Reflective groundcover effects on berry and wine composition in Cabernet Sauvignon

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Enhanced fruit exposure to sunlight has been widely reported to influence fruit quality. Studies have found higher levels of phenolics compounds such as flavonols, caffeic acid, polymeric anthocyanins, and catechin in wines made from sun exposed clusters (Price *et al.*, 1995). Increased light and temperatures have also been shown to reduce the levels of methoxypyrazines which are associated with undesirable herbaceous characteristics found in some red wines. In order to achieve greater exposure of clusters to light, viticultural practices such as shoot positioning and leaf removal are routinely employed. Use of a reflective groundcover is another tool at the disposal of the viticulturist to enhance fruit light exposure and alter the temperature profile of the vine's microclimate. This study was designed to measure the effect of a commercially available reflective groundcover, Extenday, on the vine microclimate and the resulting influence on the phenolic, colour and methoxypyrazine levels in the wines.

Extenday was placed under the vines at three different periods during berry development and maturation: flowering to veraison, flowering to harvest, and veraison to harvest. A row without Extenday was used as a control in each block. Three blocks were monitored over the course of the study as field replicates (Fig. 1). Temperature in the fruiting zone and soil were monitored using data loggers, reflected light in the fruiting zone was measured using a light meter equipped with a quantum sensor, and berry temperatures were measured using a digital infra-red thermometer.

Fig. 1. Layout of research blocks at Destiny Bay Vineyards on Waiheke Island.

Berry samples were collected for analysis covering the period of post-veraison to harvest. Berry samples and wine made from the experimental rows and blocks were analysed for pH, TA, soluble solids. Spectral analysis, HPLC and GCMS were used in analysing colour, phenolics and methoxypyrazine levels in the wines.

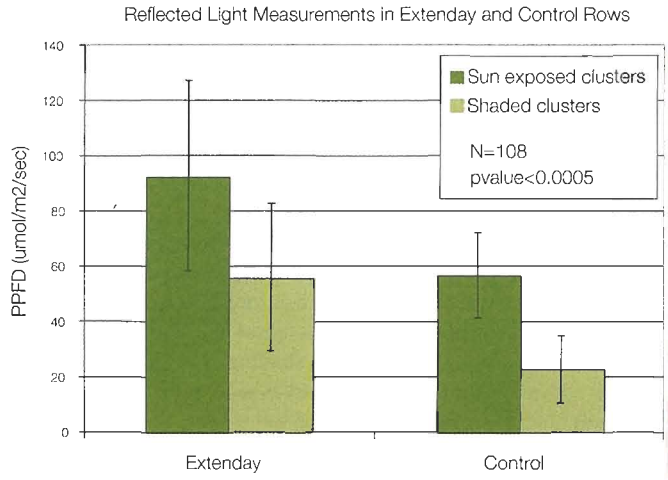

Fig. 2. PAR light measurements taken over the period of fruit set to veraison (December to March) and at different times of the day. Error bars depict one standard deviation about the mean.

The measured soil temperature under the Extenday was cooler by 1-3°C and exhibited a tighter daily temperature range. While average air temperatures in the fruiting zone were not significantly different between the control and Extenday rows, an interesting daily trend of afternoon elevated warming occurred consistently in the Extenday rows. The most significant microclimate effect was the enhanced light measured in the fruiting zone. Reflected light from Extenday was 1.5 times higher on sun exposed berries and two times higher for shaded berries (Fig. 2).

Table 1. The concentration of total flavonols in the experimental wines analysed by HPLC. Standard deviations are shown in parenthesis.

Extenday Treatment	Total Flavonol Levels in Wine (mg/L)
Flowering to veraison	37.1 (9.7)
Flowering to harvest	39.2 (12.3)
Veraison to harvest	42.9 (17.6)
Control – No Extenday	33.6 (10.9)

Table 2. The concentration of total hydroxycinnamic acids in the experimental wines analysed by HPLC. Standard deviations are shown in parenthesis.

Extenday Treatment	Total Hydroxycinnamic Acid Levels in Wine (mg/L)
Flowering to veraison	30.0 (0.4)
Flowering to harvest	28.3 (5.2)
Veraison to harvest	24.3 (2.8)
Control – No Extenday	23.9 (2.3)

Berry temperatures for sun-exposed berries in Extenday rows were also significantly higher than those in the control rows. However, berry temperatures for the shaded berries did not differ significantly between Extenday and control rows.

No significant difference between Extenday and the control fruit was found in pH, TA or soluble solids at harvest. Total flavonol levels were higher in 35 of 36 berry skin extracts from Extenday rows sampled over the period of post-veraison to harvest, regardless of the period when the Extenday was installed. Total flavonol levels in the wines from Extenday rows in all three blocks were also significantly higher (Table 1).

The total hydroxycinnamic acid levels were significantly higher in rows where Extenday was placed under the vines during berry development (i.e. flowering to veraison and flowering to harvest) (Table 2).

No significant differences between Extenday and control wines or berry skin extracts were found in hydroxybenzoic acid, flavan-3-ol, stilbene, anthocyanin levels or colour. But consistent differences were seen between the three blocks with respect to these specific classes of compounds regardless of the application of Extenday.

Extenday was placed under the vines during berry development (i.e. flowering to veraison and flowering to harvest).

The levels of all methoxypyrazines were extremely low in the wines (<6ng/L) and no significant difference could be detected between the treatments at these low levels.

The results of this study found that Extenday exerted a wide variety of influences on the microclimate of the vine resulting in changes in the phenolic content of both the berry skins and the final wines. Additional studies on the effect of Extenday in multiple years and at multiple vineyard sites are warranted. This study examined the effect of a single width of Extenday. Additional studies examining the effect of multiple widths may provide more insight into the effect Extenday exerts on the microclimate of the vine.

References:

Price, S. F., Breen, P. J., Valladao, M., and Watson, B. T. (1995). "Cluster sun exposure and quercetin in pinot noir grapes and wine." Am. J. Enol. Vitic., 46, 187-194.