The Australian Wine Research Institute

Fact Sheet
ENVIRONMENT

Winemaking in a changing climate

Background

The earth's surface is warming and this is directly linked to greenhouse gas (GHG) emissions. Mitigating GHG emissions is essential if this warming is to be slowed or reversed. All industries need to consider how they are going to go about mitigating emissions, and this includes the Australian wine industry.

Project aims

The AWRI project *Building resilience and sustainability in the grape and wine sector* aims to collate and deliver up-to-date technical information about greenhouse gas emissions, carbon sequestration and opportunities that the Emissions Reduction Fund can provide. Project extension officers will offer grapegrowers and winemakers support to reduce their emissions and consider the opportunities to benefit financially from participation in the Emissions Reduction Fund.

Reducing energy consumption

Energy audits conducted by the AWRI have shown that heating and refrigeration account for very high percentages of a winery's energy consumption and greenhouse gas emissions. Heating and cooling in more efficient ways can therefore result in significant savings as well as mitigate GHG emissions. An example of this could be reusing the water that has been heated for one process (e.g. bottling line sterilising) as a preheating option for another (e.g. hot water boiler). AWRI modelling indicates that this could potentially save up to 30% of a winery's water heating bill. This has both an environmental and economic benefit to the winery. Another opportunity for savings in water heating is through changing to a different heating technology (e.g. electrical heater versus natural gas heater or solar). Using flotation as a technique for solids removal in place of cold settling is another example of achieving greater efficiency with less energy input.

Measuring the greenhouse gas emissions of grape and wine businesses

How can grapegrowers or winemakers measure their energy use and greenhouse gas emissions? This can be done very easily using the Australian Wine Carbon Calculator, available from the Winemakers' Federation of Australia at: http://www.awri.com.au/industry_support/entwine/carbon-calculator/

Alternatively, one of the AWRI's extension officers can assist you with this process. The calculator estimates the total emissions of carbon dioxide (CO_2) equivalents produced as a result of all the activities undertaken during wine production. The Australian Wine Carbon Calculator builds on the international version that has been in use since early 2008 and includes components specific to Australian needs, such as Australian Government-endorsed emission factors. Estimating the emissions of a business opens the door to understand areas of highest energy use and of emission sources, and once known, strategies for mitigating emissions can be devised. Information on reducing emissions from viticulture can be found in the related AWRI fact sheet 'Managing greenhouse gas emissions in viticulture'.

Increased temperatures – hot/dry weather, heatwaves and compression of ripening

Increased temperatures and periods of hot dry weather will lead to faster ripening and shifting forward of harvest dates. Fruit maturing very quickly will impact on picking logistics, with increased competition for harvesting equipment and picking resources.

In early 2014, the Bureau of Meteorology launched a tool called the pilot heatwave service for Australia that allows the occurrence and severity of a heatwave to be predicted. This tool can be found here:

http://www.bom.gov.au/australia/heatwave/?ref=marketing#heatwave-forecasts

Unexpected heatwaves and compression of vintage can make planning difficult. Forward planning for vintage will need to include:

- Ensuring adequate tank space and equipment are available
- Assessing cooling capacity to ensure it will be sufficient
- Considering the possibility of red and white fruit being picked and needing processing at the same time

Heatwaves can also lead to sunburnt and shrivelled fruit along with rapid sugar level increases. Higher than expected sugar levels will lead to higher than desirable alcohol levels which can impact on yeast's ability to complete fermentation, affect wine style and potentially lead to loss of wine quality. One of the simplest things a winemaker can do in these situations is to prepare a strong yeast culture to handle this extra sugar and alcohol. Details on how to prepare such a culture are included in the AWRI's stuck fermentation management fact sheet

Higher sugars and alcohol levels

Engineering options for reducing sugar content of juice and alcohol concentration in wine include membrane-based systems (such as reverse osmosis and evaporative perstraction), vacuum distillation and spinning cone distillation. These techniques allow for effective and precise control of alcohol

reduction, and have seen widespread evaluation across the industry. However, in some circumstances, other sensory compounds might also be removed which could impact on wine quality. Scientific evidence for establishing and minimising the impact of these approaches on wine flavour is currently limited.

More frequent bushfires

One consequence of a changing climate is increasing frequency of bushfires. Damage to grapes (and resulting wines) from lingering bushfire smoke has occurred in many regions across Australia in the past decade, and is likely to become more common. The most effective time to test for levels of smoke taint in grapes is as close to the harvest date as possible. It should be noted, however, that a finding of low concentrations in grapes at harvest is not a guarantee that any wine made from those grapes will be free from smoke taint. Guaiacol and other volatile phenols can be released during fermentation as a result of bound precursors being liberated during the process. Research at the AWRI has also shown that some low levels of these compounds also exist naturally in grapes.

The AWRI recommends conducting laboratory-scale ferments of potentially affected grapes in an attempt to better understand the actual impact on the final wine. This will provide an indication of potential levels of volatile phenols likely to be liberated from the precursor forms. More information can be found on the smoke taint page on the AWRI website.

Acknowledgement

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Reference and further reading

Winemaking implications of drought

Samples for smoke taint analysis - frequently asked questions

Procedure for rescue of stuck or slow alcoholic fermentation

Carbon calculator

Reducing alcohol levels in wine fact sheet

Avoiding microbiological instabilities

Contact

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