

# Lees contact in white wine

In this column, Peter Godden continues a series examining the effects of winemaking variables on Chardonnay composition and style – this time focusing on post-fermentation lees contact in white winemaking.



## What happens when white wines are left in contact with lees after fermentation?

Fermentation lees primarily comprise yeast cells, tartaric acid salts, bacteria and grape solids (Salmon *et al.* 2000). During a period of lees contact, components of yeast cells are released into wine, which, coupled with other mechanisms, can result in an enhancement of the wine's sensory characters. If ageing on lees is appropriately managed, reported benefits include improved texture, a modification of oak aromas and flavours, and improved integration of oak-, fruit-, and yeast-derived characters resulting in greater complexity. The periodic stirring of lees to bring yeast cells back into suspension is known as '*batonnage*' and can be used to increase the sensory effects of lees contact. Lees contact is a traditional technique in many parts of Europe, most commonly associated with barrel-fermented Chardonnay in Burgundy, where the term '*sur lie*' or 'on lees' originated to describe the practice.

## What are the potential benefits of ageing wine on lees?

The most important yeast cell-derived compounds which improve wine

sensory properties are amino acids, polysaccharides, mannoproteins and fatty and nucleic acids (Stuckey *et al.* 1991, Salmon *et al.* 2000). The presence of yeast cells can also lead to the production of positive characters through oxidation reactions. During barrel fermentation and lees ageing, yeast convert vanillin to vanillic alcohol, which is virtually odourless, thereby reducing 'vanilla-like' aromas, while the 'toasty' aromas associated with oak are enhanced (Dubourdieu *et al.* 2000). In addition, oak tannins and other phenolic compounds are adsorbed onto yeast cells, resulting in a softening of mouthfeel, with one study finding that the total phenolics of a Chardonnay wine on lees fell over a two-month period, whether or not the lees were stirred (Leskó *et al.* 2011). Increases in the concentrations of other volatile compounds including esters, terpene alcohols and lactones have also been reported.

Amino acids in wine have been related to enhancements in both texture and aroma. In one study, after five months of lees ageing the concentrations of amino acids in stirred and non-stirred wines on lees were 257 mg/L and 282 mg/L respectively, compared to 197 mg/L in

a non-lees aged, non-stirred control. Sensory differences between the stirred and non-stirred wines and the control became evident between three and five months, with the concentration of amino acids increasing markedly between those time-points. A strong positive correlation between amino acid concentration and wine score was seen (Stuckey *et al.* 1991). A positive relationship between amino acid concentration and more complex wine aroma has also been reported, with increased amino acid concentration also stimulating malolactic fermentation.

Another benefit of lees ageing is the ability of lees to scavenge oxygen entering through the barrel staves and bunghole, especially when stirring occurs. This oxygen-scavenging capacity can reduce the amount of SO<sub>2</sub> otherwise required to prevent oxidation, although excessive stirring can introduce excess oxygen, leading to the loss of SO<sub>2</sub> and potentially the formation of acetaldehyde and acetic acid. Topping barrels during the period on lees also introduces additional oxygen, possibly resulting in oxidative characters or decreased 'freshness'.

## Are there any practical tips for ageing on lees?

Lees ageing is most commonly performed in small oak barrels, because lees ageing in tank is more likely to result in the formation of unwanted volatile sulfur compounds (VSCs). When unwanted VSCs are present in a tank-fermented wine at the end of fermentation or during a period of lees ageing, transferring the lees into barrels for 48 hours and then recombining them with the wine has been found to completely eliminate ethanethiol and methanethiol within 24 hours, with the concentration of hydrogen sulfide also falling by over 80% during the following four weeks (Lavigne-Cruège and Dubourdieu 2001).

The stirring of lees encourages continued cell viability, and while it has been shown that cell viability is not an important factor in the sensory changes associated with lees contact,



viability does encourage the assimilation of any residual sugar. For this reason, a small amount of stirring at the end of fermentation is recommended.

### Are there any risks associated with ageing on lees?

The greatest potential risks with lees ageing are the formation of unwanted VSCs and associated 'leesy' or 'cheesy' sensory characters, and the formation of acetaldehyde and acetic acid. Unwanted VSCs are more likely to form when initial juice solids are above 200 NTU, or when insufficient oxygen is introduced by stirring, with acetaldehyde and acetic acid being more likely to form when excessive oxygen is introduced by stirring and topping (Lavigne-Cruège and Dubourdieu 2001).

The formation of biogenic amines in Chardonnay aged on lees for 180 days has also been studied (González-Marco and Ancín-Azpilicueta 2006), with the concentrations of tyramine and histamine found to be higher than in

the same wine stored in barrels without lees. It is possible that such amines could reach concentrations problematic for sensitive individuals in wines subjected to ageing on lees, particularly when stirring is employed.

For further information about post-fermentation lees contact or other technical winemaking or viticulture questions, contact the AWRI helpdesk on (08) 8313 6600 or helpdesk@awri.com.au

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### References


Dubourdieu, D., Moine-Ledoux, V., Lavigne-Cruège, V., Blanchard, L., Tominaga, T. 2000. Recent advances in white wine ageing: the key role of the lees. *Proceedings of the ASEV 50th anniversary annual meeting, Seattle, Washington, USA, June 19-23*: 345-352.

González-Marco, A., Ancín-Azpilicueta, C. 2006. Influence of lees contact on evolution of amines in Chardonnay wine. *J. Food Sci.* 71(9): c544-c548.

Lavigne-Cruège, V., Dubourdieu, D. 2001. The appetite of wine lees for eliminating foul-smelling thiols. *Aust. Grapegrower Winemaker*. July: 37-44.

Leskó, A., Kállay, M., Nyul-Púhra, B., Nyitrai-Sárdy, D. 2011. The change of polyphenolic composition and tyrosol content of the wine as an effect of the sur lie method. *Acta Aliment.* 40 (Suppl 1): 79-90.

Salmon, J-M., Fornairon-Bonneford, c., Mazaucic, J-P., Moutunet, M. 2000. Oxygen consumption by wine lees: impact on lees integrity during wine ageing. *Food Chem.* 71: 519-528.

Stuckey, W., Iland, P., Henschke, P., Gawel, R. (1991). Influence of lees contact on quality and composition of Chardonnay wines. *Aust. N.Z. Wine Ind. J.*, November: 281-284. 



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