phenolic indicators of Shiraz quality, including tannin, were affected by choice of yeast with up to a 37% increase in tannin concentration shown for the same fruit. Across three parcels of Shiraz over two vintages (2009, 2010) wines made with *S. cerevisiae* AWRI 1631 consistently had the highest tannin concentration (1165 mg/L epicatechin equivalents, average over the two vintages). Wines made with *S. bayanus* AWRI 1375 consistently had the lowest tannin concentration (850 mg/L average) and lowest tannin size as measured by mean degree of polymerisation, but the highest non-bleachable pigments. The *S. bayanus* AWRI 1375 strain had been previously shown (Blazquez Rojas et al. 2012, Holt et al. 2013) to give wines lower in tannin. Wines made with *S. cerevisiae* AWRI 1537 were also consistently low in tannin concentration (887 mg/L epicatechin equivalents average) but in contrast to *S. bayanus* AWRI 1375 wines made from this strain were also low in non-bleachable pigments. A range of intermediate tannin and colour values were reported for the strains AWRI 1575, 1375, 1493, 796, 1483 and 1620, many of which are commercially available. The magnitudes of these differences were in line with those previously shown to influence quality grading in commercial winemaking (Mercurio et al. 2010). Importantly the strain effect on non-volatile composition did not relate to straightforward differences in the rate of fermentation, which is known to affect extraction.

To further understanding of how wine yeast influence red wine style, in 2014 a pilot-scale winemaking study (40 kg ferments) was performed with 10 commercially available red wine strains (Table 1). Chemical and sensory analyses were completed on the resultant wines. The ten strains were selected on the basis of their widespread use across the Australian industry and/or their novel properties. For example, Uvaferm HPS was chosen because it is reported to secrete higher levels of polysaccharides into wine (Gonzalez-Royo et al. 2013), while AWRI 1503 is an interspecies hybrid between *Saccharomyces cerevisiae* and *Saccharomyces kudriavzevii*.

All strains fermented to dryness, and produced wines with similar basic composition within commercially acceptable ranges. As previously observed at the laboratory scale, significant differences in tannin concentration were evident in wines sampled after alcoholic fermentation (Figure 1A). Differences in total polysaccharide content were also seen (Figure 1B), mainly due to differing levels of extraction of grape-derived polysaccharides. Strain 2323 is known for its pectinolytic activity (van Wyk and Divol 2010) and yielded the highest concentration of polysaccharides post-fermentation. Somewhat surprisingly, wines made with Uvaferm HPS did not contain higher levels of yeast-derived polysaccharides.

Table 1. Yeast strains used in this study

Yeast strain	Supplier
RX60	Laffort
F15	Laffort
1503	Maurivin
796	Maurivin
NT50	Oenobrands
BDX	Lallemand
L2323	Lallemand
CLOS	Lallemand
EC1118	Lallemand
Uvaferm HPS	Lallemand

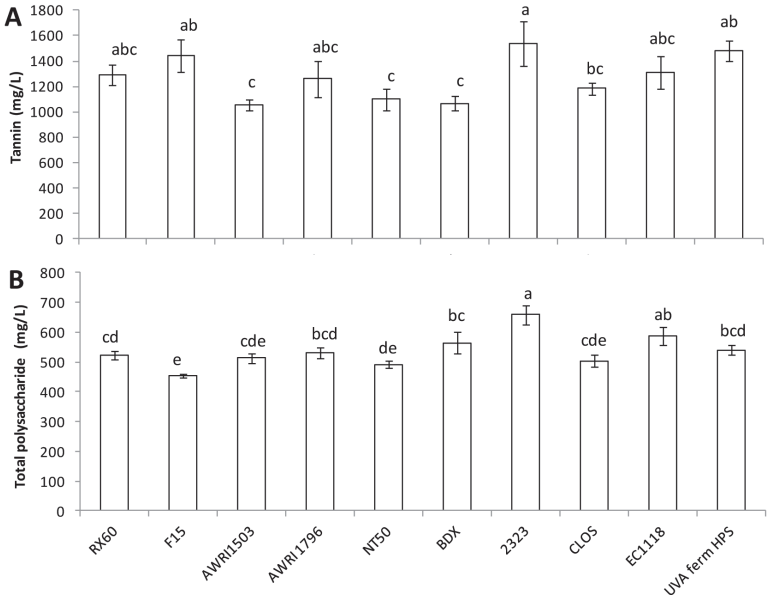

Figure 1. Effect of yeast strain on the concentration of A. tannin and B. polysaccharide determined at the end of alcoholic fermentation. Data shown are mean values ± standard error. The letter labels above the bars indicate whether or not there are significant differences between treatments (the same letter indicates no significant difference). Treatment differences were determined by one-way ANOVA $P<0.05$, $n = 30$ and a post-hoc Student's T-test.

While there were substantial differences in wines following primary fermentation, neither tannin nor polysaccharide differences were present post-filtration, which may be due to the method of filtration, or an artifact of processing small-lot wines. In a separate AWRI study, wines filtered at commercial scale through a cross-flow filtration device were found to retain differences in macromolecules. As a consequence of the homogenising effect of filtration in this study, sensory differences between the wines largely reflected yeast strain-related production of fermentation volatiles, with no significant differences in astringency or other mouth-feel attributes. Results of a descriptive sensory study are presented as a principal component analysis plot (Figure 2). Separation of the wines along PC1 (which explains 57.7% of the overall variance) occurred mainly due to differences in 'dark fruit' aroma and colour intensity, versus 'vegetal' and 'earthy' aromas. Wines made with strains BDX and AWRI 1503, and to a lesser extent NT50 and HPS, were rated lower in 'dark fruit' and colour, and higher in 'earthy' and 'vegetal' characters. Wines made with BDX, 2323, RX60, EC118 and F15 were also lower in 'red fruit' flavour.

The results of this project, while preliminary, reinforce earlier work suggesting that choice of yeast strain represents an opportunity to shape wine style. Further work comparing the impact

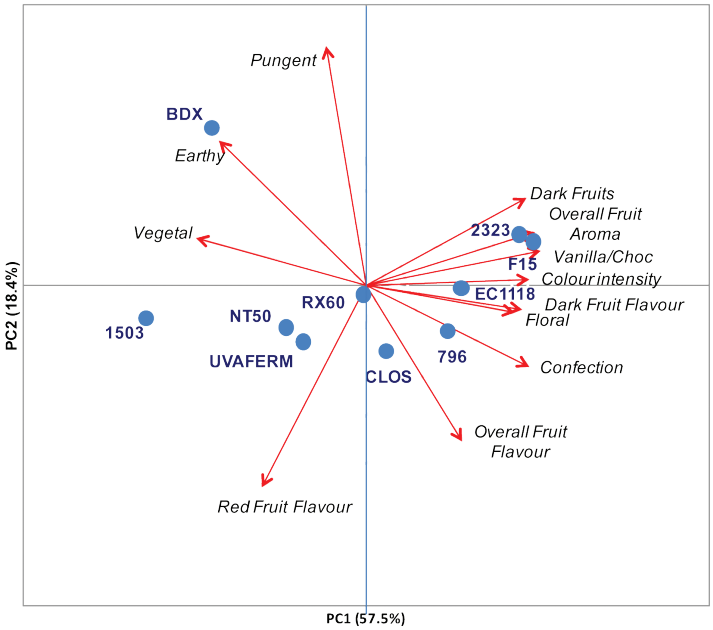

Figure 2. Principal component analysis plot of the statistically significant sensory attributes of 2014 vintage Shiraz wines made using ten different yeast strains. The wines had been bottled for two months when assessed by a trained sensory panel in triplicate.

of yeast-derived differences with those from other processing steps, including filtration, will provide winemakers with a range of options to achieve their desired outcomes.

Chris Curtin – Research Manager, Biosciences, *chris.curtin@awri.com.au*
Mark Solomon – Scientist
Leigh Francis – Research Manager, Sensory
Wes Pearson – Sensory Scientist
Alice Barker – Sensory Analyst
Stella Kassara – Scientist
Keren Bindon – Senior Research Scientist
Paul Smith – Research Manager, Chemistry

References

Blazquez-Rojas, I., Smith, P.A. and Bartowsky, E.J. (2012) Influence of choice of yeasts on volatile fermentation-derived compounds, colour and phenolics composition in Cabernet Sauvignon wine. World J. Microbiol. Biotechnol. 28, 1–11.

Gonzalez-Royo, E., Urtasun, A., Gil, M., Kontoudakis, N., Esteruelas, M., Fort, F., Canals, J.M. and Zamora, F. (2013) Effect of yeast strain and supplementation with inactive yeast during alcoholic fermentation on wine polysaccharides. Am. J. Enol. Vitic. 64, 268–273.

Holt, H.E., Cozzolino, D., McCarthy, J., Abrahamse, C., Holt, S., Solomon, M., Smith, P., Chambers, P.J. and Curtin, C. (2013) Influence of yeast strain on Shiraz wine quality indicators. Int. J. Food Microbiol. 165, 302–311.

Mercurio, M.D., Dambergs, R.G., Cozzolino, D., Herderich, M.J. and Smith, P.A. (2010) Relationship between red wine grades and phenolics. 1. Tannin and total phenolics concentrations. J. Agric. Food Chem. 58, 12313–12319.

van Wyk, H. and Divol, B. (2010) Recovery of endo-polygalacturonase activity in wine yeast and its effect on wine aroma. FEMS Yeast Res. 10, 58–71.