# Practical sensory evaluation in the winery

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Winemaking production decisions are made every day based on the sensory evaluation of wine.

Methods are available that enable sensory evaluation to be used as a valid winemaking quality control tool.

Difference and preference tests can be easily used in small to medium-sized wineries to determine real sensory differences and preferences between wines.

Detailed here are the appropriate sensory procedures to use for different winemaking operations, along with considerations for performing sensory assessment in wineries.

From tasting grapes for assessment of maturity and quality in the vineyard, to assessments of finished wine post-bottling, decisions based on sensory evaluation are made throughout the entire winemaking process. Many of these decisions are often made by an individual, highly experienced winemaker, based on his/her own sensory impressions and experience. Some sensory decisions are required rapidly, and for practical reasons, a single winemaker's assessment may be most appropriate. Other sensory decisions, however, can be aided by the use of more rigorous sensory evaluation techniques, to reduce the reliance on one taster's opinion to make significant production decisions.

This paper aims to highlight some simple, practical sensory analysis options that are available to winemakers for use in small- to medium-sized wineries.

The challenges of relying on sensory evaluation by only one winemaker include:

- variation among tasters - every taster has strengths and weaknesses
- assessments based on a personal standard or benchmark
- bias due to preconceptions when not tasting the wine 'blind'
- the 'cellar palate' phenomenon[1]
- small, insignificant differences may be dwelled upon if the individual is particularly sensitive in that area
- decisions being influenced by position in company hierarchy and seniority.

**Notes**

[1] 'Cellar palate' is the term used to describe a winemaker's adaptation to a wine or style of wine that they taste regularly. This is quite common and it is especially important to note that is easy to become accustomed to faults or taints in the wine when you are tasting them regularly. For example, someone who is accustomed to low level 'Brett' will not notice it while another person assessing the same wine who isn't accustomed to Brett, would pick the off-flavour.

Recently, Gawel and Godden (2008) reported an examination of the tasting performance of 571 experienced wine tasters who have attended the AWRI's Advanced Wine Assessment Course (AWAC). These data revealed that there was a wide variation in performance and consistency amongst individual tasters. However, combining individual results for groups of three tasters – similar to the Australian wine show judging system – greatly reduced this variation. This highlights the benefits of having more than one taster to make valid sensory assessments.

Difference testing is a simple yet powerful form of sensory evaluation, and can be used in many practical situations in the winery, for example:

- *duo-trio* difference tests can be used to determine if fermentation using different or wild yeast strains has created perceptible differences in the sensory properties of the resulting wine, compared to using the standard fermentation yeast
- taint/fault sensory screening of wine additives and processing aids should be conducted for every new batch of material to avoid contamination of wine. The AWRI has developed procedures for preparation of common additives and processing aids for sensory assessment, which are available on the website (www.awri.com.au). Use of *duo-trio* or *triangle* difference tests on the prepared samples would provide a simple, robust and valid quality control method
- the appropriate rate of copper addition to remove reductive characters from wine could be assessed using a *paired comparison* test, asking tasters to identify which wine sample of a pair is higher in reduction aroma
- a *same/different* test could be used to determine if different wine blending options are actually creating a significant sensory difference

# DIEMME

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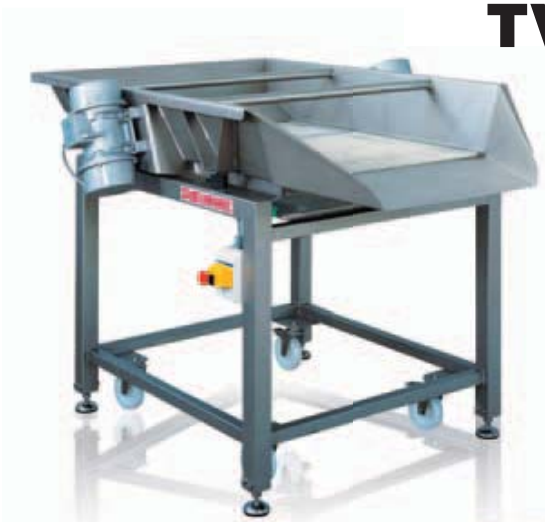

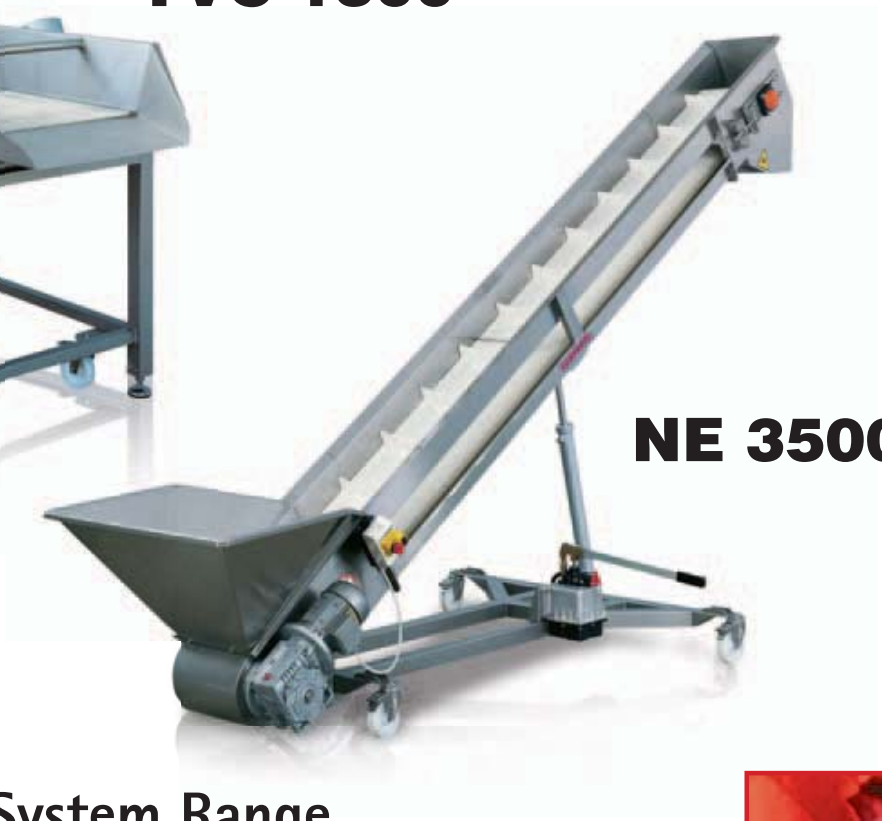

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- *paired preference* tests can be used to find out which wine of two is preferred overall.

Sensory difference testing methods are simple to perform and do not necessarily require significant time or extensive facilities and resources. Following are some simple considerations for performing sensory assessments in wineries, followed by a table highlighting appropriate sensory evaluation methods to use at different winemaking stages. Use of these methods will lead to significant sensory differences being determined leading to a higher degree of confidence in making production decisions.

## Practical sensory evaluation considerations

### *1. Tasters should taste the wine 'blind'*

The identification of the wines to be tasted should not be known to the taster(s). Wines should be presented in a different, randomised order for each taster, with no clues as to their identity. This ensures that the biases of all tasters are minimised, if not eliminated.

### *2. Have at least two independent tasters*

Quality control assessments, such as wine additive taint screening or cork taint checking, require at least two tasters who have strengths in that type of assessment, (e.g. cork taint recognition) to evaluate the wine. If the two tasters do not agree, more rigorous testing might need to be applied.

Knowledge of winemakers' (and other staff members') sensory strengths and weaknesses is important for this type of testing. Variation among tasters in their ability to perceive different aroma and flavour compounds can be quite large. For example, some wine tasters might have a high threshold for 'Brett' flavour compounds, but be very sensitive to cork taint or oxidation. To evaluate your staff members' sensory strengths and weaknesses, sensory fault kits are available through the AWRI or through other sources such as the Australian Society of Viticulture and Oenology. These kits will allow individual staff members to be tested for their sensitivity to common taints and faults, and are also useful for training in taint and fault recognition and identification.

It is important to note that sensory testing doesn't have to be limited to winemakers. Any company staff member including administration and cellar door staff can potentially be used for sensory analysis provided they are familiar with the type of test, and their individual strengths and weaknesses have been evaluated. It is, therefore, strongly recommended that the cellar floor staff members be trained in sensory evaluation. This has two benefits: it will increase the number of tasters available for sensory evaluation and will also make the cellar floor staff members more aware of taints and faults, which is an important skill for people working with your product every day.

### *3. Repeat the tasting*

When performing a difference test a single tasting by each taster might not provide the most accurate information about a wine due to the chance of tasters guessing the correct answer. Having tasters repeat the tasting exercise can decrease this chance of guessing. Difference tests also require a certain number of answers or responses to determine statistical significance and for this, the greater the number of responses the better. An easy way to increase the number of responses without increasing the number of tasters is to have each taster repeat the tasting exercise. This is simple to do as tastings can be organised so that the same sample comparison is presented twice, with the wines presented in a different order each time.

**Table 1. Outline of commonly applied sensory difference and preference tests.**

| Test | Min. tasters[1] | Use | Samples | Basic method | Results – are the wines significantly different? |
|---|---|---|---|---|---|
| ***Triangle*** | 5 | Multi purpose | Three coded test samples<br><br>Two are the same wine (A) (but are coded differently)<br><br>One is a different wine (B) | Tasters assess all three samples then pick the sample which is different from the other two, or the odd one out.<br><br>Serving orders[3]: AAB, ABA, BAA, BBA, BAB, ABB | **Correct response** – taster picks the odd one out.<br><br>**Significance** – Required no. of correct/total responses[2]:<br>Single tasting 4/5 5/6 5/7 6/8<br>Repeated tasting 7/10 8/12 9/14 9/16 |
| ***Duo-trio*** | 7 | Comparison to a reference wine | One reference sample (Ref)<br>Two coded test samples (A,B)<br><br>A is the same wine as the reference (control wine)<br>B is the wine to test | Tasters assess the reference (Ref), then the two test samples (A,B).<br>Tasters are asked to indicate which test sample is the same as the reference.<br><br>Serving orders: Ref AB, Ref BA | **Correct response** – taster picks A as the same as the reference.<br><br>**Significance** – Required no. of correct/total responses[2]:<br>Single tasting 7/7 7/8 8/9 9/10<br>Repeated tasting 10/12 11/14 12/16 13/18 |
| ***Paired comparison*** | 7 | When a difference is known | Two coded test samples (A,B)<br><br>One is known to be chemically higher in an attribute (eg. sweetness) | Tasters are asked to identify which sample is higher in an attribute (eg. identify which sample is sweeter).<br><br>Serving orders: AB, BA | **Correct response** – taster picks the sample that is higher (eg. the presumed sweeter sample.)<br><br>**Significance** – Required no. of correct/total responses[2]:<br>As for *Duo-trio*. |
| ***Same/ different*** | 7 | When a difference is unknown | Two coded test samples (A,B) | Tasters assess both samples and indicate whether they think samples are the same or are different.<br><br>Serving orders: AB, AA, BA, BB<br>(Note: two serving orders are presented to each taster) | **Correct response** – taster correctly picks the two samples as being the same or different, depending on the serving order.<br><br>**Significance** – Required no. of correct/total responses[2]:<br>As for *Duo-trio*. |
| ***Paired preference*** | 7 | Which wine is preferred | Two coded test samples (A,B) | Tasters assess both samples and indicate which one they prefer. A choice must be made; the taster can't say they prefer neither.<br><br>Serving orders: AB, BA | Count the number of people who prefer one wine over another eg. A over B.<br><br>**Significance** – Required no. preferred A/total[4]:<br>Single tasting 7/7 8/8 8/9 9/10<br>Repeated tasting 12/14 13/16 14/18 15/20 |

[1] Indicates the minimum number of tasters required for testing to achieve a statistically significant result ($p<0.05$).
[2] Figures denote minimum number of correct responses required out of the total number of responses to conclude the wines are significantly different ($p<0.05$) from each other.
[3] Serving orders denotes possible arrangements of the samples to be presented randomly to tasters.
[4] Figures denote minimum number of tasters who agree on preference for one wine required out of the total number of responses to conclude one wine is significantly preferred ($p<0.05$) over the other.

### 4. Minimise presentation effects

Fatigue, adaptation, suppression/masking of flavours and visual biases are all effects that can be decreased with correct presentation of the samples. Ideally, samples should be pre-poured at a constant tasting volume (30mL) and temperature (approx. 20ºC), into covered glasses, preferably coded with three digit random numbers. The samples should be presented in a random order, which differs for each taster. Tasters should taste within a set period (e.g. 1 hour), and if this is not possible, the samples should be repoured (but not by the taster). This is standard practice in scientific sensory assessments and also should be practiced in commercial tastings.

### 5. Minimise talking during tasting

To prevent tasters influencing the judgement of each other, tasters should not communicate until they have made, and written down, their judgement. To ensure tasters do not communicate during tasting, tasters should taste in isolation, either at different times, i.e. one person goes into the sensory lab as one goes out, or they could taste in different physical areas. If this is not possible, tasters should at least face away from each other and avoid eye contact and talking during the tasting. Use of 'tasting sheets' is also suggested as they make the taster write down a response, and enable tasters to taste and record their results in a standardised format each time. Tasting sheets also enable easy collation of results, and can be filed so there is a record of all tastings. Proformas of tasting sheets used for several sensory techniques are available on the AWRI website.

### 6. Reduce physiological effects

Fatigue, degree of tiredness, hunger and other issues of emotional state will affect taster performance. Generally it is recommended to carry out assessments in the morning, with no tasting held for at least half an hour after smoking, eating or drinking. To reduce effects of ▸

fatigue and adaptation, ideally a maximum of six to seven wines should presented at any one session, with tasters having a short rest if more samples are to be assessed.

### *7. Establish if a difference exists before deciding on preference*

Before considering preference testing, establish if there is a significant sensory difference with a difference test. Preferences are an important part of sensory testing and a winemaker will often need to state their preference to aid decision making. Before doing this though, it is essential to ensure that a real difference actually exists between the wines. If there is no sensory difference, or if personnel cannot reliably and repeatedly detect a difference between samples, their preferences are meaningless, and probably due to random choice.

## Practical sensory evaluation procedures

Difference testing methods are the most feasible to use in a winery environment and are simple and robust. There are many other sensory methods also available such as: consumer preference and acceptance testing, descriptive analysis, assessment of wine quality using the Australian 3/7/10 system, and estimation of the presence and intensity of off-flavours in wine which arise post-bottling (e.g. cork taint, random oxidation). Performing some of these tests might not be feasible in a small- to medium-sized winery, however, they are available through the AWRI, or are offered as a service by other companies if needed.

Difference testing is a way to determine if a sensory difference actually exists between the wine samples. The degree or nature of the difference might not be able to be quantified, yet difference testing is important to determine if different winemaking processing techniques or operations have had an impact on the sensory properties of a wine.

There are four suitable types of difference tests: *duo-trio, triangle, paired comparison* and *same/different* tests. Once a difference has been established a *paired preference* test can also be performed. A brief description of the methodology of each test, including how to perform the test, the number of tasters required and the required result for concluding that a significant difference exists are outlined in Table 1.

These tests are sometimes applied in a crude fashion, where only one or two tasters perform the test on the lab bench. This application is certainly better than no testing at all, however, to achieve a statistically significant sensory result that demonstrates that two wines are perceptibly different, more robust testing should be carried out using the minimum number of tasters as recommended in Table 1.

While ideally a larger number of tasters would be preferred for sensory testing (Stone and Sidel 2004, Lawless and Heymann 1998, Meilgaard *et al*. 2007), testing with a small panel of 5-7 tasters will provide highly valuable data that will greatly increase reliability of production decisions based on sensory assessment. Use of a small panel, as opposed to a single taster, reduces the risk of the test concluding there is no difference when one actually exists. Any number of panellists can be used, and the more tasters the better. The number of correct responses required for a significant result for any number of tasters can be viewed on the AWRI website.

Selection of the appropriate difference test depends on many factors, including the objectives of the test, the number of available tasters and the volume of wine needed for the test.

*Triangle* tests are useful as a multi-purpose difference test to be used throughout the winemaking process when comparing two

wines for a difference. The taster is presented with three wines; two are the same and one is different. The taster is required to select the sample which is different. *Triangle* tests are often preferred as they require fewer tasters to perform the assessment as there is a greater likelihood that a result will be genuine and not due to a chance effect.

*Duo-trio* tests are often used instead of a *triangle* test to compare unknown differences between wines. Tasters are presented with a reference wine, and then two test wines; one test wine which is the same as the reference and the other is the wine to be tested. Tasters are asked to identify the sample that is the same as the reference wine. This test might be preferred as the taster has a reference wine to compare to, which generally tasters find easier to evaluate. It can also be better for assessing red wines by palate as there is less taster fatigue, however, more tasters are required to perform the test.

*Paired comparison* tests can be used when there is a known difference in chemical composition of the wines, which requires a sensory assessment (i.e. a wine is higher in residual sugar, but is it sweeter?) Tasters are presented with two wines and asked to identify which sample is higher in the attribute. This test can be useful when assessing alternative wine blends. The test requires the same amount of wine and tasters as the *duo-trio* test.

A *same/different* test is similar to the *paired comparison* test; however it is used when the difference between two wines is unknown. Tasters are asked to identify whether they think the two samples presented are the same or different. These tests are easy to set up however more tasters are required to perform the test and tasters must perform the test at least twice, receiving a different randomised serving order each time.

Once a significant difference has been established between two wines a preference test can be performed. This is useful in situations where winemakers are trying to assess which blend or which yeast fermentation they prefer. It is important to note that a preference test should be performed separately and after a difference test. It may be tempting to combine the two but this should be avoided as results can be misleading. In determining preference, it is also important for the tasters to consider (and possibly discuss) the desired wine style required before tasting the wine. The preference decision should not be a personal preference, but a preference for the wine which best suits the desired wine style.

## Concluding remarks

Sensory evaluation is used throughout the entire winemaking process to aid decision making and to evaluate the quality of a wine. To ensure that production decisions are made based on real sensory differences between wines it is vital to ensure that sensory assessment is performed in a suitable but scientific manner. Sensory assessment should accommodate for the high degree of variability in tasters responses as one person's perception of a wine will be different from another's. Applying the techniques outlined in this paper will reduce the impact of variability among tasters, and ensure that sensory evaluation can be used as a valid quality assessment tool during winemaking.

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