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Measuring the environmental footprint of Australian grapes and wine

There is currently significant interest from grapegrowers and winemakers in understanding the environmental footprint of grapes and wine and taking steps to reduce environmental impacts, in particular greenhouse gas emissions. In this column, AWRI Manager – Sustainability and Viticulture, **Dr Mardi Longbottom**, explores the technique of life cycle assessment and some opportunities for reducing emissions in viticulture.

How can the environmental impact of a product be assessed?

Life cycle assessment (LCA) is a method for assessing the environmental impact of a product or process throughout all stages of its life cycle. An LCA includes an assessment of the resources used, waste generated and other environmental impacts. These assessments are globally recognised, with an international standard series (ISO 14040 series) defining the principles and framework for conducting an LCA, including application and reporting requirements. LCAs are useful for comparing products or processes that perform the same function, as they are conducted using standardised assessment processes. By evaluating LCA outcomes, people or businesses can better understand the critical phases in the development of a product or process, identifying opportunities for improving environmental impacts.

In general, the scope of an LCA conducted on a product is either 'cradle to grave' or 'cradle to gate'. In a 'cradle to grave' assessment, the whole production chain is covered, including the extraction and processing of raw materials, energy production, use, recycling and disposal. A 'cradle to gate' assessment, on the other hand, evaluates environmental impacts up to the point that a product leaves the production facility or farm-gate. In the context of the wine industry, a 'cradle to grave' assessment includes all impacts from growing the grapes right through to the point of sale of a bottle of wine, including package reuse ,recycling or disposal, whereas a 'cradle to gate' assessment would include grapegrowing and winemaking, but conclude at the point when wine is dispatched from the winery. The process for calculating a carbon footprint is similar to conducting an LCA, but focused only on greenhouse gas emissions and climate-related impacts.

It has been reported that the carbon footprint of Australian wine has decreased in recent years. What is behind this decrease and will it continue in the future?

It was recently reported that using a 'cradle to grave' LCA, the carbon footprint of Australian wine was 1.05kg CO2e/L (Hirlam *et al.* 2023), a 10% decrease on the value calculated back in 2016 (1.16 CO2e/L) (Abbott *et al.* 2016). While this data has not been independently verified, a similar approach to the assessment was taken at both time points and it is useful to compare the differences. Overall the greatest contribution to the carbon footprint of wine is from transport and packaging, representing approximately 74% of the total, an increase of 6% from 2016. The biggest contributors to the overall decrease in carbon footprint was from electricity use in vineyards and wineries. Interestingly, it was not that vineyards and wineries used less electricity, but rather that there has been a significant increase in the proportion of renewable energy sources across Australia. The penetration of renewable energy in South Australia and Western Australia has increased by 18%, in Victoria by 17% and in NSW by 14%. It is likely that with increasing investment in renewable energy, the carbon footprint of wine will continue to decrease; however, the biggest opportunity for reducing emissions will be packaging and transport. It is expected that this will be a focus for future research on alternative packaging.

What opportunities are there to reduce emissions from the vineyard?

In the 2022 report cited above, growing grapes contributed to 13% of the 'cradle to gate' emissions. While this is a small proportion of the overall emissions profile, a major benefit to reducing vineyard emissions is that there are usually associated cost savings. A breakdown of greenhouse gas emissions from vineyards found diesel (44%), electricity (26%) and electricity used for irrigation delivery (15%) were the biggest contributors. Less than 20% of vineyard emissions came from fertiliser (3%), grape transport (5%), agrochemicals (3%) and nitrous oxide (from nitrogen fertiliser use, 4%). The two primary sources of diesel use in vineyards are tractors and irrigation pumps, so any steps to reduce these can be considered. One way vineyards can reduce tractor use is by combining multiple operations into a single tractor pass (e.g. performing slashing and trimming together). Alternatively, many vineyards effectively graze stock in vineyards during winter, which can decrease the number of slashing passes required and reduce the need for undervine weed control (by herbicide or mechanical means). Approaches to reducing diesel used for irrigation include watering at night to avoid evaporative losses, use of soil moisture monitoring equipment to optimise irrigation timing and volume, and the installation of automated systems that also monitor changes in water pressure and provide early indication of system problems. These activities have added benefits in increasing water use efficiency.

Are there other options to reduce emissions from electricity?

For most vineyards, the primary use of electricity is for irrigation, so options to reduce electricity use mostly relate to those factors discussed above. Over the past fifteen years, there has been a significant increase in the use of on-farm solar energy capture, use and export as a substitute for coal-derived electricity. The installation of solar energy systems has been largely driven by grants and subsidies and these continue to be offered in various forms. Growers should keep an eye out for government incentives to adopt solar systems at relatively low cost. As discussed earlier, there has also been a shift towards renewable energy supplied through the electricity grid. When reviewing electricity use, there are options for growers to seek out providers or plans that offer renewable energy supply.

References and further reading

Abbott, T., Longbottom, M., Wilkes, E., Johnson, D. 2016. Assessing the environmental credentials of Australian wine. *Wine Vitic. J.* 31 (1): 35-37.

Hirlam, K., Longbottom, M., Wilkes, E., Krstic, M. 2023. Understanding the greenhouse gas emissions of Australian wine production. *Wine Vitic. J.* 38(2): 34-36.

Sustainable Winegrowing Australia case studies - https://sustainablewinegrowing.com.au/resources/

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