Machine harvesting versus handpicking: impacts on tropical and green characters in Sauvignon Blanc wines

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Introduction
CONTINUED IMPROVEMENTS IN mechanical harvesters mean that an acceptable level of wine quality is readily achieved with most grape harvests. Indeed the speed with which the grapes can be mechanically harvested means that the crop can be brought in at its optimum, in addition to cost savings to the labour involved in handpicking. At the same time, the effects of oxidation with machine-harvested grapes have been linked to a loss of grape quality (Arfelli et al., 2010), and the ability to sort out unwanted grapes and non-grape material is seen as a further issue in favour of manual harvesting (Handbook of Enology, 2006). This can lead to the view that the best quality wine can only be obtained by the handpicking of grapes, if the added cost can be justified. With many wine styles, this could well be true, but in the case of Sauvignon Blanc wines with intense tropical/passionfruit characters, an exception to this rule has been found.

Sauvignon Blanc wines with intense tropical and passionfruit characters typically have high levels of the varietal thiols 3-mercaptohexanol (3MH) and 3-mercaptohexyl acetate (3MHA) (Tominaga et al., 2000). These varietal thiols were indeed found to be important in surveys of commercial Sauvignon Blanc wines undertaken at the University of Auckland (Benkwitz et al., 2012a). A feature of many of the more intensely flavoured wines is a combination of high tropical/passionfruit characters with a strong green edge, where additional wine aroma compounds will make an impact. However, when we turned our attention to the sub-regions of the Marlborough grapegrowing area, looking to define different styles of Sauvignon Blanc wines, some problems arose. For her PhD study in 2008, Sara Jouanneau, supervised by Dr Laura Nicolau, obtained grape bunches from across the Marlborough region, and sent these back to Auckland for consistent small-scale winemaking. This was needed to avoid the impact of variable winemaking practices, and to examine what was specific to the grape source. Instead of 3MH concentrations averaging in the thousands of ng/L, as obtained in past surveys of commercial wines (Benkwitz et al., 2012a; Mateo-Vivaracho et al., 2010), the 3MH levels ranged from 122 to 1235 ng/L, and remained untypically low in further Sauvignon Blanc wines made from handpicked grapes.

To overcome this problem in 2009 and 2010, Jouanneau moved to juices obtained from the commercial harvesting and pressing operation, following from mechanical harvesting of the grapes. Higher varietal thiol levels were found in the wines, and Jouanneau completed a wide survey of the Marlborough sub-regions for several classes of aroma compounds. The results of this study have been accepted for publication (Jouanneau et al., 2012), and among the findings are an indication that 3MH levels across Marlborough can be higher in some years than others. Also wines from the southern Awatere valley, well-known for greener aroma characters, did not show higher concentrations of the methoxypyrazines usually associated with these aromas. We will return to this issue later in the article, but note here that these grapes need to travel the greatest distance by truck, from vineyard to winery, compared to grapes coming from the other Marlborough sub-regions.

Harvesting trial
At the same time Laura Nicolau remained convinced from Jouanneau’s first trial year that there was something important for Sauvignon Blanc wine aroma in the handling of the grape samples, and that this should be investigated in future projects. And so we set up a harvesting trial in 2010 to look at wine composition from grapes taken at different points in the harvesting process. Five sets of grape and juice samples from five Marlborough vineyards were included in the study.
Firstly 15kg of handpicked grapes were taken immediately prior to mechanical harvesting of the fruit, and a second 15 kg harvester sample was taken as the grapes and juice came off the mechanical harvester (Figure 1).

A third 15kg sample was taken as the grapes were tipped from the truck into the receival winery hopper (Figure 2), and were also pressed off using an 80L basket press (Figure 1). Two more samples were taken from the commercial pressing operation, the first a free run juice and a final pressed to 1 bar sample.

The juices were then cold settled for 36 hours, and were inoculated with Lalvin yeast strain, EC1118 *Saccharomyces cerevisiae*, at 0.2g/L, in triplicate 750mL green wine bottles. A rubber bung and 100µL plastic pipet tip filled with glass wool was inserted for CO2 release during fermentation. The subsequent wines were analysed for varietal thiols, as reported earlier (Allen et al., 2011), and for a wide range of compounds that make an important contribution to the aroma of Sauvignon Blanc wines, including methoxyypyrazines, terpenes, C6-alcohols, higher alcohols and esters (Benkwitz et al., 2012b).

**Wine aroma results**

**Variatel thiols**

The wines made from juices that had been mechanically harvested produced higher 3MH concentrations in some cases, but a number of exceptions were noted (Figure 3). All of the pressed to 1 bar juices produced wines with 3MH concentrations less than 750ng/L, and confirmed results from a previous pressing trial where lower 3MH values were seen with wines made from heavily pressed juices (Patel et al. 2010). Most of the wines made from handpicked grapes were low in 3MH content, with the exception of one sample that produced an unusually high value (wine D in Figure 3). Further low 3MH wines were also observed, particularly when the juice samples were found to be subject to some oxidation and browning, given by a higher 420nm absorbance (Figure 3).

At the same time it needs to be recognised that some juices do not have the potential to produce high thiol wines, regardless of how the grapes are processed. Similar trends were seen with the acetate ester 3MHA, of particular importance to young Sauvignon Blanc wines and wines stored under cooler conditions (Makhoktina et al. 2012).

The state of juice oxidation has been examined in a further harvesting trial undertaken in 2011, in which different sulfite additions were made to Sauvignon Blanc juices at harvest, with the finding that much lower 3MH concentrations were obtained in mechanically harvested juices with either nil or a small (c. 30 mg/kg) additions of SO2. In the present trial, the variable air exposure during truck transport prior to sampling at the winery hopper and variable sulfite gradients throughout the truck load could have influenced the 3MH formation capacity of the individual juice samples. On the other hand, the concentration of a further important varietal thiol, 4-mercapto-4-methylpentan-2-one (4MMP), was not greatly affected by the choice of harvesting method and sampling point (Allen et al., 2011).

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Figure 1. Left: Thomas Allen collecting grapes and juice from a mechanical harvester in April 2010; and right: pressing the 15kg grape lots at a water pressure of 2.5 to 3 bar for 20 minutes.

Figure 2. Left: Grapes and juice being transferred into a truck for transport to the winery, and right: tipping into the winery receival hopper.

Figure 3. Left: 3MH concentrations in the five sets of Sauvignon Blanc wines at five harvesting points; right: wine 3MH versus juice 420nm absorbance across the 25 samples.

Figure 4. Left: 2-methoxy-isobutylpyrazine (MIBP) and right: linalool concentrations in the five sets of Sauvignon Blanc wines at five harvesting points.
Methoxypyrazines and terpenes
It has been previously shown that the main methoxypyrazine found in Sauvignon Blanc wines, 2-methoxy-isobutylpyrazine (MIBP), is highly water soluble and is readily extracted from grapes to must (Roujou de Boubee et al., 2002). In the present trial the concentration of MIBP was very similar regardless of harvesting point and the method of grape harvesting (Figure 4). Even heavy pressing to 1 bar did not raise the methoxypyrazine concentrations. Likewise similar concentrations were obtained across the harvesting points for the terpenes, of which only linalool was present at concentrations close to the perception threshold of 25µg/L (Figure 4).

Fatty acids, higher alcohols and esters
A lack of consistent differences from harvesting method and sampling point was observed with further aroma compounds, including fatty acids like octanoic acid, and many of the higher alcohols, ethyl esters and acetate esters present in the wines. Results for isoamyl alcohol and isoamyl acetate are presented in Figure 5, two compounds that were found at concentrations well above their respective perception thresholds.

C6-alcohols and associated acetate esters
The situation was very different with the C6-alcohols, responsible for green and grassy aromas in many wines. Even more so than with 3MH, there was a marked increase in the concentration of the C6-alcohols for wines made from grapes that had been through the mechanical harvester, compared to very low values for wines made from handpicked grapes. In the case of hexanol, values below the perception threshold...
of 1100µg/L were seen in the wines made from handpicked grapes, while the perception threshold was exceeded with all of the remaining wines (Figure 6). Even higher levels were seen in wines made from the heavily pressed juices, and this trend went counter to the 3MH case, where lower values were seen with the “pressed to 1 bar” wines (Figure 3). The values for hexanol obtained here can be compared to averages in the range of 2500 to 3000µg/L for commercial New Zealand Sauvignon Blanc wines made predominantly from machine harvested fruit (Benkwitz et al. 2012a). For this study, the sensory panel gave the descriptor ‘bourbon’ to hexanol and ‘apple lolly/candy’ to hexyl acetate.

Very similar trends were seen with a further C6-alcohol, cis-3-hexenol (at times called ‘leaf alcohol’). It has been noted in the past that higher levels of cis-3-hexenol can appear in musts that include grape leaves (Joslin et al., 1978). The acetate esters corresponding to these two C6-alcohols, namely hexyl acetate and cis-3-hexenol acetate, mirrored their C6-alcohol counterparts in showing increases in concentration in moving from handpicked to machine-harvested samples, and to higher levels with the heavier pressed juices (Figure 6). These acetate esters thus followed a different trend to the other acetate esters, such as isoamyl acetate (Figure 5) analysed in the present study.

In considering which compounds contribute to the greener characters in Sauvignon Blanc wines, more attention should be given to the C6-alcohols in wines made from machine harvested fruit. The contribution of the C6-alcohols, noted for grassy aromas, may match or even exceed that due to the methoxypyrazines, described as capsicum. Further contributions to greener characters can also come from certain

![Graph of hexanol and hexyl acetate concentrations in Sauvignon Blanc wines.](image)

**Figure 6.** Above: hexanol, and below: hexyl acetate concentrations in the five sets of Sauvignon blanc wines at five harvesting points.
varietal thiols (starky/box tree), and from dimethyl sulfide (canned asparagus) in older wines. During longer periods of truck transport, particularly if sulfate levels become depleted, juice oxidation may lead to the formation of greater quantities of C6-aldehydes in the juices and ultimately C6-alcohols in the wines. This may apply to some wines made in Marlborough from grapes sourced in the Awatere Valley, where longer transport times to the winery are typically required.

Conclusions
The method of harvesting, machine harvesting versus handpicking, and the sampling point in the commercial pressing operation, had varying effects on the levels of aroma compounds in Sauvignon Blanc wines. Some compounds were present at similar concentrations regardless of harvesting method and pressing conditions, such as the methoxypyrazines, 4MMP, fatty acids, terpenes, higher alcohols and their acetate esters. The compounds that were lower in concentration in the wines made from the hand-picked grapes were the C6-alcohols and their acetate esters and in most cases the varietal thiols 3MH and 3MHA. Higher values of the C6-alcohols were found in wines made from the heavily pressed juices. To obtain a Sauvignon Blanc wine with intense tropical and green characters, machine harvesting of the grapes would be favoured, so long as adequate protection of the juice from oxidation is ensured through the use of adequate sulfate applications, to maintain higher varietal thiol levels. While this study has focused on Sauvignon Blanc, many of the trends observed above can be expected in other wine varieties.

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References

FRANCE
French exports post double-digit growth in 2012

FRANCE IS ON track to yield impressive export sales in 2012, with value exports already nearly 15 per cent up on last year.

Over the first half of this year, some 5 billion euros worth of French wines and spirits were exported worldwide; by the end of July, this figure had hit the 6 million-euro mark, a rise of almost 15 per cent on the same period in 2011.

The leading performers this year are Bordeaux, whose export sales by value rose by 300 million euros (+31 per cent), and Cognac, up 200 million euros (+20 per cent). The excellent 2009 and 2010 Bordeaux vintages allowed the region to surge upwards while demand for Cognac continues to be fuelled by spirit-thirsty Asian drinkers, amongst others.