Manganese levels in wine – an update

In early 2014 it became clear that Chinese authorities were enforcing a 2 mg/L limit on the manganese content of wines imported into China. Reports were received that a number of wine shipments had been rejected based on this manganese limit, with the wines either destroyed or returned to their point of origin. This news caused considerable concern among wine producers, in particular because the limit imposed did not seem to take into account the naturally occurring levels of this element in wine or relate to any known risks to human health or wine quality.

At the time that this issue emerged, Wine Australia (now AGWA) provided a recommendation that all Australian wines being exported to China be tested for manganese, and that the safest course of action for wines with manganese concentrations exceeding 2 mg/L was not to send them to China.

Since the enforcement of the limit, AWRI Commercial Services has tested over 2,000 finished Australian wines for manganese. This data set is an important resource in understanding the distribution and drivers of manganese content in Australian wines.

How much manganese is found in wines?

The median level of manganese in all wines tested to date is 1.4 mg/L with around a quarter over the regulatory limit of 2 mg/L. Levels are somewhat higher for red wines than white wines; the median result for reds is 1.7 mg/L with 28% over the limit (Figure 1) and the

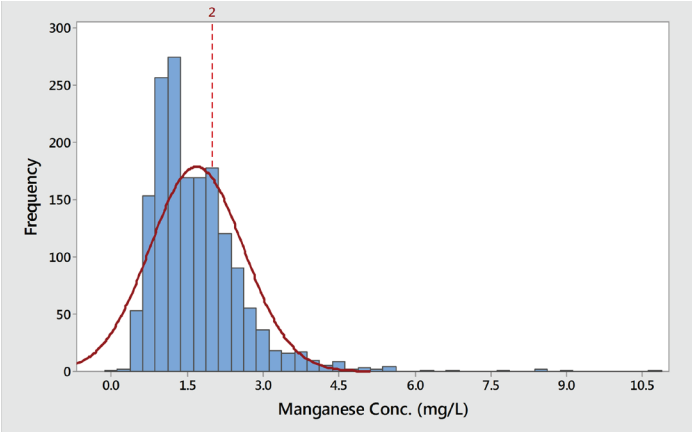

Figure 1. The distribution of manganese concentrations in red wines from vintages 2008–2014 tested at the AWRI Commercial Services laboratory (n=1,651).

median value for whites is 1.1 mg/L with 16% over the limit. These findings align with current thinking that the more extractive nature of the red winemaking process results in higher manganese concentrations, likely due to transfer of manganese from grape skins into wine.

Do manganese concentrations vary with vintage, variety or region?

The most obvious variations seen to date relate to vintage (Figure 2). For example, the median value for 2013 is significantly higher than that for 2011. This suggests that weather differences between vintages may have an impact. Initial data for wines from the 2014 vintage suggest that the levels will be at least as high as those in the 2013 vintage wines.

Breaking down the results by different varieties suggests that median manganese levels are very similar among Shiraz, Cabernet and Merlot wines. Wines made from Pinot Noir or Grenache appear to have slightly lower median manganese concentrations, but the limited numbers of samples in the data set for those varieties make the significance of this result unclear.

Comparison between wines from different regions is difficult as the numbers of samples for any given region are relatively low. However the data seem to hint at significant differences between some regions, which could be linked to regional differences in soil type, manganese bioavailability and climatic conditions.

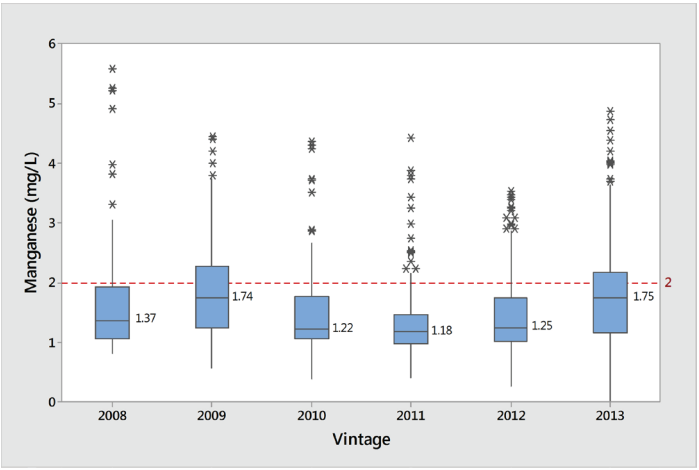

Figure 2. Median values and distributions of manganese concentrations in red wines for vintages from 2008 to 2013 (results over 6 mg/L have been excluded from the graph for clarity but still contribute to the median value).

Is this just an issue for Australian wine producers?

Two major surveys of manganese levels in wines from the world's major wine-producing countries have been conducted by the AWRI. Results of these surveys show that the distribution of manganese results is consistent across different countries of origin. This means that meeting China's regulatory limit for manganese is an equally significant issue for other wine-producing countries as it is for Australia.

Where is the manganese in wine coming from?

The vineyard appears to be the major source of manganese in wines. The main drivers of manganese concentration appear to be soil bioavailability and local environmental conditions. Vineyard practices may be able to modulate but not eliminate manganese levels and the vinification process does not usually add significantly to the levels already found in grapes.

While there are some winery sources for manganese, these seem to be relatively insignificant. Some bentonites have been identified as capable of contributing significant amounts of manganese (Catarino et al. 2008); however this varies significantly between different bentonite products and is unlikely to affect red wines which are typically not bentonite fined.

Another study identified manganese-containing fungicides as a possible significant source of manganese (La Pera et al. 2008). However, work at the AWRI during vintage 2014 found no clear link between the number of spray applications of one manganese-containing fungicide (mancozeb) and the final concentration of manganese in wine (Figure 3). Such sprays do not appear to be the primary source of manganese in the Australian context.

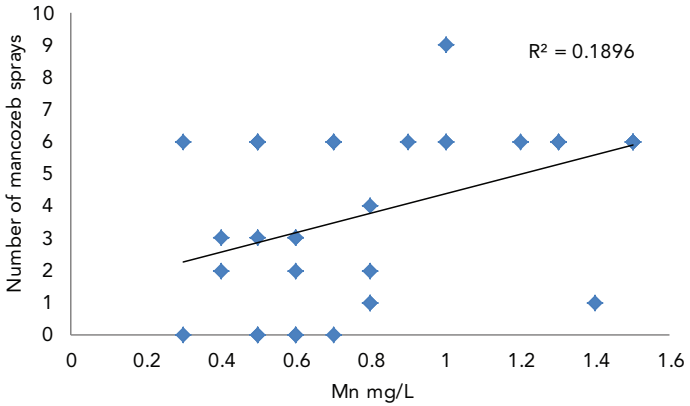

Figure 3. A comparison of the final wine concentration of manganese with the number of applications of the manganese-containing fungicide mancozeb. No correlation was found.

What can producers do?

Given the fact that most of the manganese found in grapes and wine is likely to be naturally occurring, it is difficult, if not impossible, for wine producers to ensure that they will meet an arbitrary regulatory limit. Typical winemaking processes do not seem to affect the amount of manganese found in wine, making it difficult to modify the vinification process to reduce levels. To date none of the allowable wine fining agents have shown any significant ability to remove manganese. A number of companies are offering manganese removal services based on filtration/ion exchange or electrodialysis; however these processes can add significant costs to production and may affect the wine flavour profile.

Efforts to negotiate more realistic regulatory levels of manganese in wine continue at intergovernmental level. In the mean time it is recommended that wine producers analyse their products for manganese before export to China.

References

Catarino, S., Madeira, M., Monteiro, F., Rocha, F., Curvelo-Garcia, A.S., De Sousa, R.B. (2008) Effect of bentonite characteristics on the elemental composition of wine. J. Agric. Food Chem. 56: 158–165.

La Pera, L., Dugo, G., Rando, R., Di Bella, G., Maisano, R., Salvo, F. (2008) Statistical study of the influence of fungicide treatments (mancozeb, zoxamide and copper oxychloride) on heavy metal concentrations in Sicilian red wine. Food Additives Contaminants. Part A. 25(3): 302–313.

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