Technical note

Understanding the variability of different sampling/extraction techniques used in grape assessments at the winery

Background

The point where transfer of title occurs for a load of grapes from grower to purchaser is often at the winery. This is the final opportunity for grapes to be assessed to verify how well they comply with defined specifications before they enter the winemaking process. Growers and wineries need to feel confident that the methodology of sampling and measurement is accurate, consistent and reliable, and that outcomes are accurate and representative. When sampling grapes from a load at the receival point it can be difficult to achieve a representative sample. In addition, the accuracy of juice analysis conducted can be affected by the sampling/extraction method used. Commonly juice is extracted either by manual or mechanical pressing. However, for machine-harvested fruit, free-run juice present in the bottom of the load is sometimes used for analysis. For more representative sampling of a load of grapes, screw core sampling mechanisms with inline laboratory analysers (e.g. Maselli Misure or Relco) can also be used.

The Australian Competition and Consumer Commission (ACCC) recently recommended that industry quality assessment standards should be reviewed to develop standard methods for the determination of sugar and colour in wine grapes. An important aspect of this is sampling in the vineyard and at the receival point. As part of work addressing these recommendations, the AWRI set up a study to assess the effects of different sampling and extraction methods on juice total soluble solids (TSS) and pH measurements at grape receival points during harvest in 2021. This article reports on the results of that study and complements a previously published article comparing laboratory-based juice extraction methods (hand-pressed vs homogenisation) used when analysing grapes (Hirlam et al. 2021).

Achieving a good sample

The basic principles of achieving a good representative sample of fruit at the receival point include:

- Sampling from multiple locations within a load (i.e. bin, trailer, truck)
- Consolidating samples or averaging the results to ensure that analysis is representative of the entire load
- Incorporating enough grapes to ensure that the minimum sample size requirements are met for specific grape analysis.

It is generally recommended that every second bin on a load is sampled and/or all components of a load (i.e. individual trailers) are sampled, with at least four sampling points per truck/trailer. The sampling point in each bin should be from a random location, representative of the load, spanning the entire depth of the bin/truck/trailer.

Comparing sampling and extraction methods

During vintage 2021, the AWRI in collaboration with industry representatives accessed three SA-based receival points (Sites A, B and C) to assess loads of grapes using different sampling/extraction methods, to better understand the variability of each method.

Site A consisted primarily of loads delivered in a truck and/or trailer combination, all machine-harvested fruit. Site B consisted of fruit delivered in either 0.5-tonne or 2.5-tonne bins, with a combination of machine- and hand-harvested fruit. Sampling and extraction methods trialled at these sites were:

- Free-run juice collected using a sampling cup on a rod
- Full berries, collected using a shovel or Yuba sampler, followed by hand-destemming and hand-pressing in a snap-lock bag.
- Mechanic screw core sampler (Maselli or Relco) with attached analytical station.

Site C consisted primarily of 2.5-tonne bin loads and only free-run juice samples were collected and analysed at this location. A series of 15 loads (5 white and 10 red) were assessed at Site A, and a series of 12 loads (all red) were assessed at Site B.

For both white and red loads assessed at Site A, the aggregated data presented no clear differences among the three sampling/extraction methods for the final total soluble solids levels, measured in degrees Brix (Figures 1 and 2, respectively). Assessing individual loads for Site A, for the five white loads the hand-pressed Brix values were greater than the free-run juice Brix values four out of five times, with a maximum difference of 0.4°Brix. For ten red loads assessed at Site A, the hand-pressed juice had a higher Brix than the free-run juice sample seven out of ten times, with the maximum difference being 0.9°Brix.

The assessment at Site B included only loads of a minimum of five bins. For the analysis undertaken, free-run juice sampling tended to result in lower overall total soluble solids (Brix) levels, with increased extraction through hand-pressing and mechanical screw core sampling tending to yield higher values (Figure 3). An assessment of the pH of samples from each load taken via the differing extraction techniques showed that pH tended to

be lower (more acidic) in hand-pressed samples than in free-run or screw core samples (Figure 4)

Variability of total soluble solids (TSS) results across a load of grapes

Free-run juice samples collected from Site C from individual bins were analysed for TSS across vintages 2019, 2020 and 2021. To understand the naturally variability of TSS (Brix) across a load of grapes harvested from the same vineyard, data was collected from loads where a minimum of eight bins across the load (most commonly 2.5-tonne bins) were

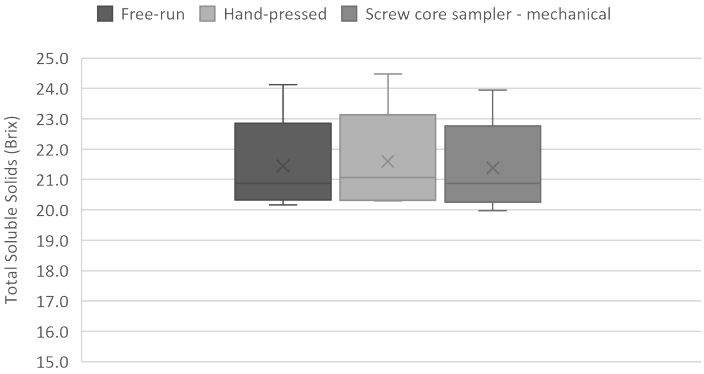

Figure 1. Range of results for total soluble solids (TSS) measured after different sampling/extraction methods for white grapes at Site A. The boxes represent the spread from the first quartile to the third quartile of the data, with the horizontal line within the box representing the median value and the crosses representing the average value. The 'whisker' lines above and/or below each box extend as far as the minimum and maximum values measured, excluding outliers, which are represented as dots.

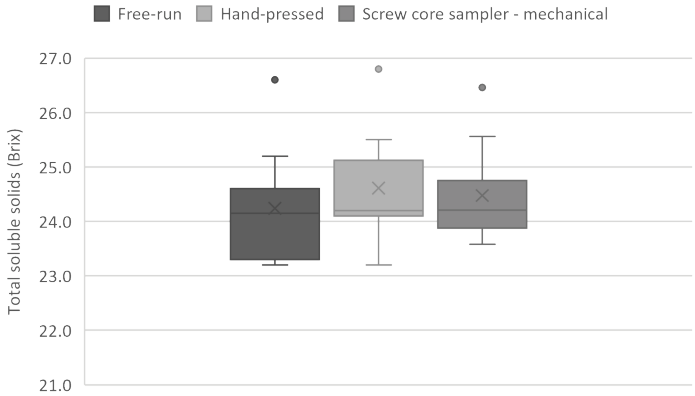

Figure 2. Range of results for total soluble solids (TSS) measured after different extraction methods for red grapes at Site A. The boxes represent the spread from the first quartile to the third quartile of the data, with the horizontal line within the box representing the median value and the crosses representing the average value. The 'whisker' lines above and/or below each box extend as far as the minimum and maximum values measured, excluding outliers, which are represented as dots.

analysed. The average variation of TSS values across a load was observed to be between 0.7 and 1.0°Brix, and this was consistent across all three vintages assessed (data not shown). The variability was found to be similar for both red and white grapes across the three vintages. A further point to note is that variation in TSS measurements across a load was up to and beyond 3°Brix in some instances. Further investigation demonstrated that the variation across a load tended to be greater for fruit received from warm inland regions (e.g. Riverland, Murray Darling, data not shown).

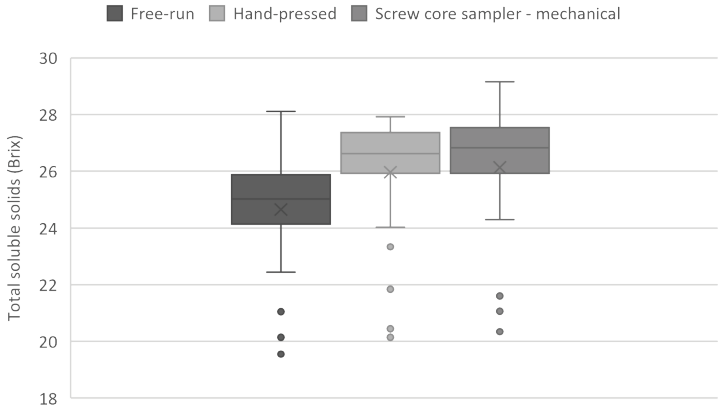

Figure 3. Range of results for total soluble solids (TSS) measured after different sampling/extraction methods at Site B. The boxes represent the spread from the first quartile to the third quartile of the data, with the horizontal line within the box representing the median value and the cross's represent the average value. The 'whisker' lines above and/or below each box extend as far as the minimum and maximum values measured excluding outliers, which are represented as dots.

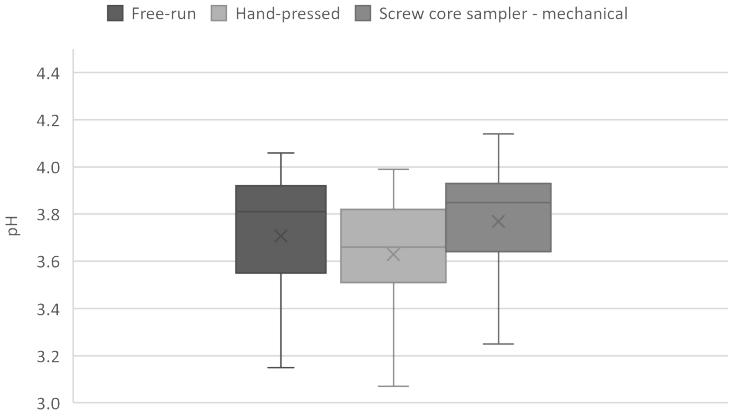

Figure 4. Range of results for pH measured after different extraction methods for Site B. The boxes represent the spread from the first quartile to the third quartile of the data, with the horizontal line within the box representing the median value and the cross's represent the average value. The 'whisker' lines above and/or below each box extend as far as the minimum and maximum values measured excluding outliers.

Conclusions

The results of the experiments undertaken onsite at multiple winery sites demonstrated that free-run juice sampling tended to result in lower overall total soluble solids (Brix) levels in red grapes compared to hand sampling/pressing and mechanical screw core sampling. Given that the majority of red fruit is pressed to some extent, free run juice cannot be considered representative of the load and therefore free run juice sampling is not recommended for use in dertermining total soluble solids.

In addition, notable variability in total soluble solids measurements was seen between bins from the same load/vineyard, with the average variation across the measurements between 0.7 and 1.0°Brix. This highlights the importance of combining grape samples from multiple locations across a load to obtain a representative sample or of averaging results from multiple samples (at least four). Relying on just one or two samples has a very high probability of giving an incorrect result.

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References and further reading

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