



Growing conditions can significantly impact the color of juicing oranges. Image Credit: Unsplash user Brian Jimenez

When you own an orange grove, your money actually does grow on trees. If you're lucky enough to be in the orange business, this means it's very important to know the best ways to keep your trees producing the highest quality oranges possible. What is the ideal soil mix? Which minerals and nutrients should be fed to the trees roots, and in which proportions? At which temperature and humidity levels is it necessary to test for infestations? There are many variables that must be measured and weighed against each other, all for the purpose of knowing the answer to a simple question: what makes my oranges grow the best? By using a spectrophotometer to assess the color of oranges and studying the factors that contributed to the development of their color, it's possible to obtain an answer.



Research reveals that the color of orange juice affects consumer's perception of its taste. Image Source: Unsplash user JÉSHOOTS

Color Affects Taste Perception in Orange Juice

Before we explore how spectrophotometers can help you determine your ideal growing processes, it's important to define what is meant by the best. In the case of juicing oranges, [quality is often perceived through color](#). This is because color is a primary indicator of customer preference and can even alter perceptions of taste. As discovered in a study published in the *Journal of Consumer Research*, while brand and price information had no effect on consumer taste perception, the effect of color was significant.¹ In fact, the effect of color even stronger than the effect of taste. According to the study:

Given two cups of the same Tropicana orange juice, with one cup darkened with food coloring, the members of the researcher's sample group perceived differences in taste that did not exist. However, when given two cups of orange juice that were the same color, with one cup sweetened with sugar, the same people failed to perceive taste differences.

From this, we can assume that orange groves which produce the most desirably colored oranges will be the most successful if other factors are equal.

Refining Agricultural Practices

The orange color in oranges and their juice is produced by organic pigments the orange creates called carotenoids.² These are the same pigments found in carrots and butternut squash. Different environmental factors affect the production of carotenoids in oranges in different and intermingling ways. By measuring the color of oranges produced in different areas within the same grove—or different groves across the state, nation, or world—and correlating the color profiles with environmental variables like humidity, moisture, and soil quality, orange farmers can develop a

better picture of which conditions make the best oranges. They can then apply these findings to their agricultural practices to improve their crops.



Spectrophotometric color measurement allows you to analyze the color of your oranges with the highest degree of accuracy possible. Image Credit: Unsplash user Keilidh Ewan

Spectrophotometers Assess How Orange Oranges Are

So what is the most desirable color of a juicing orange? The fine folks at the United States Department of Agriculture (USDA) has furnished an answer. In 1983, the USDA combined all previous references into a color scale for orange juice with six gradations, the first grade being the most desirable.³ Orange juicers can compare their products against this scale to see how well they rank. It is possible to order a set of six graduated cylinders from the USDA, each one corresponding to one of the grades. Orange juicers can then visually compare their products against the color of the liquids in these cylinders. Of course, there's also a much simpler, more accurate method: [spectrophotometric analysis](#).

Using a spectrophotometer eliminates the necessity of ordering the USDA's graduated cylinders. Instead, color standards for orange juice can come pre-programmed in the instrument, allowing for greater specificity than is possible via visual inspection and ensuring the highest degree of grading accuracy. In fact, HunterLab spectrophotometers were used by the USDA to develop and define their color standards in the first place.⁴

[Spectrophotometers can fill multiple niches](#) within an orange grove's operations. They have immediate applications on the juicing floor, helping ensure juice products meet color quality standards for their grades. However, these instruments can also be useful in improving a grove's agricultural output. Spectrophotometers can be used both by farmers and agricultural corporations

to analyze the groves on their land as well as by agricultural researchers to study the factors that influence the color of oranges on a worldwide scale. Armed with this knowledge, orange grove operations can adjust their growing practices as necessary to produce a superior yield.

The HunterLab Difference

At HunterLab, we've been [working with the orange industry](#) for decades to develop the highest quality color measurement instruments. Our technologies and expertise have made us a trusted name in orange agriculture, and we're proud to continue in this tradition. We have a complete range of spectrophotometers engineered to analyze juice color, and our [ColorFlex EZ Citrus](#) spectrophotometer was designed specifically to measure the color of orange juice concentrate. [Contact us to learn more](#) about how the ColorFlex EZ Citrus or our other instruments can improve your orange operation.

1. "More Than Meets the Tongue: Color of a Drink Can Fool the Taste Buds Into Thinking It Is Sweeter," February 16, 2007, <https://www.sciencedaily.com/releases/2007/02/070212182136.htm>
2. "Carotenoid Chameleons: Scientists Chart How Orange Juice Changes Color", March 18, 2015, <https://www.beveragedaily.com/Article/2015/03/18/Carotenoid-chameleons-Scientists-chart-how-orange-juice-changes-color#>
3. "United States Standards for Grades of Orange Juice", 1983 https://www.ams.usda.gov/sites/default/files/media/Canned_Orange_Juice_Standard%5B1%5D.pdf
4. "Equivalent Color Scores for Florida Frozen Concentrated Orange Juice," 1969, [http://fshs.org/proceedings-o/1969-vol-82/200-205%20\(HUGGART\).pdf](http://fshs.org/proceedings-o/1969-vol-82/200-205%20(HUGGART).pdf)