

# Small-to-Medium-Scale Sensory Evaluation of Horticultural Crops—Sensory Attributes<sup>1</sup>

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## Introduction

As the number-one domestic producer of oranges, tropical foliage plants, squash, watermelons, cut cultivated greens, and fresh-market tomatoes, as well as the number-two producer of all fresh-market vegetables, Florida plays a significant role in the horticultural production of the United States (Hodges and Rahmani 2016). Similar to other commodities in open markets, it is often necessary to assign an approximate value or measure of acceptability to these crops, whether for economic or quality control purposes. This approximate value or acceptability measurement is often assigned through sensory testing, or the objective measurement of sensory attributes. According to the Sensory Evaluation Division of the Institute of Food Technologists (IFT), sensory evaluation is defined as “A scientific discipline used to evoke, measure, analyze, and interpret those responses to products that are perceived by the senses of sight, smell, touch, taste, and hearing” (quoted in Stone and Sidel 1993).

Given the economic impact associated with this value, sensory evaluation of horticultural crops is commonly employed in research, product development, and quality control, with very specific parameters for its proper execution. Once the evaluation has been performed, the resulting data can be used to make sound decisions about crop quality and marketability, ultimately determining the overall value.

This publication is the first in a series designed to assist producers in the small-to-medium-scale sensory evaluation of their horticultural crops. The guidelines outlined in this publication were taken from the 4th edition of *Sensory Evaluation Techniques* (Meilgaard, Civille, and Carr 2016).



Figure 1.  
Credits: skeeze from Pixabay

## Sensory Attributes

When examining sensory evaluation in the context of horticultural crops, appearance, odor/aroma, texture/consistency, and flavor of the food item are all important sensory attributes. While this publication series will often reference consumption of fruits and vegetables as examples, the information listed can be applied to almost any horticultural crop.

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## Appearance

The appearance of a fruit or vegetable is often the first thing we encounter, whether on our plate or on the display shelves of the local market. Within the appearance, the color (bright/dark, uniform/blotchy, ripe/unripe), size and shape (weight, length, deformations) and surface texture (dull/shiny, rough/smooth, defects) are all important factors, especially because deterioration (rotting) is associated with changes in all these parameters. Figure 2 shows an example of these changes in an apple. Two other factors important to appearance, clarity (presence/absence of haze) and carbonation (light: fruit drinks; medium: beer/cider; high: champagne), are more applicable when dealing with liquids produced from horticultural crops.



Figure 2. Inclusion and deterioration injury in an apple.  
Credits: Free commercial use, Piqsels.com

## Odor/Aroma

Upon approaching a fruit or vegetable, the second thing often noticed is the odor/aroma. While the word odor can be used to define a wide range of experiences, aroma is specifically the odor of a food product, caused when volatiles emitted from the food are perceived by the olfactory system. This occurs when volatiles enter through the nose (orthonasal olfaction). Note that the term “smell” is primarily avoided; while “smell” is often associated as a negative aspect of a food or beverage, “odor” and “aroma” are more commonly considered neutral qualities.

## Texture/Consistency

The next two sensory attributes of texture/consistency and flavor are more applicable during consumption of horticultural crops. Commonly, texture and consistency are defined as being measured by receptors in the mouth separate from those responsible for taste and chemical responses, but they can also apply to a wide range of physical interactions, from the papery feel of a mature hop cone to the plumpness of a fresh blueberry.

Two main variables are considered when classifying texture in horticultural crops: their reaction to an applied stress and their tactile-feel properties. Reaction to applied stress is measured as different mechanical properties (e.g., hard/soft, sticky/springy, gummy/rigid) and is sensed mainly by the muscles of the mouth and hands. Tactile-feel properties are sensed by the tactile nerves of the mouth and hands and are measured as particle (gritty, grainy, flaky) or moisture (wet, dry, oily) properties. Figure 3 displays examples of commonly used terms for applied stress (mechanical), particle (geometric), and moisture properties in different variations of mustard in whole seed, dried and condiment form. While consistency (how thick or thin a fluid is) is also an important factor, it is more applicable when dealing with liquids produced from horticultural crops.



Figure 3. Examples of different particle (grainy, smooth) and moisture (wet, dry) components of texture and consistency in varying mustard samples.

Credits: Rainer Zenz, Wikipedia

## Flavor

Finally, there is the overall impression resulting from chemical senses occurring in the mouth, also known as flavor. Flavor can be further broken down into two factors, aromatics and tastes. Aromatics are the olfactory (volatiles entering the nose) responses caused from food in the mouth; when chewing, volatile substances are released from the food, moving through the back of the throat and into the nasal passage (retronasal olfaction). Hence food tastes bland when you have a cold—blockage of the nasal passage keeps the volatiles from reaching the nose.

Tastes are gustatory perceptions; soluble substances in food are identified by receptors in the mouth, leading to the sweet, sour, salty, and bitter tastes we associate with foods. Recently there has also been evidence of a fifth taste, umami, responsible for the “meaty” flavor of foods like mushrooms and broths (Zhang et al. 2003). Chemical feelings, sometimes referred to as trigeminal sensations, are those that are caused by chemical stimulation of exposed nerve endings in the mouth and nose. These can include spicy, cooling (menthol), astringent (dry wine), metallic (copper), or the bite of vinegar.

## References

Hodges, A., and M. Rahmani. 2016. *Florida Agricultural Facts Booklet*. Gainesville: University of Florida Institute of Food and Agricultural Sciences. [http://branding.ifas.ufl.edu/media/brandingifasufledu/portfolio-brochures/16\\_AG\\_Facts\\_Booklet.compressed.pdf](http://branding.ifas.ufl.edu/media/brandingifasufledu/portfolio-brochures/16_AG_Facts_Booklet.compressed.pdf)

Institute of Food Technologists. n.d. “Sensory Evaluation.” [https://web.archive.org/web/20180712174257/http://www.ift.org/~media/Knowledge%20Center/Learn%20Food%20Science/Food%20Science%20Activity%20Guide/activity\\_is-seeingbelieving.pdf](https://web.archive.org/web/20180712174257/http://www.ift.org/~media/Knowledge%20Center/Learn%20Food%20Science/Food%20Science%20Activity%20Guide/activity_is-seeingbelieving.pdf)

Meilgaard, M. C., G. V. Civille, and B. T. Carr. 2016. *Sensory Evaluation Techniques*. Boca Raton: CRC Press.

Stone, H., and J. Sidel. 1993. *Sensory Evaluation Practices*. San Diego: Elsevier Academic Press.

Zhang, Y., M. A. Hoon, J. Chandrashekar, K. L. Mueller, B. Cook, D. Wu, C. S. Zuker, and N. J. P. Ryba. 2003. “Coding of Sweet, Bitter, and Umami Tastes: Different Receptor Cells Sharing Similar Signaling Pathways.” *Cell* 112(3): 293–301. [https://doi.org/10.1016/S0092-8674\(03\)00071-0](https://doi.org/10.1016/S0092-8674(03)00071-0).