Soils, Climate and Vine Management: Their Influence on Marlborough Sauvignon blanc wine style

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ABSTRACT

Sauvignon blanc was first planted in Marlborough, New Zealand in the mid-1970s. Since that time, Marlborough has gained an international reputation by producing the definitive wine style of that grape variety. However, within the relatively small geographic region of Marlborough, distinctive sub-regional differences in flavour and aroma profiles are now being defined. For example, wines made from fruit grown in the lower Awatere Valley (30 km south of Blenheim) typically have higher herbaceous characters, associated with higher concentrations of iso-butyl methoxypyrazine (IBMP) when compared to wines made from fruit harvested at the same soluble solids in the Wairau Valley.

Experiments conducted over the past five years have investigated the extent to which these differences in flavour and aroma profiles are a reflection of soil, climate or management (in particular grape yield and harvest date). Fruit has been harvested at a soluble solids of 21.5 to 22.5 ^{o}Brix on each of five vineyard sites (four in the main Wairau Valley and one in the cooler Awatere Valley), and covering a range of soil types. Vines were either trained using a 2-cane or 4-cane vertical shoot positioning system at each site, to investigate the possible effect of vine yield. The higher yields resulted in a later harvest date (the date on which 21.5 ^{o}Brix was reached) at each site. In general this also resulted in lower IBMP concentrations in the wines.

The results from these experiments provide winemakers with an understanding of the effect of the interaction of site, grapevine yield and harvest date on Sauvignon blanc wine aroma and flavour profile, allowing them to express the sub-regional Marlborough "Terroir" of this wine.

KEYWORDS

Marlborough, Sauvignon blanc, Terroir, thiol, methoxypyrazine

INTRODUCTION

The increase in the planted area of vines in Marlborough has been nothing short of astonishing. While there was a very small area of vines planted in the 19th Century, these were removed in the first part of the 20th Century and it was not until 1973 that vineyards reappeared. By 2000 the vineyard area had reached 4,054 ha, but it was the recognition and demand for Marlborough Sauvignon blanc as a distinctive wine style, particularly in England, the USA and

Australia that resulted in the growth of the industry to a planted area of 23,921ha. Today Marlborough represents 52% of the area of vines in production in New Zealand (Anon, 2009). Approximately 70% of this area is planted in Sauvignon blanc. Sauvignon blanc is the flagship wine from New Zealand and providing 80% of the volume of wine exported from New Zealand (Anon, 2009). Currently, New Zealand wine enjoys the highest per litre price of any country in the UK market.

Marlborough Sauvignon blanc is recognized by intense, fruit driven flavours. A balance of herbaceous/asparagus and passion fruit/tropical aromas are generally recognized as necessary to provide typical Marlborough Sauvignon blanc style (Parr et al., 2007). The initial plantings occurred in the Central Wairau Valley (Figure 1), but have expanded out into the Awatere Valley (30 km south) and into the periphery of the Wairau Valley.

Research conducted in Marlborough, New Zealand, investigates how differences in climate and soils within the region affect fruit development.

MATERIALS AND METHODS

Five Sauvignon blanc vineyard (Fig. 1) were chosen to represent a range of soil and Marlborough sub-regional climates. Vines (clone UCD1 on SO4 rootstock) were of similar age (10 to 12 years old at the start of the experiment), and planted 2.4 m between and 1.8 m apart within the row. Rows were orientated approximately north: south. All trial areas were within commercial vineyards and pest and disease management was achieved following Sustainable Winegrowing New Zealand practice (http://www.nzwine.com/swnz/). The under-vine area was kept weed free using herbicides while the inter-row was generally a closely mown rye-grass sward; vines were trickle irrigated as determined by the vineyard manager.

Two uniform bays of four vines were selected in each row as trial plots. These vines represented vines of average trunk circumference. We anticipated significant differences in vine yield from the different sites. To investigate the potential influence of yield on fruit and wine composition four rows of vines were pruned using a 4-cane vertical shoot positioning system (10 nodes per cane + 2 spurs) (4-cane VSP) and the remaining rows 2-cane VSP. Canes were lightly wrapped on fruiting wires, 0.9 and 1.1 m above the ground, the 2-cane treatments using only the lower fruiting wires. Foliage wires were used to maintain the canopy in a vertical shoot position (VSP) and vines were trimmed two or three times during the season to maintain the canopy height 2.0 m from the soil surface and 0.5 m wide.

Fruit composition was monitored regularly from just before veraison to harvest. Berry samples (32 berries) were collected from each plot, cooled in an insulated box and analyzed in the laboratory. The fruit was weighed and gently macerated by hand, coarsely sieved and the juice analyzed for soluble solids (^{o}Brix), using an Atago PAL-1 digital pocket refractometer and pH was measured using a Metrohm 744 pH meter. The titratable acidity (TA) was measured on a juice sample (2.5 mL until TA ~ 15 g/L after which time a 5.0-mL sample was used) using a Metler Toledo DL50 autotitrator. The juice was diluted with 50 mL distilled water and titrated using 0.1 M NaOH to pH 8.4. The titratable acidity is expressed as g/L tartatic acid equivalent.

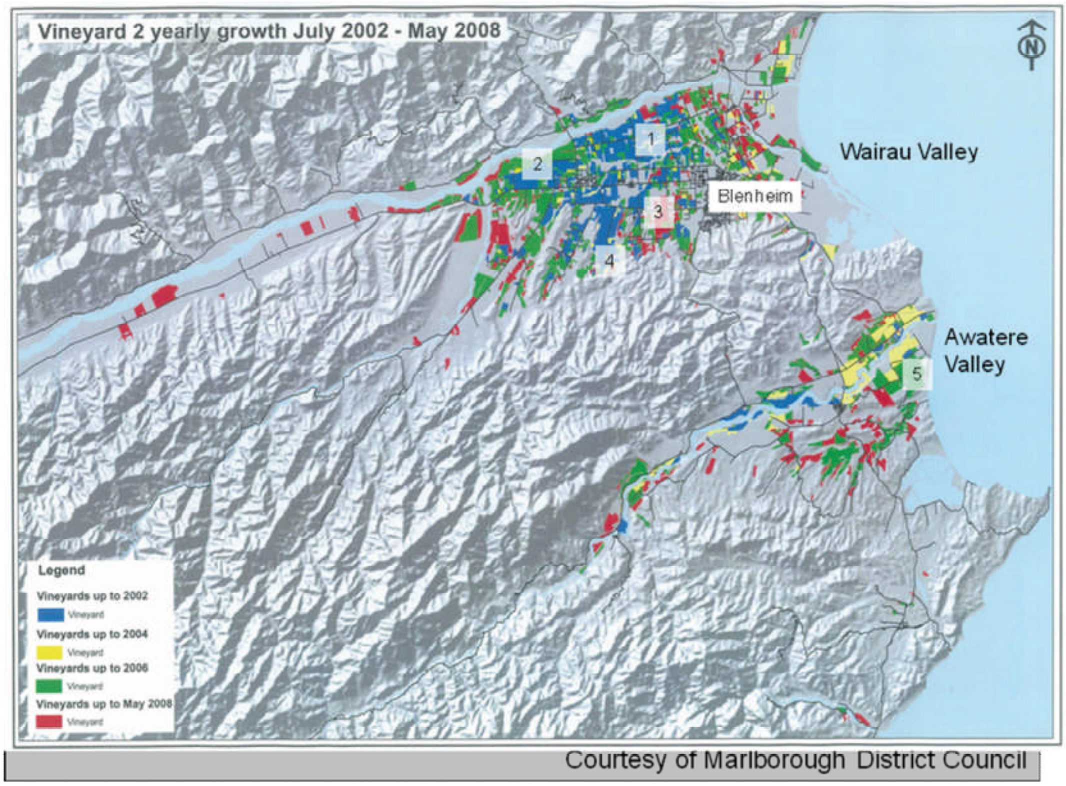

Fig. 1. Changes in Marlborough vineyard area 2002 to 2008
(http://www.marlborough.govt.nz/Environment/Land/Land-Cover-Land-Use/Crop-Types.aspx) (*Note: vineyard sites 1=Rapaura (R); 2=Western Wairau Plain (WW); 3=Fairhall (F); 4=Brancott Valley (BV); 5=Lower Awatere (A))*

Winemaking and sensory analysis

All grapes were harvested at each site and training system at similar soluble solids (21.5 – 22.5 ^{o}Brix). Two hundred kilograms of fruit was crushed and destemmed and the must was given three and a quarter hours of skin contact, with the addition of sulphur dioxide (as potassium metabisulphite at a rate of 80g/T) and a covering of CO_2. The must was transferred to a 200 L bag press and juice collected under a CO_2 cover. Pressing consisted of slowly increasing the pressure to 0.2 mPa. Juice recovery was equivalent to approximately 500 L T^{-1}. Once pressed, Rohapect D5L enzyme (rate 0.03ml L^{-1}) was added to the juice, which was then cold settled at 10°C for approximately 48 hours. The juice from each 2- and 4-cane treatment was racked and split into three 17 L replicates for fermentation.

Each replicate was inoculated with EC118 yeast and fermented in a stainless steel tank at 12°C. The ferment was stopped with the addition of 50 ppm sulphur dioxide (as potassium metabisulphite), once it had been determined that the ferment contained less than 2.0 g L^{-1} residual sugar. After fermentation, the replicates were cold stabilized, racked and filtered for bottling. Thiol (3-mercaptohexanol (3MH) and 3-mercaptohexanol acetate (3MHA)) and Iso-butyl methoxypyrazine (IBMP) were analysed at the end of ferment by gas chromatograph mass spectrometry (Brajkovich et al., 2005).

Sensory analysis was undertaken using the Marlborough Wine Research Centre industry panel. This panel of experienced winemakers and viticulturists were asked to rate the intensity of a range of aroma characteristics associated with Sauvignon blanc. The French concept of typicité (Sauvageot, 1994) was included in the assessment to investigate the degree to which the wine represents the concept of a Marlborough Sauvignon blanc.

RESULTS AND DISCUSSION

Marked changes in soil texture can be observed in Marlborough vineyards (Trought et al., 2008) and despite the close proximity of the five vineyards, differences in air temperature and soil texture were observed. Soils varied from well drained alluvial gravels of varying depths (Rapura /Waimakariri and Renwick series) at the Rapaura, West Wairau and Brancott sites respectively, to young loess over gravel (Seddon series) at the Lower Awatere site and poorly drained clayey alluvium (Paynter series) at Fairhall (Rae and Tozer, 1990).

All sites were cooler than the Marlborough Regional meteorological station and accumulated less growing degree days (base 10^{o}C) during the growing season (Fig. 2). The lower Awatere site, close to the sea, was warmer than the regional site until bud-break in mid-October (Fig. 2). As a result bud break occurred first at this site. However, for the remainder of the season, temperatures were lower than elsewhere.

Pruning weights were similar at all sites, except the West Wairau site, which had lower pruning weight (Table 1). The average shoot weights were lower where vines had been 4-cane pruned and this was reflected in a higher proportion of smaller shoots sizes (Table 1). Two-cane pruned vines had a higher bud break (overall 136%), when compared to 4-cane (overall 107%).

Table 1: Influence of site and pruning on yield, pruning weight, juice composition and wine composition

	Rapaura		**Upper Wairau**		**Fairhall**		**Brancott**		**Awatere**	
	2-c	**4-c**	**2-c**	**4-c**	**2-c**	**4-c**	**2-c**	**4-c**	**2-c**	**4-c**
Harvest Date	13 Mar	14 Mar	15 Mar	20 Mar	23 Mar	30 Mar	15 Mar	24 Mar	06 Apr	31 Mar
Yield/vine (kg)	3.40	4.86	4.43	7.82	6.09	7.57	5.56	7.71	5.18	6.30
Pruning weight (kg)*	2.65	2.59	1.97	1.99	2.75	2.58	2.24	2.05	2.81	2.91
Average shoot weight (g)	104	59	79	38	99	49	76	40	98	57
Harvest Juice Analysis										
Soluble solids (^{o}Brix)	22.3	21.6	22.1	21.9	21.4	22.1	22.1	22.1	22.3	22.4
pH	3.15	3.04	3.07	3.04	3.04	3.03	3.09	3.06	2.98	3.07
TA (g/L)	10.8	11.0	11.7	11.7	10.9	10.3	11.7	10.3	11.0	11.1
Wine Analysis										
Thiol 3MH (ng/L)	4285	4367	5198	5152	4340	4913	4953	5268	4864	5741
Thiol 3MHA (ng/L)	174	242	255	203	187	166	259	271	200	233
IBMP (ng/L)	8.2	7.3	8.2	8.1	9.4	9.8	12.6	11.6	29.3	16.7

***Pruning weight includes the cordon**

The harvest date (the day when fruit achieved the target soluble solids of 22 °Brix) was a reflection of temperature from flowering to harvest and vine yield. In general, higher yielding vines ripened later, (compare 4- and 2-cane pruned vines) than lower yielding vines at the same site. The cooler Lower Awatere site ripened later than those of the Wairau Valley (Table 1). Vineyard site had little effect on titratable acidity and pH (Table 1).

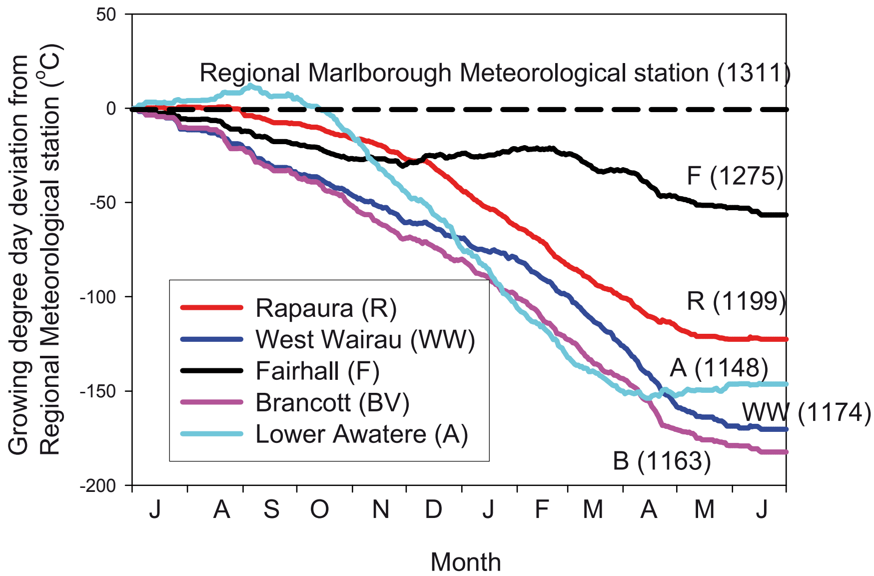

Figure 2: Influence of site on the deviation in growing degree days (GDD base 10°C) from the regional meteorlogical station. Figures in brackets are the accumulated GDD September to April for each site.

There were small differences in the thiol concentrations in wines made from the different sites. However, the largest difference was in methoxypyrazine concentration, with the cooler, Awatere site having higher methoxypyrazine concentrations in both juice and wines (Table 1). The chemical properties of the wines were reflected in the sensory properties. The sensory panel rated the green descriptors (grassy, capsicum, leafy, herbaceous) and boxwood higher on wine made from fruit in the Awatere Valley (Fig. 3). The Awatere wine was rated as being more "typical" of Marlborough Sauvignon blanc. These results have proved consistent over the other years of the trial (data not given). Grapevine yield had little influence on the sensory properties of the wine (Fig. 3).

CONCLUSIONS

Marlborough Sauvignon blanc is recognized by intense, fruit driven flavours. A balance of herbaceous/asparagus and passion fruit/tropical aromas are generally recognized as necessary to provide typical Marlborough Sauvignon blanc style. Despite differences in soil texture and climate, Sauvignon blanc wines from the four Wairau Valley sites, harvested at similar soluble solids and processed using a standard protocol had similar sensory properties. Vine yield had no significant effect on sensory properties, although fruit from 4-cane pruned, higher yielding vines achieved the target soluble solids up to nine days later than those of 2-cane pruned vines at the same site. Fruit from the Awatere Valley site had thigher methoxypyrazine concentration when compared to Wairau sites, giving wines from this site a distinctive herbaceous sensory character and greater Marlborough typicité.

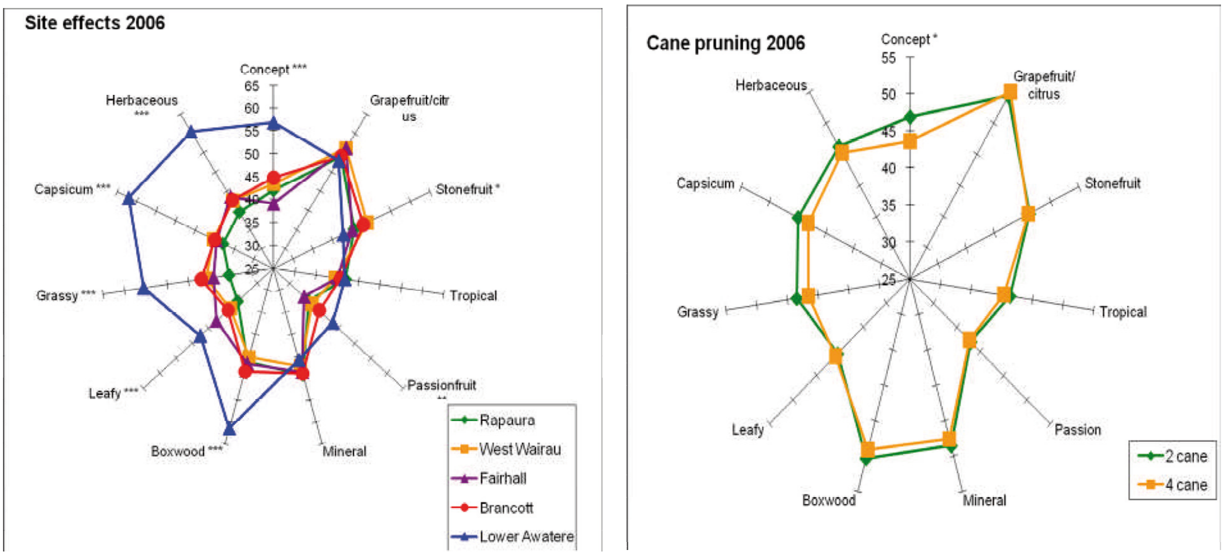

Fig. 3: Influence of site and vine training on sensory properties of Sauvignon blanc

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