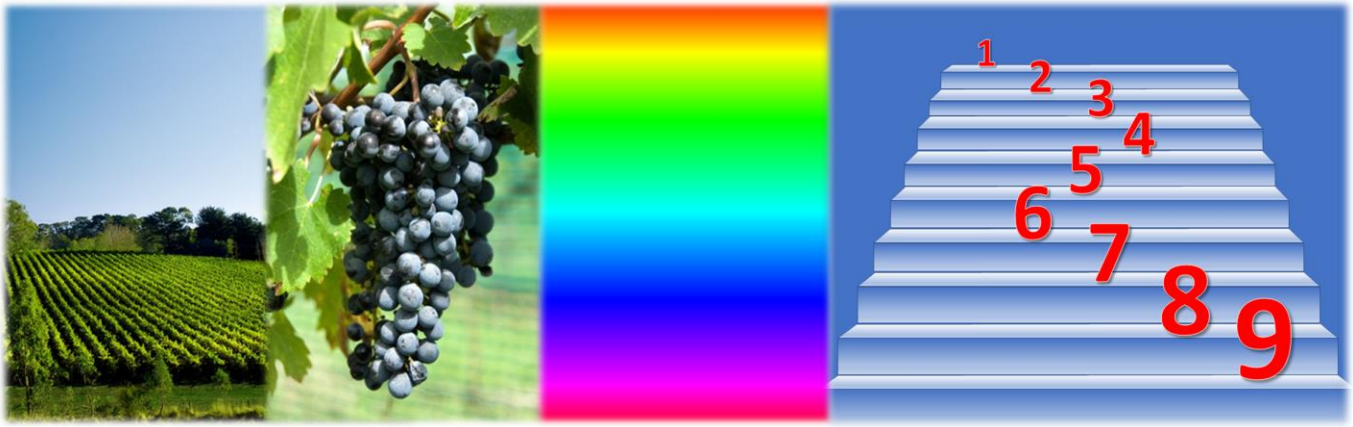
The Australian Wine Research Institute

Fact Sheet
VITICULTURE

Objective measures of grape quality



Background

In Australia, the value of wine-grapes is assessed in a range of ways, many of which can be considered subjective. This can result in uncertainty as to whether grape products achieve the maximum value possible. Using objective chemical measures that are directly related to wine quality, for example the compounds responsible for taste, aroma, texture and appearance, could improve both transparency and value. A recent project at the AWRI investigated whether existing subjective grading allocations could be predicted using objective chemical or spectral measures.

The project measured a range of chemical compounds in Chardonnay (CHA), Shiraz (SHZ) and Cabernet Sauvignon (CAS) grapes of different grades and regions in Australia from a single producer (Accolade Wines). The aim was to determine whether there was a relationship between chemical measures and fruit grade, and if fruit grade could be reliably predicted. The overall goal of the work was to identify accessible, rapid and simple measures which could be applied in the grape and wine industry context; and to provide guidelines to producers who intend to apply these measures in their systems.

Simple and rapid objective measures

The project employed a range of chemical analyses, many of which are widely available for use by the wine industry, plus a few more specialised analytical measures. Non-targeted spectral analysis in the UV-visible, MIR and NIR regions was also investigated as an alternative to targeted chemical analysis.

Table 1 lists the chemical measures identified which were both significant predictors of grade, and readily accessible to wine producers.

Of the more advanced analytical measures (data not shown), the 'green, grassy' C_6 alcohols were found to be either positively or negatively related to fruit grade for all three varieties tested. For CHA, the precursors to tropical thiols were found to be an important positive attribute. Amino acids were found to be significant predictors of grade, but their influence was variably positive or negative depending on the type of amino acid, the variety and the season.

Table 1. The simple objective measures which were positively (+) or negatively (-) associated with grape grade for three grape varieties

Variable	CHA	SHZ	CAS
pH	-		
TA	+		
Malic acid	+		
YAN*	+	+	+ -
AAN*	+	+	+ -
NH_3	+		
°Brix	+	+	+
CI	+	+	+
370 nm	-	+	+
280 nm		+	+
420 nm		+	+
520 nm		+	+
Tannin		+	+
Laccase		-	
Berry wt		-	
GG**	+		+

*YAN= yeast assimilable nitrogen, AAN= alpha amino nitrogen; for CAS these measures were both positive and negative depending on the season. **GG = glycosyl glucose

The statistical method of discriminant analysis was used to predict grade from all the chemical analyses, and the subset of simple measurements (Table 1, excluding glycosyl glucose). The percentage of correct predictions using these approaches is shown in Table 2. Using only simple measurements, grape grade was predicted as well, or close to that achieved using more complex analyses. This was particularly successful for CHA, where 95% accuracy of prediction was maintained.

Table 2. Grape grade prediction accuracies (%) using either detailed analysis, simple measures, or non-targeted spectroscopy.

Predictor	CHA	SHZ	CAS
All chemical analyses	95%	85%	88%
Simple chemical analyses*	95%	83%	84%
UV-visible spectrum	-	94%	96%
Juice MIR**	92%	82%	95%
Homogenate MIR**	78%	90%	100%
Homogenate NIR**	86%	94%	87%

*Compounds shown in Table 1, excluding glycosyl glucose.

** MIR = mid-infrared, NIR = near-infrared

Non-targeted spectroscopy

For CAS and SHZ, using non-targeted spectral analysis in the UV-visible, MIR and NIR regions was found to be more successful for grade prediction than targeted chemical measurements (Table 2). Using only spectra, grade prediction accuracies ≥94% could be achieved. This was an encouraging result since spectral analysis is readily available to many wine industry laboratories and could be calibrated to the grading system requirements of individual producers.

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References and further reading

Assessment of relationships between grape chemical composition and grape allocation grade – Wine Australia Final Report. https://www.wineaustralia.com/research/search/completed-projects/awr-1202

Bindon, K.A., Schulkin, A., Dambergs, R.G., Solomon, M., Barter, S., Capone, D., Kassara, S., Cynkar, W., Francis, I.L., Smith, P.A. 2017. Objective measures of grape quality. Beames, K.S, Robinson, E.M.C., Dry, P.R., Johnson, D.L. (eds.). *Proceedings of the 16th Australian Wine Industry Technical Conference: Adelaide, South Australia, 24-28 July*. Glen Osmond, S.A.; The Australian Wine Industry Technical Conference Inc: 161-164; 2017. https://awitc.com.au/program/proceedings/sixteenth/download/

Bindon, K., Smith, P., Schulkin, A., Dambergs, B., Kassara, S., Barter, S., Solomon, M., Cynkar, W., Capone, D., McRae, J., Francis, L., Robinson, E., Johnson, D. 2017. Exploring the potential for grape objective measures to predict wine grade and style. *Wine Vitic. J.* 32(2): 46-47; 2017. https://www.awri.com.au/wp-content/uploads/2013/01/s1913-Bindon-WVJ-32-2-2017.pdf

Smith, P., Schulkin, A., Kassara, S., Barter, S., Solomon, M., Cynkar, W., Capone, D., Francis, L., Bindon, K., Johnson, D. Applying the latest understanding of grape composition. *Wine Vitic. J.* 30(6): 33-36, 38; 2015 https://www.awri.com.au/wp-content/uploads/2013/01/1774-smith-WVJ-30-6-2015.pdf