Project title: Effect of canopy management on Pinot noir grape composition, in particular, grape colour

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Introduction

In recent years plantings of Pinot Noir vines have increased, particularly in the cooler viticultural regions. Directions for managing Pinot Noir vines to produce specific wine styles were required. This research project focussed on the concept of 'effective leaf area to fruit weight ratio' and its relationship to berry composition and wine style. As part of these investigations a new analytical method was developed, termed the G-G assay. This assay determines the pool of glycosides in grapes and includes the anthocyanins (colour) and flavour compounds. It was found that colour makes up a large proportion of the total G-G and that measures of the two are highly correlated. Thus in this summary only colour measures will be reported.

Objectives

The objectives of the project were:

1) to determine the range of grape colour values that relate to the different Pinot Noir wine styles.
2) to determine the relationship between the index of 'leaf area to fruit weight ratio' and measures of grape colour.

Results

Survey of Australian vineyards

In a survey of Australian vineyards, values for measures of grape colour ranged from 0.3 to 1.2 mg anthocyanins/gram berry weight. Based on a subjective assessment of the wines made from grapes having colour values in this range (from both small lot experimental wines and commercial wines) grapes with colour values below 0.6 mg anthocyanins/gram berry weight produced light-bodied wines with low colour and flavour intensity, while grapes with higher colour values (above about 1.0 mg anthocyanins/gram berry weight) produced wines with adequate colour, however the flavour profile were less distinctive than those of wines produced from grapes with colour values in the intermediate range (0.6 to 1.0 mg anthocyanins/gram berry weight. The latter wines generally had raspberry and plum tones and other(difficult to define) positive Pinot Noir features. Generally, to produce grapes with colour values in the intermediate range and with desirable flavours, vines needed to be grown in cool climates with balanced growth and be lower rather than higher yielding (less than 10 tonnes/ha), and have open canopies with small berries (about 0.8 to 1.0 grams).

Adelaide Hills study

In a trial with Pinot Noir vines in the Adelaide Hills where yield was varied by different pruning levels and where bunch exposure was varied by leaf removal, significant positive relationships were found between (a) grape colour measures and maturity as measured as oBrix and (b) grape colour measures and 'leaf area to fruit weight ratio'.

In order to achieve grapes with colour values in the order of 0.6 to 0.7mg anthocyanins/gram berry weight, the 'leaf area to fruit weight ratio' needed to be in the order of 20 to 30 cm2/gram. In this case, this value was associated with a yield value of about 1.5 kg/vine (3 to 4 tonnes per hectare). It should be appreciated that for this leaf area to be effective leaves need to be functioning efficiently, ie not water stressed or heavily shaded. Another point that the data showed was that it is not necessarily one factor that regulates anthocyanin production in berries. It is more likely that an understanding of the combined effects of maturity, yield, ' leaf area to fruit weight ratio' and other factors is important in determining the colour produced in berries. For example multiple linear regression analysis showed that in this experiment the values of grape colour were related to both stage of maturity and 'leaf area to fruit weight ratio' by the following equation: grape colour = — 28.264 + 3.092 oBrix + 0.765 'leaf area to fruit weight ratio'. The values for the 'leaf area to fruit weight ratios' reported here for Pinot noir are higher than the values reported in the literature (in the order of 12 cm2/gram). It may be that Pinot Noir is a variety that requires higher leaf area to fruit weight ratios, since other studies that formed part of this project indicated that for the variety Shiraz, adequate grape colour could be achieved with 'leaf area to fruit weight ratios' in the order of 7 to 12cm2/gram.

It is important to appreciate that the relationships reported here are only valid for the range of values investigated. For example, even though a positive linear relationship was found between Pinot Noir grape colour and 'leaf area to fruit weight ratios', values higher than about 30cm2/gram may not necessarily lead to higher colour values, as these higher values for leaf area to fruit weight ratio are often associated with vigorous shoot growth (high leaf area) and low yields; conditions which are not necessarily favourable for colour production in berries.

Experiments at a site in Tasmania

These trials were carried out an a mature Pinot Noir vineyard grown at a site in northern Tasmania for two years. The four treatments were:

1) vertically non-divided canopy, shoots positioned up (control),
2) vertically non-divided canopy, shoots positioned up with leaf removal in the bunch zone one week prior to veraison,
3) vertically divided canopy, shoots positioned up and down and,
4) vertically divided canopy, shoots positioned up and down with leaf removal in the bunch zone one week prior to veraison.

Leaf removal on the non-divided canopy significantly increased increased berry colour by about 20%. This was attributed in part to improved bunch exposure, since a significant positive correlation was found between grape colour and an index of bunch exposure. However, the same increases in grape colour could be achieved by vertical canopy division; additionally, leaf removal on the divided canopy did not significantly increase grape colour when compared to that of the divided canopy alone, indicating that sufficient bunch exposure was achieved by canopy division alone.

In both years, grape colour measures were significantly negatively correlated with yield per vine.

Conclusions

The results of these studies suggest that to obtain desirable characters in Pinot Noir wines, vines need to be grown in cool climates, be low yielding and have open canopies with small berries. Irrespective of row x vine spacing, to achieve a measure of grape colour in the order of 0.6 to 0.8 mg/gram berry weight, vines needed to be functioning efficiently, and yield had to be below 9 tonnes per hectare and more often below 5 tonnes per hectare. Berry weight was an important determinant of berry colour; generally berries that weighed over 1.1 gram were associated with lighter coloured and lighter flavoured wines.