The Australian Wine Research Institute

Fact Sheet
WINEMAKING

Adding oxygen during fermentation – Case studies

Background

There are many reasons a winemaker might want to limit the amount of oxygen their wine is exposed to during its life; however, a Wine Australia-funded research project at the AWRI has shown a number of benefits from adding oxygen or air during fermentation.

In red fermentations, benefits include:

- mitigation of reductive characters (Bekker et al. 2021)
- improved stylistic outcomes.

In white fermentations, the addition of oxygen can result in:

- healthier and faster ferments and fewer stuck ferments
- alleviation of fermentation problems associated with nutrient deficiencies or other adverse conditions.

This fact sheet presents case studies from three different wineries that have adopted aeration of ferments.

Why Calabria Wines in the Riverina has adopted oxygen addition

Adding oxygen during fermentation was an easy decision for Calabria Wines Senior Winemaker Jeremy Nascimben. Jeremy is an avid reader of technical papers and wine journals and has kept in touch with the science on the benefits of using oxygen during fermentation. He has been applying this knowledge since 2014 at Calabria Wines. This case study explores how oxygen is used in red ferments at Calabria Wines in the Riverina.

Calabria Wines is a 20,000+ tonne winery in Griffith, NSW in the Riverina region, which is

responsible for approximately 20% of all wine grapes crushed in Australia.

For Jeremy at Calabria wines the decision to add oxygen to red ferments has primarily been driven by the desire to better manage 'reductive' issues which he has found to be associated with poor yeast-assimilable nitrogen (YAN) levels in fruit. Jeremy noticed that YAN levels in certain varieties were consistently low year after year and a different approach was needed rather than just continually adding DAP. In Jeremy's eyes, 'Wines that have a lot of DAP added to them provide an unwanted hardness on the palate whereas wines that have been treated with oxygen during fermentation are softer and more approachable and require less DAP addition'. Since 2014 when the winemaking team at Calabria Wines started adding air to red ferments, the amount of DAP used in the winery has decreased, reducing a winemaking input cost.

The set-up used at Calabria Wines

The mechanism for adding oxygen at Calabria Wines involves delivering filtered compressed air via a series of 'nipple fittings' located on the rack arm on each fermenter (see Figure 1).

Each red fermenter has a dedicated air line which can be manually turned on and off in the cellar. The amount of air that each ferment receives depends on the size of the ferment. For example, the largest ferment (a 220 kL tank or 185-tonne fermentation) receives six hours of air at a flow rate of 12 m^3/min a day for the first half of the fermentation, whereas a smaller 5-tonne fermenter might only receive 40 minutes per day at a flow rate of 12 m^3/min for the first half of the ferment.

If 'reductive' characters are observed as the ferment progresses, then air is given in the second half of the ferment but typically this is not required.

Practical barriers that Jeremy has had to overcome include blocking of the delivery nipples with grape skins/seeds, which can prevent the delivery of air; however, there are plans in the future to use fittings that can be easily removed and cleaned.

Figure 1. The set-up used for air addition at Calabria Wines, with filtered compressed air delivered via 'nipples' on fermenter rack arms

Repurposing rotary fermenters at Chapel Hill, McLaren Vale

This case study presents Chapel Hill winemaker Bryn Richards' experiences using air during the production of red wines, with a particular focus on the use of air in rotary fermenters. Chapel Hill is a 600+ tonne winery located in McLaren Vale, South Australia.

Rotary fermenters

Rotary fermenters are anaerobic in nature, as they are designed as closed systems. The cap is broken up and wetted by gently rolling the vessel on an axial basis; however, during this process there is little to no oxygen introduced to the ferment. As a consequence, wines produced in these fermenters can be at risk of developing 'reductive' characters during fermentation.

Avoiding 'reductive' characters

There are a number of different options used by winemakers to treat 'reductive' characters that form during fermentation. A recent project at the AWRI compared five different strategies and found that the simplest and most effective was to introduce air/oxygen into the fermentation at multiple time points in the first half of fermentation. Not only did this decrease 'reductive' characters in the resultant Shiraz wine but it also increased 'red fruit' characters (Bekker et al. 2021).

The set-up used at Chapel Hill

Chapel Hill has been using oxygen in red ferments for over a decade with the knowledge that yeast health and yeast strength are key for successful fermentations. Webinars and research papers produced by the AWRI have played a part in Chapel Hill's adoption of using oxygen, and in recent years staff have liaised directly with AWRI researchers to explore how far they can go with it. Fitting air/oxygen spargers within the rotary fermenters (beneath the cap) has enabled 'reductive' issues (should they arise) to be addressed and has improved fermentation performance overall. For the winery's 20 kL rotary fermenters, sparge times are 2 x 30 minutes per day at a flow rate of 20 L/min on the first couple of days and then increasing once the ferment becomes active to 4 x 30 minutes of sparging per day at a flow rate of 20 L/min. Chapel Hill uses filtered food grade compressed air rather than bottles of oxygen, which reduces the cost.

Why Chapel Hill has adopted oxygen addition to red ferments

For Bryn Richards, the addition of oxygen in red ferments has primarily been to minimise 'reductive' issues in rotary ferments as well as improving yeast health and yeast strength. He noted that 'air is part of a tool kit that winemakers can delve into'.

Practical barriers that Bryn has overcome with this technique is that initially the rotary fermenters were fitted with 0.5 micron sinters; however, these blocked easily and were difficult to keep clean, which led to 'reductive' issues coming back. These have since been swapped for 'nipples' which bubble air straight into the ferment and are less prone to blockages due to their larger hole size.

Using air at Houghton Wines, Margaret River

Winemaker, Courtney Treacher, indicated that initially when aeration was adopted at Houghton Wines, air was introduced into red ferments through practices such as splashing during drain and returns, or simply via a sinter on a 'stick', pushed below the cap on open top fermenters when deemed necessary. Now most red fermentation tanks at the winery have permanent compressed air lines plumbed to them, with a series of sinters within the tank that deliver the filtered compressed air to the ferment at the appropriate time.

The set-up at Houghton Wines

At Houghton Wines, the philosophy is to deliver one minute of compressed air per tonne of fruit twice every 12 hours. For example, a 10-tonne batch of Shiraz would be given 10 minutes of compressed air twice every 12 hours. Ferments typically receive this treatment in the first half of the fermentation. In smaller open top fermenters, air is delivered by the sinter on a 'stick' for the duration of all pump-overs.

Why Houghton Wines uses air

The main driver for using air in red ferments at Houghton Wines has been to mitigate 'reductive' issues and to improve yeast health. This has seen wine quality improve through no stuck or sluggish fermentations, and wines that are clean of 'reductive' characters.

From a practical point of view, Courtney advises that if the oxygen use is overdone, skins can be shredded and in that case pump-over times should be adjusted to a shorter period.

References and further reading

Ways to introduce oxygen into an active red ferment (AWRI fact sheet)

Bekker, M. Z., Nandorfy, D.E., Kulcsar, A. C., Faucon, A., Bindon, K., Smith, P. A. 2021. Comparison of remediation strategies for decreasing 'reductive' characters in Shiraz wines. *Aust. J. Grape Wine Res*. 27: 52-65.

Acknowledgement

This work was supported by Australia's grapegrowers and winemakers through their investment body Wine Australia, with matching funds from the Australian Government. The AWRI is a member of the Wine Innovation Cluster.

Contact

For further information, please contact:

The AWRI helpdesk.

Phone 08 8313 6600 **Fax** 08 8313 6601

Email helpdesk@awri.com.au

Website
https://www.awri.com.au/industry_support/winemaking_resources/aeration-of-ferments/

Address Wine Innovation Central Building, Corner of Hartley Grove & Paratoo Rd, Urrbrae (Adelaide), SA 5064