

Aerating red ferments

The influence of oxygen on wine fermentation has been studied at the AWRI since 2014. Over that time, a great deal has been learned about how to use oxygen to achieve different winemaking goals. In this column, AWRI Research Manager, **Dr Simon Schmidt** and AWRI Senior Oenologist, **Matt Holdstock** explore answers to key questions winemakers might ask before trialling oxygen addition next vintage, with a focus on red fermentations.

What are the effects of adding oxygen to ferments?

While winemakers and wine drinkers have traditionally been taught that oxygen is an enemy of wine, the AWRI's research has shown that oxygen addition during fermentation can have significant beneficial effects. Interestingly, the benefits are not the same for red and white winemaking. In white winemaking, oxygen addition during fermentation can improve yeast health and speed up fermentation times, increasing processing efficiency. In red wine fermentations, however, the fermentation performance effects are less noticeable, and it may be more helpful to think of oxygen affecting aroma, flavour and mouthfeel.

What are the specific benefits of adding oxygen to a red ferment?

Aerating red ferments can cause changes in mouthfeel and texture, with wines appearing 'softer' and with lower perceived astringency. Oxygen addition also increases 'red fruit' characters and makes red wines more 'fruit forward'. These positive stylistic outcomes have been seen consistently across multiple research trials on Shiraz ferments.

Which gas should you use? Air or oxygen?

Either air or pure oxygen can be used to add oxygen to a fermentation. However, clean, filtered compressed air may be the simplest, safest and cheapest option. Air contains 20.9% oxygen and 78% nitrogen, with tiny amounts of other gases. Pure oxygen (100%) requires less volume to achieve the same effect as air, but associated safety aspects need to be considered. For example, oil and grease or organic matter can ignite spontaneously in contact with pure oxygen. Another risk when using pure oxygen is the potential to over-oxygenate should an incorrect addition occur (e.g. through a

leaky valve). It should be noted, however, that there are wineries that use pure oxygen without any problems.

What equipment is needed to add air to a ferment?

There are many ways to add air to a ferment, depending on the size and type of ferment vessel used. Some wineries with large-format tanks have installed static sinters or injectors at the bottom of the tank and control them manually or remotely via an electronic control device. For smaller fermenters, one of the simplest and most convenient ways to aerate is to use a device in the pump-over system. Devices such as a Venturi injector (Figure 1, see over) or a 'vortex sparger' (Figure 2, see over) are suitable for closed pump-over circuits and sit in line with the pump. These types of fittings inject air as the ferment is pumped past the fitting and can be an excellent place to start for any winemaker interested in getting more oxygen into their ferments.

When is the best time to add air to a red ferment?

It is difficult to be definitive about the optimal timing for aeration of red ferments because the reason for aerating them relates more to wine style rather than to yeast health. For these style-related effects to occur, the oxygen needs to interact with the wine chemically, not just by stimulating yeast biology. Oxygen needs to be present in measurable amounts for some time to stimulate the chemical interactions. It can also be challenging to get oxygen into a rapidly fermenting tank because of the high rate of carbon dioxide production. For these reasons, it can be helpful to think about cumulative oxygen exposure over the entire ferment duration rather than individual aeration events.

Coordinating aeration with cap management operations has proven to be a successful and efficient approach



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Figure 1. Venturi injector

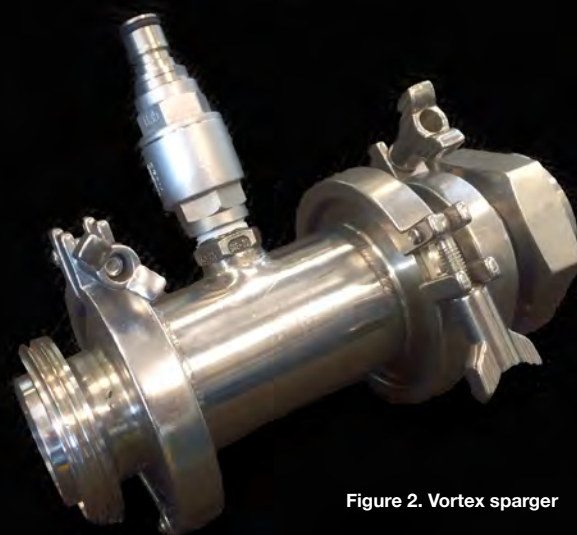


Figure 2. Vortex sparger

to red ferment aeration. If daily cap management is undertaken using pump-overs, for example, four times a day for 15 minutes each, a ferment can easily achieve a cumulative oxygen exposure of four hours with an in-line aeration device. Similar aeration regimes can be used in rotary fermenters preceding rotation. In static fermenters where caps are managed by plunging, diffusers in the bottom of the tank may be the most efficient delivery method. In this case, aeration should start two or three days after inoculation and can run continuously at a low flow rate for 24 to 48 hours. The volume of air that a ferment requires or can handle will vary. As a starting point, gas flow rates between 0.5 L/min/kL in static situations up to 10 L/min/kL during a pump over with an in-line sparger could be considered.

Do traditional cap management techniques expose ferments to air?

One aspect of the research was to understand how much oxygen enters the ferment during cap management techniques such as pump-over or plunging. Interestingly, very little

dissolved oxygen can be measured in the fermenting liquid following any of these operations, suggesting that more active aeration techniques are required to achieve the benefits of oxygen exposure during fermentation.

Can you add too much oxygen? Will aerating the ferment oxidise the wine?

In all of the trials conducted, red ferments have shown themselves to be very resistant to oxidation. Active ferments constantly generate carbon dioxide, which helps protect the wine, and yeast cells tend to take up and use any available oxygen quickly. Overt oxidative characters were never observed in any of AWRI's red-ferment aeration trials, suggesting that the risk of oxidation is very low. Winemakers should feel confident in trialling the aeration of red ferments.

Where can I find more information?

The AWRI has developed a range of extension materials, including an online workshop and two episodes of the podcast 'AWRI decanted', to support the uptake of oxygen use during fermentation,

which are being released prior to vintage 2022. For further information, contact the AWRI helpdesk on (08) 8313 6600 or helpdesk@awri.com.au

References and further reading

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More about the benefits of aeration during fermentation is explored further in Sonya Logan's article starting on page 60. **CW**