



TCA Sensory Workshop Report

Two sessions were held on July 26 and 27 with a total of 33 panelists. Each session consisted of three sensory flights characterized by wine background. Flights were comprised of 25 wine samples that included six samples spiked with TCA at concentrations of: 1, 2, 4, 8, 16 and 32 parts per trillion. The first sample of each flight was the control entry.

Panelists were given scoring sheets with two columns. They were instructed to mark one column for each incidence where they detected TCA in the sample. The remaining column was used to note sensory "differences" or "off-aromas".

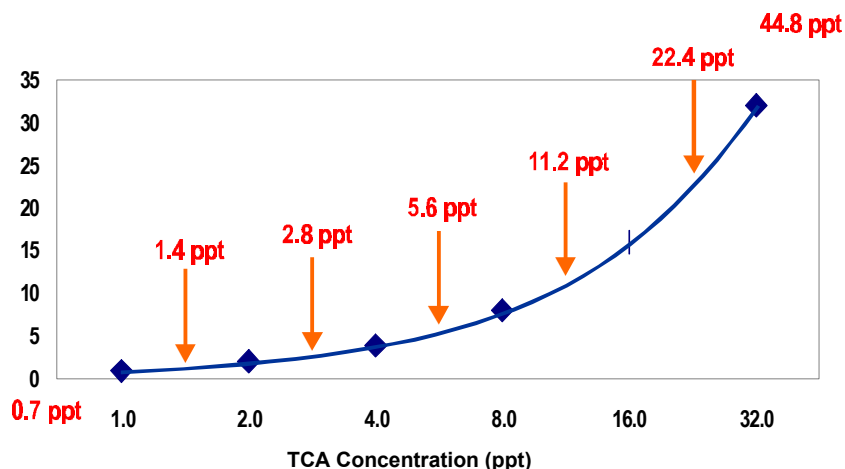
Scoring: Threshold Values

Recognition thresholds were calculated based on responses characterized as "TCA". Thresholds for "difference" were calculated based on the combination of TCA responses with those earmarked as "other differences" or "off-aromas".

Calculated Thresholds are determined by finding the highest TCA concentration where the panelist was unable to identify the sample. The threshold value is calculated as that point on a logarithmic curve halfway between the sample missed and the next highest sample.

This graph shows the midpoint calculations for the concentrations used at the CQC session. As an example, if a panelist failed to identify the sample at 4.0 ppt, but correctly identified samples at 8-32 ppt, the midpoint between 4 ppt and 8 ppt will represent "Recognition Threshold" – in this instance – 5.6 ppt.

Threshold Calculations



Though threshold calculations provide a useful benchmark for individual performance, the CQC has found the calculation to be subject to several limitations.

1. The formula tends to understate sensitivity when the panelist displays any inconsistency. Threshold calculations ignore all correct responses below the highest value missed. A panelist who correctly identifies samples at 2 ppt, 4 ppt, and 8 ppt – but misses the sample at 16 ppt would receive a threshold value of 22.4.
2. The formula does not reward accuracy, and allows someone who indicates TCA for every sample with a perfect score. In the Cork Industry, we obviously do not benefit from a panelist who habitually detects false positives for TCA. At the winery, this practice is less crucial, but false positives create a possibility that the winery may fail to act on QC issues that are not cork related.

Scoring: Accuracy Rates

Accuracy Rate is an algorithm used by the CQC to provide what we think is a more realistic measurement of TCA sensitivity. It is a simple ratio that rewards correct answers and penalizes errors.

The formula used by the CQC for “accuracy” takes the overall percentage of correct answers for samples of 4 ppt. and over, and subtracts the percentage of false positives. As an example: If a panelist correctly identified 4 ppt, 8 ppt and 32 ppt – they would have correctly identified 75% of the target samples. If they had incorrectly noted “TCA” on 2 or the 14 control samples – they have a 14% false positive rate. The net accuracy rate is 61%.

We chose a target range of 4 ppt and up because it represents a range that we think a trained panelist should be able to reliably recognize. Some panelists show good recognition at 1 ppt and 2 ppt – but that is exceptional performance.

Session Results

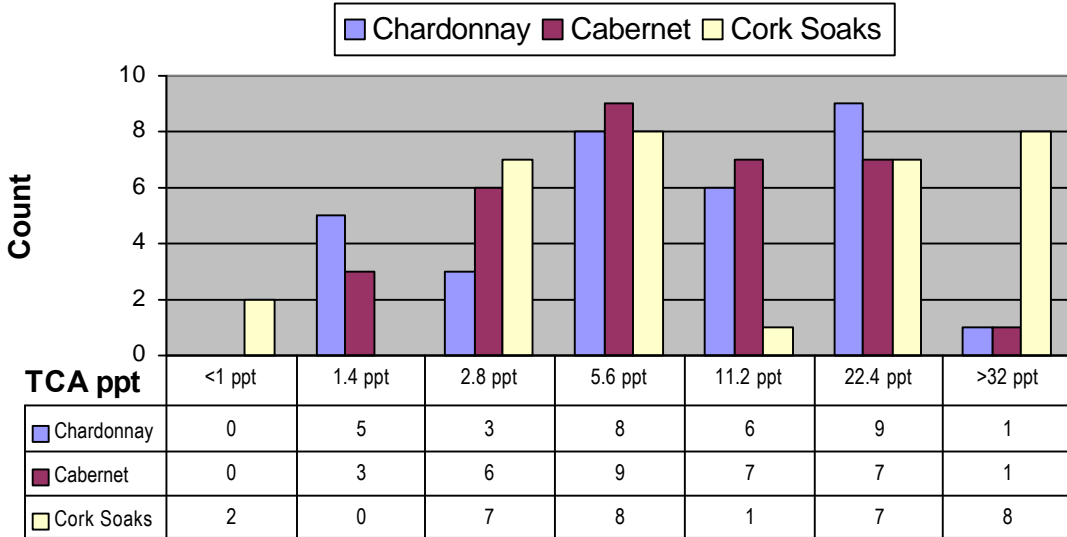
There were a total of 33 panelist in the two day session. With one exception, each panelist completed all three flights. A breakdown of completed flights is shown:

Flights	Chardonnay	Cabernet	Cork Soaks	Total
Day 1	17	17	17	51
Day 2	15	16	16	47
Total	32	33	33	98

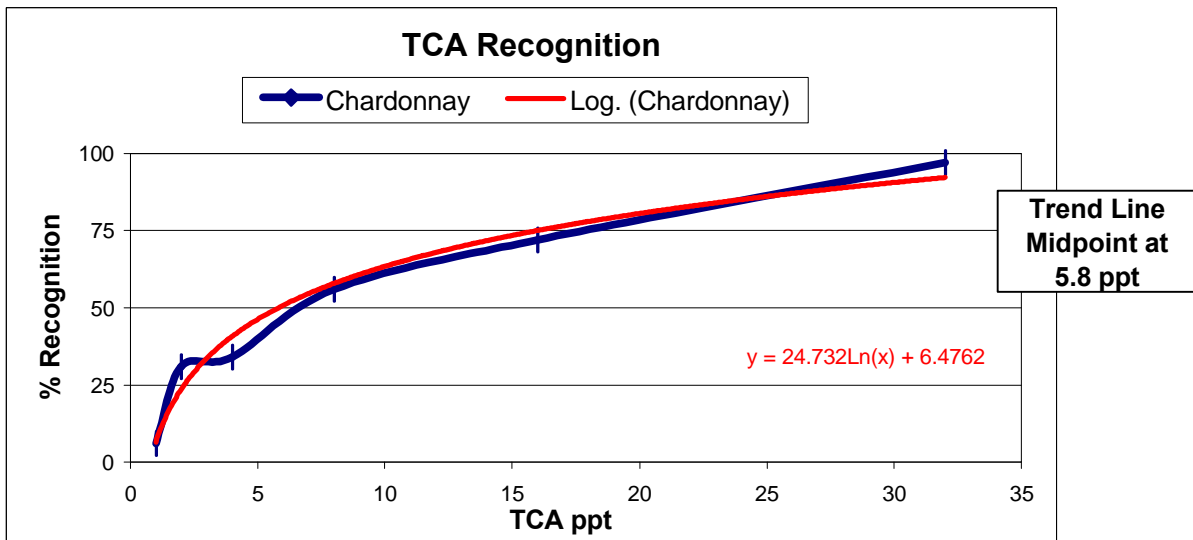
Recognition Threshold - Overall TCA sensitivity in this session is similar to our historic records. There was a wide range of calculated threshold scores. The averages were **11.7 ppt** for Chardonnay, **10.6 ppt** for Cabernet and **17.9 ppt** for Cork Soaks. The range of scores for the 98 individual flights is shown below:

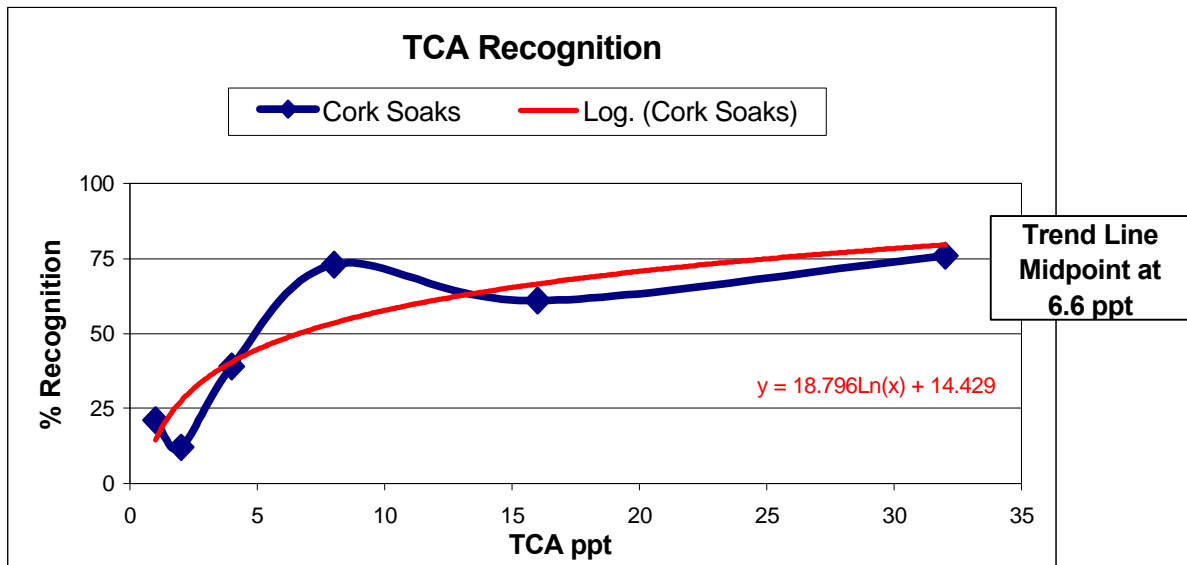
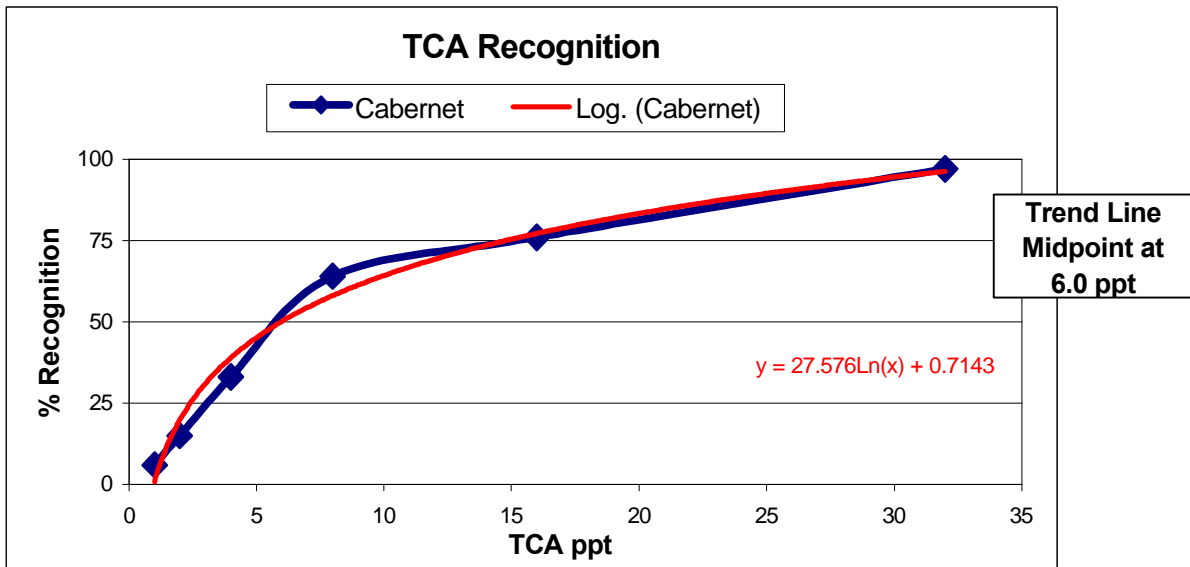
Recognition Midpoint – When comparing group results the CQC often measures the

Calculated Recognition Thresholds



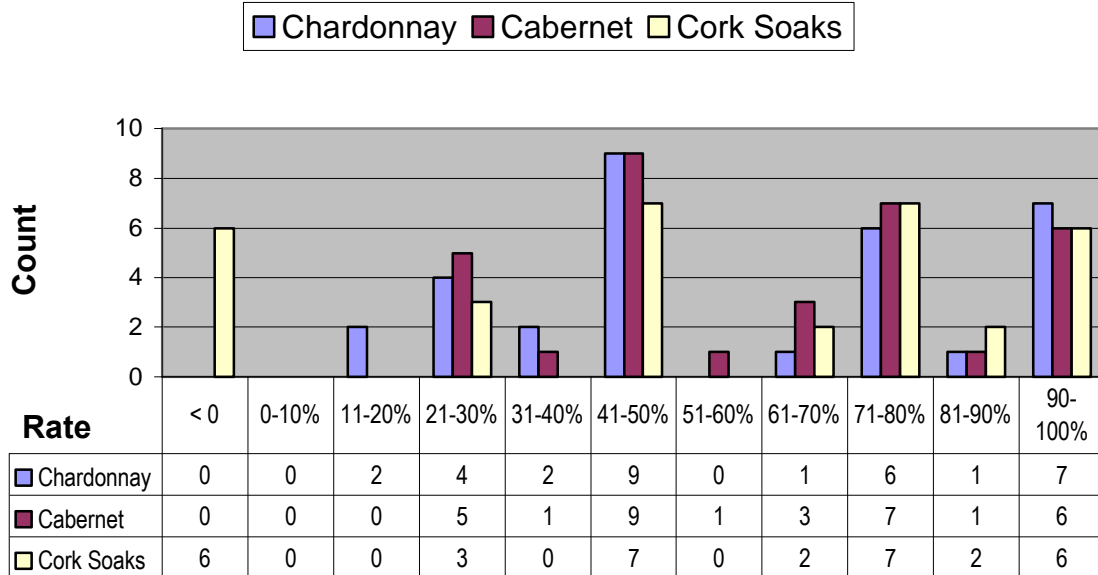
midpoint for TCA recognition as a quantification of group sensitivity. The midpoint is calculated to be that point on a regression curve of total responses, where 50% of the group has correctly identified TCA. The Recognition Midpoint for this session averaged 6.1 ppt. The Midpoints for individual flights were **5.8 ppt** for Chardonnay, **6.0 ppt** for Cabernet and **6.6 ppt** for Cork Soaks. Regression curves and individual recognition midpoints for each flight are display below:





Recognition Accuracy Rate – as defined in this study, reflects the panelist’s accuracy at recognizing TCA in samples of 4 ppt or higher. The score includes an adjustment for false positives defined as the indication of TCA in samples where none is present. The overall average rate for the group was 59%. There were six instances of flight scores (all in the cork soak flight) where the accuracy rate was below zero. This is caused when the panelist has a higher percentage of false positives from the 14 control samples than their percentage of correct responses to the 4 samples in the target range (4 ppt, 8 ppt, 16 ppt and 32 ppt). The graph below shows the count of individual flights (98) within a range of Recognition Accuracy Rates. The highest incidence occurs in the range of 41-50% accuracy.

Accuracy Rate at 4ppt or Higher



The average rate consisted of 35% false negatives – where the panelists failed to identify a sample with 4 ppt or higher. False negatives comprised a further 6% downward adjustment.

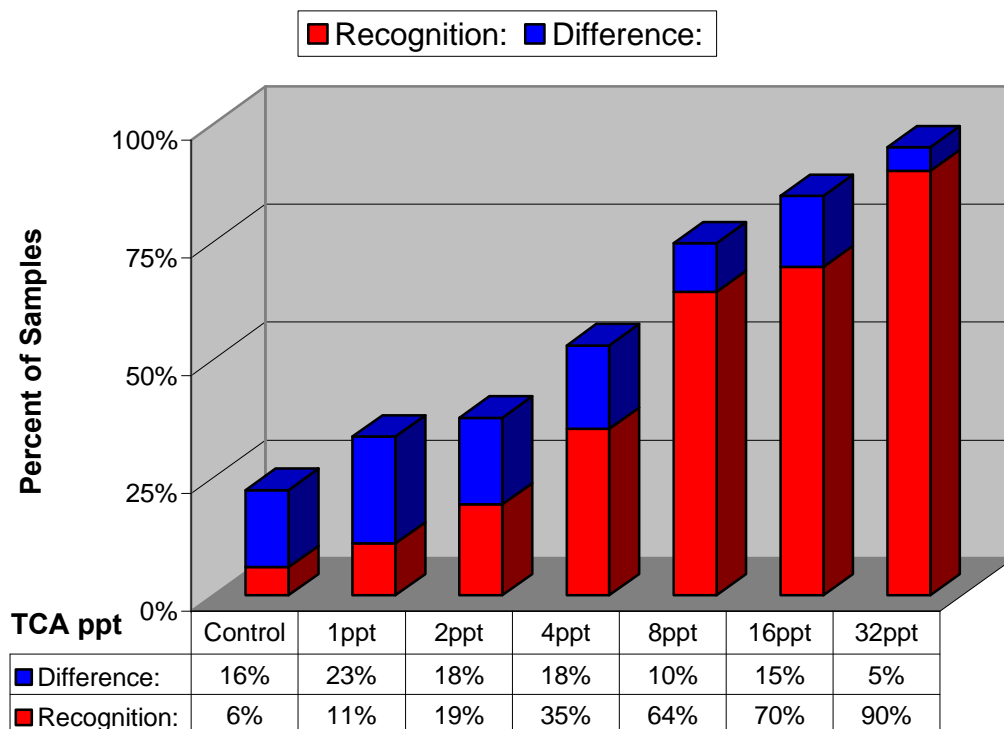
TCA Recognition 4.0 ppt and above	Chardonnay Flight	Cabernet Flight	Cork Soaks
False Negatives	-35%	-33%	-38%
False Positives	-5%	-5%	-8%
Accuracy Rate	60%	62%	54%

“Difference” Detection Thresholds – as defined in this study reflect the combined response of “TCA” and “Other Off-Aromas”. The purpose of this measurement is to illustrate the panelist’s sensitivity to TCA at levels below the “Recognition” threshold. In theory, these responses are expected to be concentrated at the lower TCA levels. Results from the first sessions show that much of the "other difference" responses were evenly distributed throughout the various TCA levels and through a sizeable percentage of the control group. For samples with TCA levels ranging from 0 to 16 ppt, the recording of "other off-aromas" was between 10% and 23% of the total samples. Only at the 32 ppt level did this response fall below 10%.

Though the controls samples in the Cork Soak Flight were open to subjective interpretation to determine off-aromas, the control samples in the wine flights were consistent. There was no indication of any pattern to the false positives that might

suggest contamination of individual control samples. The relatively high rate of "difference" response given to the control samples in the Chardonnay (16%) and Cabernet (16%) flights suggests that these responses were related to factors unrelated to definitive sensory attributes.

TCA Recognition and Identification of "Difference"



The Difference Threshold for the group was 9.1 ppt compared to 13.4 ppt for Recognition. A higher level of false positives – where control samples were noted as having other “off-aromas”, offset this improvement. The increased level of false positives made the Accuracy Rate for “Difference” lower than that for “Recognition”.

TCA Difference 4.0 ppt and above	Chardonnay Flight	Cabernet Flight	Cork Soaks
False Negatives	-23%	-24%	-22%
False Positives	-21%	-21%	-25%
Accuracy Rate	56%	55%	53%

Preliminary Observations

The goal of the session was to provide participants with an opportunity to calibrate their ability to detect TCA. A secondary goal was to develop data that might indicate range of TCA sensitivity in a variety of realistic wine backgrounds and cork soaks.

Noteworthy results from the initial session are:

General Accuracy

Numerous panelists recorded low thresholds and high accuracy. Many did not. The pattern illustrates that human sensitivity to TCA is difficult to rely on. Group totals for all flights showed that 36% of panelists failed to identify TCA at 8 ppt – 30% did not recognize TCA at 16 ppt. CQC members witnessed similar results in their tests. That is one of the reasons they have adopted a protocol of chemical tests for TCA.

Similar TCA Recognition Rates in Different Backgrounds

Literature suggests that different wine backgrounds will produce significant variances in TCA sensitivity.

Results from this initial group showed very little difference between average TCA recognition levels within the flights. A comparison of trend lines (regression curves) for the three flights is displayed below. The point where 50% of the panelists correctly recognized TCA ranged from 5.8 ppt to 6.6 ppt across all flights.

