



## SENSORY ANALYSIS

### Section 3.

#### Sensory Panelists

A unique feature of wine is its complexity. Indeed, more than 1000 compounds have been identified in grapes and wine. Although wine is often defined by complexity, among other things, enology does not have all the answers to help assure complexity. Our limited understanding lies with the features below, with the multifaceted interactions that occur among the numerous chemical components, and the effect of these interactions on perception:

- adaptation
- individual variability
- carry-over effects
- difficulty in distinguishing some sensory components
- non-standardized language
- expectations/bias
- differences between “expert” opinion and consumer preferences

Control of the human aspect of sensory evaluation is one of the more difficult factors of sensory evaluation. This may be accomplished best by carefully selecting the people that will be participating in the test. Important qualities in a sensory panelist include availability, dependability, interest, objectivity, stability,

and acute senses of smell and taste (ASTM, 1968; ASTM, 1981; Hootman, 1992; Meilgaard et al., 1991; Stone and Sidel, 1985).

The selection of panelists is also dependent on the type of information desired about the product. Panelists may be classified as consumers, experienced, or trained. Experienced and trained panelists complete testing in the laboratory setting.

### Panelist Selection

Panelists are selected based on the type of test needed. Consumer panelists or experienced or trained panelists are used to answer different sensory questions.

### Consumers

The consumer group may be selected to represent a geographic area, age group, socioeconomic status, or other population criterion. Frequently, panelists are randomly selected from consumers that frequent a given location, such as a grocery store or a shopping mall.

Information from these consumers is valuable for demonstrating preferences, degree of acceptability, product use, or consumer opinions about the wine samples. This could be the most important information received about the wine in relation to marketing and sales. Consumer testing is time consuming and costly, but important in understanding consumer attitudes.

### Experienced Panelists

Experienced panelists are used to provide information about the product itself, not personal opinion or preference. Specific characteristics or differences of the wine products are evaluated.

To accomplish this, experienced panelists are instructed about the product characteristics of interest so they can evaluate wines for specific characteristics, or determine if differences are evident between wine samples. These panelists are not considered trained panelists, because validation of panelist performance is not completed.

It is wise for the sensory specialist to develop a pool of experienced panelists, so that a panel of 12 or more individuals may be assembled quickly, if necessary. If an experienced panelist cannot participate in a test on a given day, an alternate panelist from the “pool” may be substituted into the panel to obtain a sufficient number of responses.

### Trained Panelists

Most wineries want to know how wines differ. This requires descriptive analysis and panelists who have been trained to assess qualitative and quantitative differences between products (Hootman, 1992; Meilgaard et al., 1991; Stone and Sidel, 1985).

The trained panelist does not permit personal bias regarding the product to influence judgment of product characteristics. The understanding of wine character is much more complete with a trained panelist, as compared with an experienced panelist, because of the extensive training provided.

To determine confidence in the performance of a trained panel, validation of panelist performance and understanding is accomplished through statistical

analysis, prior to beginning a descriptive analysis test. Therefore, other panelists cannot be substituted into a trained panel, and absenteeism, lack of motivation, inadequate performance, etc., by panel members can be costly to the project outcome. The sensory specialist is advised to select individuals for participation on a trained panel carefully, and to train an adequate number of panelists so that absenteeism has a minimum effect.

### *Number of Panelists*

The number of panelists is dependent on the type of testing required (ASTM, 1968; Hootman, 1992; Meilgaard et al., 1991; Stone and Sidel, 1985). To obtain a good understanding of consumer opinions, a minimum of 50 panelists is needed, and more are desirable. Tests for differences between products may be completed with as few as 10 to 12 experienced panelists; however, differences may not be observed with such a small number (see Discrimination Tests). Twenty or more panelists are recommended.

Descriptive panels, in which the panelists have received extensive training and performance is well documented, may consist of five or more panelists. It is wise to have more than five people on a trained panel, however, because if one panelist misses an evaluation, the influence on the data can be extreme. Ten to twelve trained panelists on a trained panel is more satisfactory to provide more statistical confidence in the data. See Table 1 for more information on numbers of panelists for different purposes.

### *Panelist Screening for Trained Panels*

Panelists are selected for participation on an experienced or trained panel by initially screening for motivation to perform the test, and ability to concentrate and

communicate. Further screening is completed to determine abilities to identify differences using dilute solutions that may represent, for example, the basic tastes of sour, bitter, salty, sweet, and umami. Additional screening may include determination of threshold testing for each taste sensation. Candidates that successfully complete the screening tests are eligible for participation in discrimination testing.

Potential panelists for descriptive testing should also exhibit verbal acuity, the ability to think abstractly, and sensitivity to the characteristics of importance. Panelists must be highly motivated to undergo many hours of training time.

Additional screening tests, in addition to those needed for discrimination testing, might include determination of characteristic differences in a wine system, a ranking of reference wine standards containing differing levels of a single characteristic, and a test to assess abstract thinking by providing a verbal description of some unidentified but common aroma compounds (Hootman, 1992; Meilgaard et al., 1991; Stone and Sidel, 1985).

Contrast in sensory response can be the result of the following variations:

- genetic
- biological
- physiochemical
- psychological

**Genetic Variation.** It is recognized that there are five primary tastes: sweet, sour, bitter, salty, and umami. Taste is sensed by taste receptors located within the tastebuds. There are four types of tastebuds, and a total of about 9000 tastebuds in adults. A taste component must be dissolved in saliva and physically enter the clove-shaped tastebud.

Taste acuity involves the following:

- Taste acuity is positively correlated to the number of taste pores on the tongue; the average is 70 fungiform papillae per  $\text{cm}^2$ , but so-called hypertasters, or supertasters, possess more than 100 per  $\text{cm}^2$ .
- Many taste receptors can sense more than one taste; as such, the tongue does not have areas that detect certain tastes exclusively.
- Receptors of similar sensitivity are group together on the tongue.
- Individual receptor neurons may react differently to one or more compounds.
- Protein(s) associated with tastebuds play a role in promoting taste reception.

Test paper impregnated with PTC (phenylthiocarbamide) can be used to demonstrate genetic variation with regard to perceiving a certain type of bitterness. This is a well-documented example of how dramatically people vary in their ability to taste bitterness. While this test is for certain types of bitterness found in wine, it has not been directly correlated with wine bitterness.

Test papers which contain thiourea or sodium benzoate highlight the differences in taste perception for simple compounds. Most people will experience a bitter taste from thiourea, while sodium benzoate may be perceived as sweet, salty, bitter, or tasteless. A non-taster of the PTC will not report a bitter taste response to the sodium benzoate.

If a single chemical component can elicit a multitude of different descriptors, it is not difficult to imagine why, in a complex matrix such as wine, we have trouble reaching a consensus.

**Biological Variation.** In order to be tasted, the tastant must be dissolved in or mixed with saliva. The number of both tastebuds, and sensory receptors per tastebud, declines past middle age, although age-related sensory loss is not known to seriously limit wine tasting ability.

There is about a 10-fold difference in saliva production among humans. Taste receptors are replaced every 7-10 days. There is less reception in smokers and the elderly, where cell regeneration may be slow.

Wine stimulates salivary flow, which both dilutes and modifies wine chemistry. The proline-rich proteins of saliva, which make up about 70% of salivary proteins, effectively bind tannin. The result is to reduce bitterness by lowering the tannins' ability to react with bitter-sensing receptor proteins.

Saliva chemistry changes throughout the day (affecting its buffering action) and often differs between individuals. People also differ notably in their saliva flow rates which, among other things, can affect how quickly an individual may react to tastants (Fischer et al., 1994).

Acuity is generally measured as a detection threshold, the lowest concentration at which a substance can be detected. Thresholds differ notably among individuals and classes of wine components.

### **Panelist Orientation**

Before beginning any discriminative sensory analysis, panelists must receive some instruction (Hootman, 1992; Meilgaard et al., 1991; Stone and Sidel, 1985). This instruction may be as brief as an explanation of the scorecard and familiarization with standardized testing procedures.

If the characteristic to be evaluated is not clearly understood or not easily perceived, it should be defined. A reference sample that clearly illustrates the desired characteristic may be used to help the panelist distinguish the attribute. The sensory specialist should document that each panelist can identify the characteristic of interest in a wine system before beginning the test.

### Panelist Training

Descriptive testing requires extensive training and validation of the panel's performance before confidence can be placed in results. The actual training time requirements are dependent on the ability of the panelists to learn to identify and measure the selected characteristics within the wine.

In the initial stages of training, the panelists should meet as a group to discuss the characteristics that contribute to the descriptive profile of the wine. The sensory specialist acts as a facilitator for the group discussion, as well as preparing samples and reference standards used during the training sessions.

Using wines that represent the range of characteristics expected in the sample set of wines, the group develops a list of descriptors (e.g., fruity, vegetative, oaky, vanilla) for those characteristics, facilitated by the sensory specialist. The descriptors are discussed to determine definitions, and reference standards are created that reflect those definitions. The aroma wheel represents descriptors that may be observed in a variety of wines.

Training ensues, initially using standards in water to demonstrate the descriptors until all panelists can identify each characteristic. Training continues using reference standards in a wine. Usually, the panel will begin by discussing a small number of wines for the most identifiable characteristics, adding additional characteristics for discussion as abilities and confidence build.

Training sessions are continued until all panelists have developed confidence in identifying and rating intensity of each characteristic of interest in the wine. Limiting the discussion to six or fewer descriptors allows panelists to concentrate on those limited concepts without fatigue. In quantitative descriptive analysis, panelists also learn to evaluate the intensity of the characteristics on a scaling system, usually reflected by an unstructured line scale.

### Reference Standards and Descriptors

The numerous descriptors that are used to describe aroma and flavor of wines are listed in the wine aroma wheel.

### Performance Evaluation

Panel performance is assessed for descriptive testing before initiating the evaluation on the test wines. To evaluate the performance of the panel, two or three wines reflecting a variety of the characteristics of interest are selected for evaluation.

The individual panelist evaluates each wine as if in a testing situation (see Descriptive Analysis), identifying and rating each characteristic present in the wine. This evaluation is replicated three times to determine reproducibility among panelists and within each panelist, not on differences in the wines.

Analysis of variance, a statistical method used to compare more than two mean values in a single study, is used to determine if differences exist among panelists for the characteristics measured (Meilgaard et al., 1991). Extreme differences among panelists' responses for a given characteristic suggest further training is

needed to assist the panel in identifying and rating the characteristic of concern. If one individual panelist shows high variability in replication, the sensory specialist may work with that individual independently until greater skills are achieved, or that panelist may be excused from the panel.

### *Panelist Motivation*

Trained panelists must be motivated to contribute the time and effort required for frequent testing situations. Discussions with each panelist about successes and improvement areas are helpful in directing and motivating the panelist to high achievement. The importance of the panelist's contribution to the test outcome should be stressed. Verbal and written expressions of appreciation from the sensory specialist are important. Management should provide support of these motivational activities through some form of reward or commitment.

### *Timing of Panel*

Training and testing time periods should be scheduled when the panelists will be most receptive to product characteristics and have adequate attention to the task at hand. Do not schedule the session immediately after a meal or coffee break, as this may contribute to sensory error. All sensory sessions should be conducted at the same time of day.