Regional panel smoke taint sensory evaluation procedure

Contributors:

Patricia Williamson

Damian Espinase Nandorfy

Leigh Francis

Con Simos

For further information or assistance, please contact the AWRI helpdesk helpdesk@awri.com.au or 08 8313 6600.

1. Introduction

This document outlines a procedure for evaluating smoke taint in wines in an objective matter. The procedure has been developed based on the fundamentals of sensory science and quality control sensory methods. It adapts methodology that has been extensively applied with sensory panels at the Australian Wine Research Institute (AWRI), which produces robust results and is well correlated with chemical analysis. Although this is a rigorous method, some statistical power may be compromised as a result of the adaptation.

The role of the regional association

Developing a regional capability for smoke sensory assessment will support grape and wine producers and help them to identify and manage the risk of smoke taint. The regional association will be instrumental in deciding when a panel is required, maintaining a list of potential panellists, identifying a venue, scheduling tastings, providing administrative support, and conducting the tastings in confidence.

The purpose of a regional smoke taint sensory assessment panel is to support producers who require sensory assessment of wines made from grapes that may have been affected by smoke exposure. In many cases the wines will be from small-lot fermentations made to assess the impact of smoke exposure. In assessing the risk of smoke taint, the current best practice advice from the AWRI is to use a combination of chemical analysis and sensory assessment. Chemical analysis can determine with a high degree of confidence if grapes have been exposed to smoke. Sensory analysis can help determine if the smoke exposure is likely to lead to a sensory defect in the resultant finished wine.

The role of the AWRI

The AWRI has developed a number of initiatives to support regions affected by bushfires, including ongoing support for the effective operation of regional sensory assessment panels. Please contact the AWRI helpdesk helpdesk@awri.com.au or 08 8313 6600 for assistance with conducting smoke taint sensory evaluations using the method outlined in this document, including panel screening and training, and data analysis.

2. Sensory evaluation

A trained, screened panel should be used, consisting of panellists known to be sensitive to smoke taint. The panel selection process is critical as each individual has different degrees of sensitivity to specific aromas and flavours. AWRI sensory data indicate that 20-30% of experienced sensory assessors (including winemakers) are not sensitive to smoke characters. The AWRI can provide assistance with conducting screening sessions for potential judges.

Even with a sensitive, highly trained and experienced sensory panel, 'false positives' can occur, with non-zero scores given by assessors for unaffected wines, due to an expectation effect, which commonly affects assessors evaluating taints. Making judges aware that a clean sample is included in each set can prevent judges from expecting a level of smoke in every sample.

Assessing smoke-affected wines can be extremely challenging, especially if it involves assessing small-lot ferments, which are prone to off flavours that are unrelated to smoke taint. Wines from small-lot ferments are often made from grapes that are sampled many weeks before optimal harvest. These wines may show overt green, unripe flavours and high acidity that can mask smoke characters. The ability to discriminate smoke characters from other wine attributes requires skill and training.

Implementing sensory evaluation best practices allows reliable outcomes from sensory assessments of small-lot ferments, minimising the impact of biases and physiological effects on the results. These practices include:

- independent judgements
- blind sample coding
- a limited number of samples evaluated in each session
- uniform temperature across samples
- proper rinsing and resting intervals
- balanced random evaluation order across judges
- minimisation of sensory fatigue and carry-over
- inclusion of a negative, clean control
- inclusion of blind replicate(s) or all wines repeated
- avoidance of distractions
- use of a structured evaluation form.

This procedure has been developed to fit within the resources of a regional panel context.

Judges

There is significant variation within the population, including winemakers, irrespective of age, position within the organisation, level of experience or training to recognise smoke taint. Undergoing screening and training is an essential prerequisite for participating in a sensory panel.

A minimum of 8 judges should be used, with 10-12 recommended. Using a smaller group would affect the robustness of the results, with the data obtained not as reliable or sensitive. All judges should be available and motivated to participate in the panel and have previously demonstrated the ability to recognise smoke characters consistently, through successful completion of screening tests (see appendix).

Familiarisation with sensory methods

Judges should be familiarised with the use of the rating scale by initially rating a set of samples, preferably actual smoke-affected samples, at increasing concentrations of smoke volatiles (four samples). Encourage judges to think about the presence of 'smoky', 'medicinal', 'ashy', 'phenolic/tarry' aromas or flavours, and avoid considering too closely bitterness, astringency and drying/'harsh' palate characters or 'dirty' aftertaste in the absence of 'smoky' flavour, as these are common reasons for false positives.

The final choice of judges

Judges should evaluate real wines with different levels of smoke taint as a practice before the first real sample set. Remind judges that not all wines are tainted, and there are usually clean control wines included in the assessment, so scores of zero should be expected in some cases.

Present at least one set of six wines, with at least one sample in duplicate. Options for samples for this test include sourcing smoke-affected wines of varying intensity, together with a clean control, or using samples 'spiked' with smoke compounds. The AWRI can assist with providing samples and guidance for screening and selection sessions.

Each judge's performance will be assessed for discrimination and agreement with the panel mean. Those judges who perform poorly will be either subject to further training or excluded from the panel.

Sensory evaluation conditions

- The tasting area should be odour-free, quiet, well ventilated and temperature-controlled, with no open fires or obvious smells.

- Judges should face away from each other so as not to influence one another.

- Samples should be prepared in a separate room and out of sight of the judges.

- Ideally, assessments should be held mid-morning or mid-afternoon.

- Judges should not eat or drink (including coffee) for at least 30 minutes before the test.

- Assessments should be conducted in silence.

- A two-minute rest is required between samples to minimise the carry-over effect from one sample to the next.

- If suffering from colds or other illnesses, judges should be excluded until they recover.

- The AWRI will provide access to ShowRunner, an online electronic scoring system, to facilitate the sensory evaluation process and data collection. The software can be accessed via a QR code or an email link using the judge's own internet-enabled mobile phone, tablet or computer.

Sample preparation

Assign each wine (including repeats) a unique 3-digit code. Use data collection software or the [University of Oregon's random number generator](#) to generate 3-digit codes. Write the codes on the bottles to be poured.

Code rows of glasses with a non-permanent whiteboard marker (see Figure 1) with the 3-digit sample code for each wine, with enough glasses for the number of judges, and align wine bottles on the bench with the corresponding coded glasses.

Figure 1. Setting up glasses for a session with six wines and 11 judges

Ensure constant temperature across samples (e.g. 20-22°C). If wines have come from cool storage, pre-pour them early enough to reach a uniform room temperature across samples (approximately 20 minutes).

Use disposable 30 mL plastic pourers (shot glasses), widely available from most supermarkets, to ensure a constant volume of 30 mL across samples.

Use random presentation order. Each judge should receive glasses in a different order (not just starting in different positions of the same order) to reduce the impact of order effects. To achieve this, use the randomisation function of the data collection software, or, if not available, judges can shuffle samples randomly, or the person setting up the tasting can do this.

Samples should be expectorated; spittoons are therefore required.

Evaluate white wines before red wines. Where possible, split sets into groups of similar varieties or styles.

Include negative and positive controls. The panel should be aware of the inclusion of controls and expect that not all samples will be smoke-affected.

- o A negative control is a clean, unaffected wine, preferably of the same variety as samples in the set and made in a similar way. A negative control must be included in each set. For example, if a set involves six aromatic white wines, followed by a set of three light reds followed by a set of four Shiraz, include one appropriate control in each set.
- o In the case of small-lot ferments made after a fire event, a commercially made wine from a previous vintage can be included as a control, but control small-lot ferments are preferred.
- o If the number of samples to be assessed is large and cannot be split over several sessions, then include at least two controls over the whole test.
- o A positive control (a known, obviously smoke-affected sample) should be included when possible, on a regular basis, to ensure judges are still able to recognise smoke compounds.

Present a maximum of eight to ten samples per set (depending on the nature of the samples), including controls and duplicates, followed by a break of at least 10 minutes.

Carefully consider the number of samples for the time allocated for the session (maximum of 20 samples per hour). Twenty samples are recommended as an appropriate maximum number for a session.

Include at least one duplicated sample in each set to assess judges' repeatability.

Assessing the wines

Distribute devices with data collection software to each judge or ask them to open the session on their own devices.

Ask judges to concentrate, be honest with themselves, not be too critical and not gravitate to the middle of the scale.

Remind judges that there are clean control wines included in the assessment, and scores of zero should be expected.

Remind judges to confirm the 3-digit sample code on the screen and follow the tasting order that has been individually assigned to them.

Remind judges that all assessments should be conducted independently and blind (no knowledge of samples, regions, producers), with no discussion or comments made during the assessment.

Ensure judges have a 2-minute break between samples to minimise carry-over effects and a 10-minute break between each set of samples.

Encourage judges to rinse with water during the breaks between samples.

An example of the electronic rating system appears in Figure 2, using mobile phone format. A line scale is used, with indented anchor points of 'low' and 'high' placed at 10% and 90%, respectively. Please note that a score of zero should be placed at the far left-

hand edge of the scale, not on the 'low' mark. This continuous type of scale expresses smaller differences and is, therefore, more discriminatory. Separate scales are used for rating 'smoke' and 'overall fruit' for each wine to be tested as well as an 'other' term, which may indicate the presence of off-flavours that could mask smoke taint perception. A comment box to specify the off-flavour is included to capture this information.

Figure 2. Example of the electronic scoring rating template formatted for a mobile phone with the line scale and anchor points for rating the three attributes, 'overall fruit', 'smoke taint', and 'other' and attribute definitions.

3. Analysis of results

When using ShowRunner or other online sensory software, close the session and export the results from the software. Send the results as a *.csv file to the AWRI (helpdesk@awri.com.au) for analysis. A copy of the results will then be provided, presented as two tables (Tables 1 and 2).

Table 1. Example of results provided by the AWRI, showing two judges' rating of 'overall fruit', 'smoke taint' and 'other' attributes for four wines (0-10).

Judge	Wine	Blinding Code	Overall fruit	Smoke taint	Other
John Smith	Control Chardonnay	413	6.63	0.12	0
John Smith	Chardonnay A	839	3.63	3.41	1.57
John Smith	Chardonnay B	899	1.53	5.82	3.7
John Smith	Chardonnay C	998	4.18	2.09	2.4
Ana Silva	Control Chardonnay	413	6.69	0.90	3.13
Ana Silva	Chardonnay A	839	3.86	2.64	0
Ana Silva	Chardonnay B	899	2.09	6.12	0
Ana Silva	Chardonnay C	998	5.78	1.11	4.32

- Data is analysed using Analysis of Variance (ANOVA) with judge and wine as factors, for the attributes 'overall fruit' and 'smoke'.

- Inspecting the ANOVA results (Table 2), if there is a significant difference between the wines (indicated by a P-value <0.05 for the 'wine' factor) for the attribute 'smoke', a Dunnett's means comparison test is conducted at 95% confidence level using the clean sample as the control. (This is why it is essential to include a clean sample as a negative control in every set of wines tasted). This test will indicate which samples are statistically different from the clean control sample. If the mean attribute values for the test wines are significantly different from the clean control, a wine is considered affected.

Table 2. Example of results provided by the AWRI, comparing each sample with the clean control

Wine	Smoke mean score	Significantly higher than control[†]?
Chardonnay A	3.1***	Yes
Chardonnay B	6.3***	Yes
Chardonnay C	1.5*	Yes
Control Chardonnay	0.7	-

[†]*Dunnett's means comparison test. *** P < 0.001   * P< 0.05*

4. Results and decisions

Sensory results should not be used in isolation when making critical harvest decisions. It is highly recommended that sensory results be considered in conjunction with corresponding chemical analysis of smoke marker compounds in grapes, including both the volatile phenols and glycosides. Ultimately, it is the role of the regional panel to provide information to producers so they can make the appropriate harvest decisions for their business.

5. Motivation and panel performance

After each session, the performance of judges should be monitored to ensure that performance criteria continue to be met. Judges' individual agreement with the panel mean, ability to discriminate between clean control and different levels of tainted samples and repeatability in the duplicated samples should be taken into consideration. The AWRI can assist with panel performance analysis.

Individual judges' performances are assessed by checking the scores for negative and positive control samples and repeat samples. The panel's precision is assessed by checking scores/conclusions on the repeated samples. Other checks that can be made include:

- o Comparing individual judge scores with the panel mean.

- o Looking at individual standard deviations from the panel mean when possible.

- o Looking for false positives; that is, checking if clean controls were scored low.

- o Checking smoke ratings for positive controls (known tainted samples should have high smoke scores).

- o Checking individual repeatability by comparing ratings for the repeated samples from each judge.

Data from poor performing judges can potentially be excluded from the session, without reducing panel size below eight. If a judge consistently performs poorly, consider not inviting for further sessions and offer him/her to help with setting up and analysing results instead.

It is important to appreciate and acknowledge the efforts that judges undertake to attend the sessions. Provide performance feedback to judges constructively, being encouraging and thankful for their time and effort. Keep individual performance results confidential. Judges should participate on a regular basis to maintain their performance. Weekly participation is desirable, with a minimum of monthly participation if possible. The AWRI will assist in re-training judges after long periods of interruption (six weeks or greater).

6. Acknowledgement