Grape solids in white winemaking

Since 2016 the Australian Wine Research Institute (AWRI) has made a series of wines from single batches of grapes, changing one variable in each fermentation, with the resulting wines being presented to winemakers in workshops around Australia. In 2019, the trial was conducted with Chardonnay. The AWRI's **Peter Godden** covers key questions on grape solids in white winemaking and is the first in a series that will examine winemaking variables included in the 2019 trial that have a significant influence on Chardonnay wine style.

Why are juice solids important?

In white winemaking, the degree of juice clarification is one of the first decisions a winemaker has to make, with the quantity of juice solids affecting the primary and secondary fermentation kinetics, and the sensory profile of the resulting wine.

What are juice solids?

The solids content of juices varies markedly, depending on the characteristics of the grapes and the processes used for juice extraction. However, the exact composition of juice solids remains unclear and consequently there are no standardised methods to characterise them, or to assess the ideal inclusion rate to achieve a given wine style.

Alexandre *et al.* (1994) found that the solids fraction of white juice contained about 70% polysaccharides and 8% lipids, with the remaining material made up mostly of minerals, pectin and about 2.5% nitrogen. It has also been reported that phenolic compounds are present. Most grape-derived solids in white juice have a particle size less than 2µm in diameter, although once fermentation commences the size of particles decreases, possibly due to agitation caused by CO_2. Towards the end of fermentation, as CO_2 production slows, the particles tend to aggregate to form larger particles, which then settle with the yeast lees. (Casalta *et al.* 2016).

What effects do solids have on fermentation?

Grape solids provide nutrients for yeast cell development, particularly lipids and nitrogen. Lipids are integral components of cell membranes, which allow the cell to tolerate the ethanol concentration found late in fermentation. Consequently, fermentations containing a greater proportion of solids are generally faster and less likely to become sluggish or stuck. In addition, wines made with high juice solids have a faster rate of malolactic fermentation.

How can I measure the degree of solids in my juice?

Turbidity measurement, with results expressed in nephelometric turbidity units (NTU), is the most common way in which the degree of solids of a juice is assessed, with total wet or dry suspended solids or percentage solids also used. However, none of these measures characterise the composition or particle size of the solids present. Nonetheless, in a practical sense, NTU is the most useful way to assess and compare the quantity of solids in individual juices.

Is there an ideal NTU for white winemaking?

Schneider (2013) (referenced in Casalta et al. 2016) recommended NTUs of 50 to 150 to ensure that yeast had access to sufficient lipids. However, in fermentations with more clarified juice, the addition of oxygen at the end of the yeast growth phase can compensate for the lack of juice lipids, with the yeast able to use the oxygen to synthesise lipids.

An Italian study fermented juices of three white varieties at six turbidity levels ranging from 15 to 350 NTU. Greater turbidity resulted in shorter fermentations with lower residual sugar concentrations, independent of yeast assimilable nitrogen content. A turbidity of 100 NTU was considered the 'best compromise' to maximise 'fruit' aromas while avoiding either sluggish ferments at lower turbidity, or 'reductive' sensory characters observed at higher turbidity (Nicolini *et al.* 2011).

What effects on wine composition and sensory properties have been related to the concentration of juice solids?

The concentrations of at least 40 volatile and non-volatile compounds have been shown to be affected by changes in juice turbidity, with higher turbidity resulting in lower volatile acidity and acetaldehyde concentrations, and increased glycerol. High solids have also been shown to produce wines with lower concentrations of esters and higher concentrations of volatile sulfur compounds and higher alcohols, resulting in subdued varietal character.

In one study, wines of three varieties made from high-solids juices contained more polysaccharides than wines made from low-solids juices, regardless of the extraction method (whole bunch pressing, free-run juice or hard pressing). However, the results were not as clear for the phenolic content of the wines. Although the wines made from high-solids juices generally contained comparatively high concentrations of total phenolics, ratings of wine astringency were not affected. However, when the wines made from higher solids juices were adjusted to the same pH as low-solids wines, they were rated higher for 'oiliness' and viscosity, which was attributed to higher polysaccharide and phenolic concentrations. Increases in glycerol concentration of up to 1 g/L were seen; the authors noted that while this might lead to an increased perception of sweetness, it would not affect perceived wine viscosity (Gawel *et al.* 2015).

Are there dangers in using a greater quantity of solids?

Most of the polyphenol oxidase enzymes which can cause juice browning in the presence of oxygen are found in the grape skin, and therefore high-solids juices may be more susceptible to oxidation. In addition, the concentration of any vineyard-derived elemental sulfur would also increase with increasing solids content, with that sulfur potentially contributing to the formation of negative 'reductive' characters in wine. However, if managed correctly, the inclusion of a greater concentration of solids can facilitate the production of the 'struck flint' reduction character prized in some Chardonnay wines.

For further information about grape solids or other technical grapegrowing or winemaking questions, contact the AWRI helpdesk on (08) 8313 6600 or helpdesk@awri.com.au

Acknowledgements

Michael Downie is thanked for his assistance in finding and acquiring information resources used in the preparation of this article.

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