

# Going green with whole bunches

By Martin Day<sup>1</sup>, Keren Bindon<sup>1</sup>, Dimitra Capone<sup>1,2</sup>, Stella Kassara<sup>1</sup>, Eleanor Bilogrevic<sup>1</sup>, Damian Espinase Nandorfy<sup>1</sup>, Flynn Watson<sup>1</sup>, Leigh Francis<sup>1</sup> and Mark Krstic<sup>1</sup>

Mark Krstic



***Anecdotally, the inclusion of whole bunches in wine ferments is a technique that is increasing in popularity worldwide. Winemakers may experiment with this technique to seek 'freshness' or 'complexity'. A recent winemaking study at the AWRI sought to quantify the effects of this technique on wine colour, aroma and mouthfeel in Shiraz and Pinot Noir.***

## INTRODUCTION

In recent years, there has been a rise in popularity of the use of whole bunches in fermentation during winemaking (Godden 2018), with the aim of adding complexity to wines by changing texture/mouthfeel attributes or aromas and flavours. In Australia, this technique has most commonly been used with Pinot Noir and Shiraz from cooler regions, with the practice also applied in Burgundy and Northern Rhône, and elsewhere internationally. Inclusion rates can range from anywhere between 10% and 100% whole bunches. Whole bunch fermentation is not typically used with varieties such as Cabernet Sauvignon as it can result in excessive 'green' characters and astringency (Godden 2018). Previous studies have shown that most consumers do not respond positively to high levels of these characters in wine (Francis and Williamson 2015).

The compound 3-isobutyl-2-methoxy-pyrazine (IBMP) is found in the berries of grape varieties such as Cabernet Sauvignon, Cabernet Franc, Merlot and Sauvignon Blanc (Harris *et al.* 2012). The aroma of this compound in wine is often described as 'fresh green beans', 'green capsicum', 'grassy' or 'herbal'. Such characters are commonly observed in these varieties and can be considered a signature of their wine styles. Pinot Noir and Shiraz, on the other hand, produce only small amounts of IBMP in the berry (Botezatu *et al.* 2016, Romero *et al.* 2006).

A recent study of material other than grapes (MOG) in fermentations found

that the inclusion of stems (rachis) in a cool climate Shiraz fermentation increased 'green' characters such as 'green capsicum' and 'green stalks' as well as astringency (Capone *et al.* 2018). The 'green' characters were a result of an increase in IBMP in the wine extracted from the stems, with no IBMP detected in the ferments that were made from fruit without stems (Capone *et al.* 2018). This finding led to a new study on the effects of different proportions of whole bunch fermentation in Pinot Noir and Shiraz carried out during the 2018 vintage.

## TRIAL DESIGN

Pinot Noir and Shiraz grapes were hand-harvested from premium vineyards in the Adelaide Hills in 2018 and small-lot replicated winemaking was completed by WIC Winemaking Services at the Waite Campus, Urrbrae, South Australia. The bunches were randomly separated into five treatments: no whole bunch inclusion (control, all destemmed and crushed fruit) and inclusion of crushed whole bunches at 25%, 50%, 75% and 100%. Whole bunches were placed at the bottom of a 50kg fermenter together with a small amount of inoculated must, with destemmed and crushed fruit then added in the required proportions. All treatments received hand-plunging twice a day during fermentation. After pressing, the wines went through malolactic fermentation and received no oak treatment. They were then bottled and stored for approximately nine months after which time sensory and chemical analyses were completed. ▶

## AT A GLANCE

- Methoxy-pyrazines are the volatile compounds that contribute 'green capsicum' and 'herbaceous' notes to wine
- While Pinot Noir and Shiraz grape berries contain negligible levels of methoxy-pyrazines, their stalks (rachis) can contain high levels of these compounds
- Inclusion of stalks in ferments through techniques such as whole bunch fermentation might therefore impart 'green' notes to Shiraz or Pinot Noir wines
- A winemaking trial was set up to investigate the contribution of whole bunch inclusion to 'green capsicum' characters in Shiraz and Pinot Noir wine
- For both varieties, the sensory intensity scores for 'green capsicum' and the concentration of the key compound responsible for this aroma were highly correlated with the proportion of whole bunches in the ferment
- For Shiraz, the concentration of tannins and the astringency ratings were also highly correlated with the proportion of whole bunches. Differences in the perception of wine colour and hue were found for both varieties.

<sup>1</sup>The Australian Wine Research Institute, Urrbrae, SA

<sup>2</sup>Current address: ARC Training Centre for Innovative Wine Production, The University of Adelaide, Urrbrae, SA

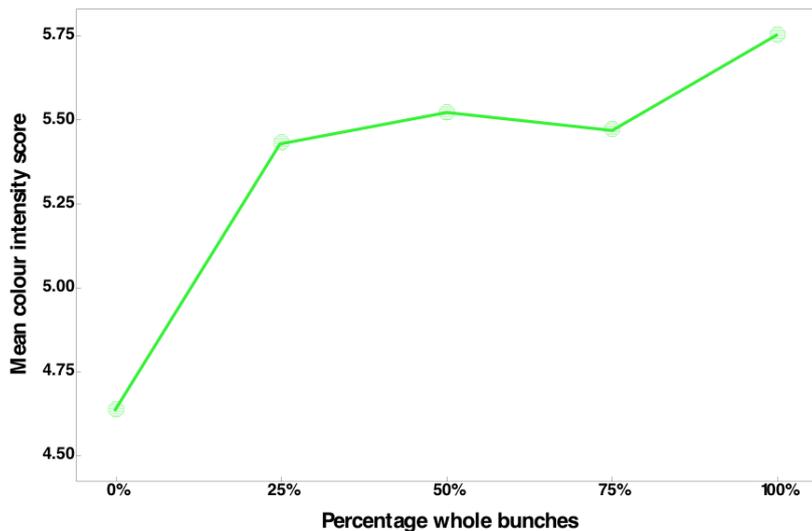


Figure 1. Relationship between mean colour intensity scores of the Shiraz wines and the percentage of whole bunches included in the fermentation.

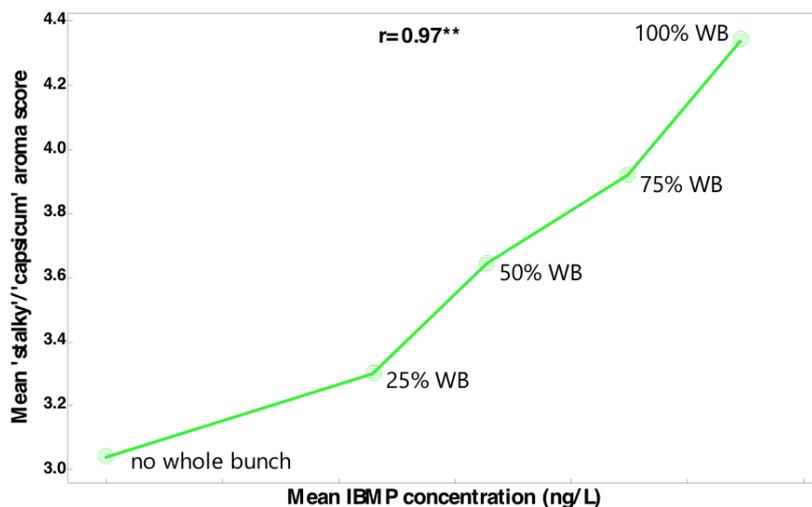


Figure 2. Relationship between mean 'stalky'/'capsicum' aroma score and the concentration of IBMP for each of the whole bunch (WB) treatments of Shiraz. (No whole bunch treatment: IBMP not detected, 100% whole bunch treatment IBMP concentration = 5.5ng/L).

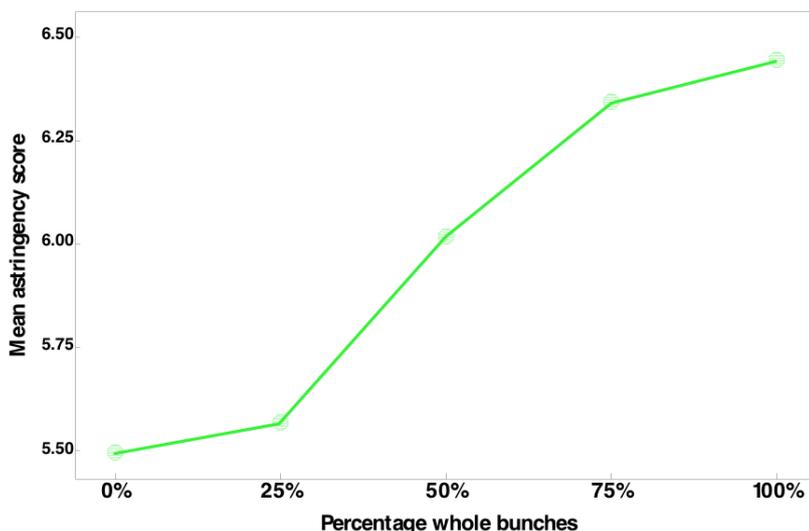


Figure 3. Relationship between mean astringency scores of the Shiraz wines and the percentage of whole bunches included in the fermentation.

**RESULTS – SHIRAZ**

The visual perception of colour intensity of the Shiraz wines increased significantly with whole bunch inclusion compared to the control treatment (Figure 1), with no significant difference among the different whole bunch treatments. The whole bunch treatments also showed lower 'red fruit' aroma than the control sample, but there was no significant difference for 'dark fruit' aroma. 'Stalky'/'capsicum' aroma and flavour were rated higher in the treatments with greater percentages of whole bunches, and there was a strong linear relationship between the 'stalky'/'capsicum' character and IBMP concentration, with the wines made with the highest proportion of whole bunches highest in both measures (Figure 2).

A positive relationship was also seen between the percentage of whole bunches and the perceived astringency (Figure 3) of the Shiraz wines. This was well correlated with the tannin concentration in the wines, which was between 596mg/L and 1360mg/L. All other palate/mouthfeel attributes were not significantly different across the wines.

**RESULTS – PINOT NOIR**

The visual perception of red colour intensity of the Pinot Noir wines increased significantly in the wines with 75% and 100% whole bunches, compared to the control. There was also a strong decrease in brown tint with whole bunch inclusion, giving the higher whole bunch treatments a more vibrant red appearance (Figure 4, and 5 on page 32). The higher percentage whole bunch treatments had higher intensity of 'red fruit' and 'red confectionary' aromas than the 0-50% treatments, likely related to the concentration of fermentation-derived esters. There was no significant difference in 'dark fruit' aroma among the treatments.

As in the Shiraz wines, the 'capsicum' aroma in the Pinot Noir wines was strongly related to the proportion of whole bunches (Figure 6, page 32) and again there was a correlation with the concentration of IBMP. However, unlike the Shiraz wines, there were no significant textural/mouthfeel

differences among the treatments. There were also significantly different intensity scores for a 'cooked vegetable' aroma, which decreased as the proportion of whole bunches increased (data not shown).

**CONCLUSION**

The inclusion of whole bunches in fermentations resulted in significant sensory and chemical effects for the Pinot Noir and Shiraz wines in this study. Both varieties saw changes in appearance and increases in 'green' characters as the percentage of whole bunches increased. For Pinot Noir there was an additional increase in 'red fruit' and 'confectionary' aromas, while the Shiraz had an increase in both tannin and astringency.

This study clearly showed that the inclusion of stems in Shiraz and Pinot Noir fermentations can result in significant increases in IBMP concentration. Winemakers considering use of this technique should consider the trade-off between possibly

undesirable 'green' characters and enhancement of the visual perception of wine colour, desirable flavour changes and increased tannin (Shiraz).

It should be noted that this study was conducted in only one season with

fruit from a single cool climate vineyard. Further studies investigating aspects such as the 'woodiness' of the stems and influence of inclusion of whole berries (Cowey 2018) would be beneficial.

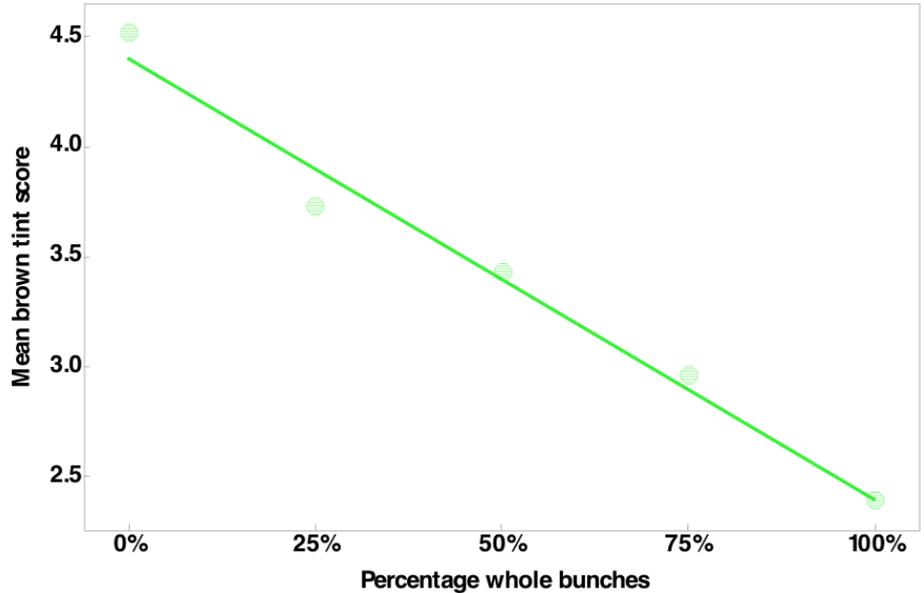


Figure 4. Relationship between mean brown tint scores of the Pinot Noir wines and the percentage of whole bunches included in the fermentation.



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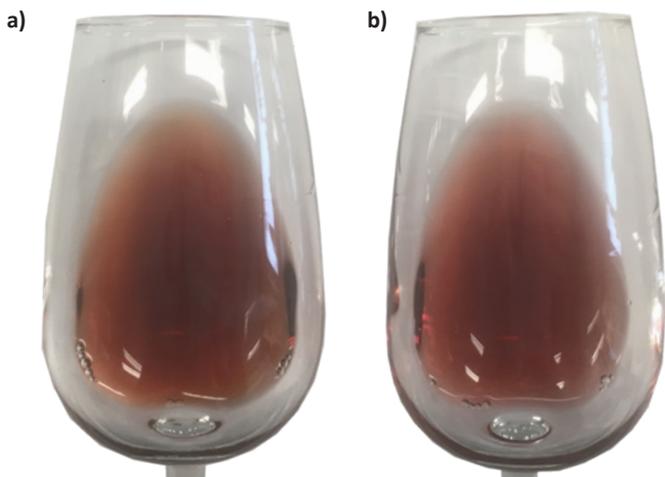


Figure 5. The colour difference between the Pinot Noir treatments: a) no whole bunches and b) 100% whole bunches.

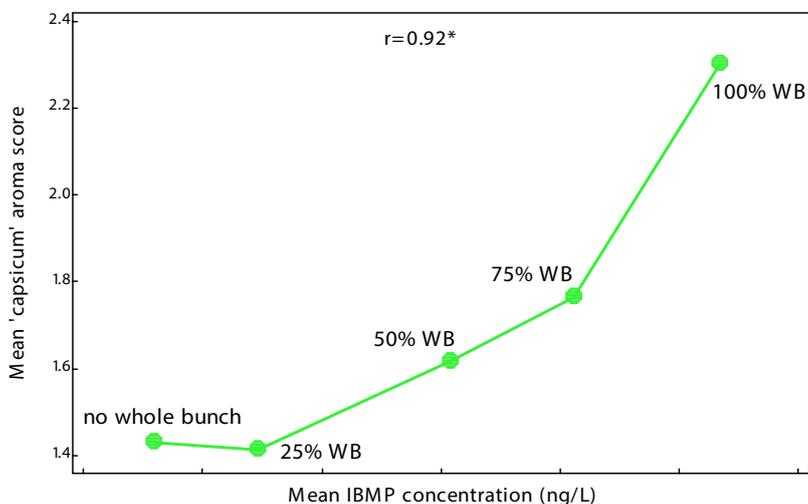


Figure 6. Relationship between mean 'capsicum' aroma scores and the concentration of IBMP for each of the whole bunch (WB) treatments of Pinot Noir. (No whole bunch treatment: IBMP not detected, 100% whole bunch treatment: IBMP concentration = 6.3 ng/L)

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