

The modulation of Sauvignon Blanc wine aroma through control of primary fermentation

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Declaration

I declare that this thesis is a record of original work and contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution. To the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference has been made in the text. The publications included in this thesis have not been previously submitted for the award of any degree at the University of Adelaide or other University.

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Publications

With the exception of Chapters 1, 6 and 7, this thesis is a collection of manuscripts published in different journals. As such, the text and figures in these chapters are formatted differently, according to the requirements of the specified journals. Before each of these chapters is a Statement of Authorship, signed by all authors, listing individual contributions to the work.

The journals are ranked below in the order of impact factor in reference to their scientific significance (*Journal citation report* 2009, Thomson ISI).

Journal title	Impact factor	ERA rating
<i>Food Chemistry</i>	3.146	A*
<i>Journal of Agricultural and Food Chemistry</i>	2.469	A
<i>Australian Journal of Grape and Wine Research</i>	1.872	B
<i>American Journal of Enology and Viticulture</i>	1.171	B

The thesis is based on the following papers.

- Chapter 2.** King, E.S., Swiegers, J.H., Travis, B., Francis, I.L., Bastian, S.E.P. and Pretorius, I.S. (2008) Coinoculated fermentations using *Saccharomyces* yeasts affect the volatile composition and sensory properties of *Vitis vinifera* L. cv. Sauvignon Blanc wines. *Journal of Agricultural and Food Chemistry* 56, 10829-10837.
- Chapter 3.** King, E.S., Kievit, R.L., Curtin, C., Swiegers, J.H., Pretorius, I.S., Bastian, S.E.P. and Francis, I.L. (2010) The effect of multiple yeasts co-inoculations on Sauvignon Blanc wine aroma composition, sensory properties and consumer preference. *Food Chemistry* 122, 618-626.
- Chapter 4.** King, E., Francis, I.L., Swiegers, J.H. and Curtin, C. (*in press*) Yeast stain-derived sensory differences are retained in Sauvignon Blanc wines after extended bottle storage. *American Journal of Enology and Viticulture*.
- Chapter 5.** King, E.S., Osidacz, P., Curtin, C., Bastian, S.E.P. and Francis, I.L. (*in press*) Assessing desirable levels of sensory properties in Sauvignon Blanc wines – consumer preferences and contribution of key aroma compounds. *Australian Journal of Grape and Wine Research*.

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Thesis summary

There are a number of aroma compounds that are fundamental to the sensory properties of Sauvignon Blanc wines. Two such classes of compounds are volatile thiols and esters, both of which are modulated by yeast during alcoholic fermentation. Therefore, controlling fermentation using appropriate inoculated wine yeast is likely to be an effective means of enhancing wine aroma.

In an initial study, Sauvignon Blanc wines were made using different commercial *Saccharomyces* yeast strains, with two- and three-yeast co-inoculations, as well as single-strains, and equal blends of the single-strain wines after fermentation. The wines were analysed for volatile aroma compounds, and sensory descriptive analyses were performed approximately six months post-bottling. Differences in the chemical composition and sensory profiles were observed (which confirmed and elaborated on previous research). The co-inoculated yeast treatments generally had higher concentrations of volatile thiols and higher levels of esters, with higher ratings for ‘tropical’ and ‘fruity’ attributes, than their single-strain components and the blends of the single-strain components. The co-inoculated treatments generally fermented faster and issues with an ‘acetic’ flavour for one strain were eliminated when included in co-inoculation.

Some of the wines were stored, under screw cap closures, at 15°C for three years, and the chemical and sensory analyses were repeated. The results showed that some of the yeast-derived flavour differences in young Sauvignon Blanc wines were retained after extended bottle storage.

A subset of wines showing large sensory differences was subjected to consumer acceptance testing approximately six months after bottling. Differences in liking for the different yeast treatments were observed, with the largest group of consumers preferring the two-yeast co-inoculation with an intermediate sensory profile, while another group favoured the wine made using the three-yeast co-inoculation with highest ratings for the ‘estery’ and ‘floral’ aromas and highest concentrations of volatile thiols.

To further investigate this result, a study was conducted to identify which sensory attributes drive consumer preferences for Sauvignon Blanc wines, and furthermore, the volatile compounds and their levels responsible for these sensory attributes. Volatile thiols, esters and

methoxypyrazines were added to a neutral white wine at realistic levels to mimic those found in Sauvignon Blanc wines. A sensory descriptive analysis was conducted, and a subset of samples was evaluated by consumers for liking. All three classes of compounds were responsible for influencing consumer liking, with ‘confectionary’, ‘cat urine/sweaty’, ‘cooked green vegetal’ and ‘fresh green’ aromas identified as the strongest drivers of liking for different groups of consumers identified. Demographic information, and wine usage and attitudes of these white wine consumers were also used in a segmentation exercise to gain insights into consumer behaviour.

The results of this study demonstrate that the choice of yeast inoculum, using single or multiple yeasts, affects wine aroma composition and sensory properties even after an extended period of bottle age, and that there are sufficiently large differences to influence consumer preference. This study has also shown, for the first time, clear linking of Sauvignon Blanc aroma compounds, their associated sensory attributes and interactions, and effects on consumer preference. These findings highlight the importance of yeast strain selection, and give wine producers a clearer direction for tailoring white wine styles that can be targeted to specific consumer groups.

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