



## Things We're Dwelling on Now...

# Residual Sugar: Chemistry and Perception

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Eric Asimov recently offered a critique of overly colorful wine language in *The New York Times*, saying “the more specific the description of a wine, the less useful information is actually transmitted.” He proposes a simplified system wherein all wines start in one of two camps: sweet or savory. Sweet, in his lexicon, can refer to any wine with “the impression of sweetness,” not just those we historically think of as sweet wines. We had also been thinking about the role of sugar in wines, and how our biology allows us to perceive this “impression of sweetness.” Aromatic white wines, for which New York is gaining a growing and deserved reputation, often contain some amount of residual sugar. RS can arrive in a wine by a number of routes. Perhaps the fermentation stopped (whether we wanted it to or not), or perhaps the wine has been “back-sweetened” using stabilized juice (sweet reserve), partially fermented wine, or simply sugar. It stands to reason that a wine with a measured RS of 10 g/L may have different sensory attributes depending on what method was used to attain the sweetness, but how and why will it be different, and how will we be able to tell?

First of all, when dealing with sweetness, we have to distinguish between taste and “flavor.” Pure taste, using only taste buds, with aroma removed from consideration, is a matter of intensity and duration. Sweetness is not so much characterized as it is quantified- like pushing a button and measuring the force and span of the push. When you taste fructose, for example, it will have a certain perceived “relative sweetness level,” but it will also plot a curve of intensity over time. The perception of non-caloric (a.k.a. artificial, although some are now plant-based) sweeteners often lingers much longer than standard sugars, and this difference can be quite noticeable. I accidentally bought “light” cranberry juice containing sucralose last week, and I’m still not sure whether my horror over the taste or my cheapness and aversion to waste will triumph.

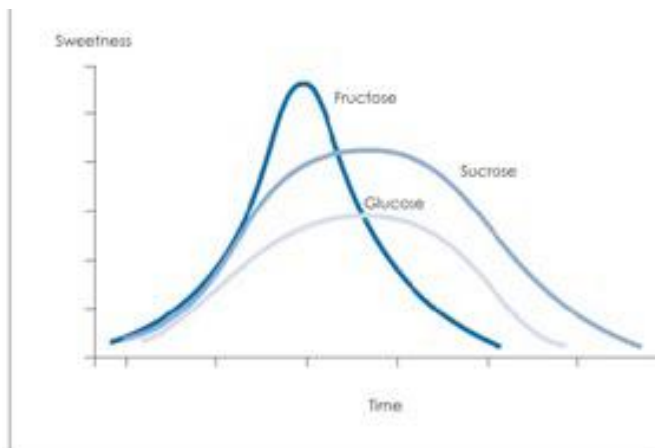


Figure 1. Time-intensity curves of fructose, glucose and sucrose.  
Source: Shallenbeiger RS. Taste Chemistry, 1993

When we talk about aroma and flavor, we are really talking about aroma experienced two different ways: orthonasal perception (a.k.a. “sniffing”), our traditional idea of aroma, and retronasal perception, the impression we get from air passing through the back of our throats to our nose during sipping and chewing. Retronasal olfaction is often what we mean when we say “flavor,” and it is here that sugar can play a role. Sugars are not volatile, meaning none of them should create an aroma that can be identified by smell alone -think hydrogen sulfide (rotten egg) or methyl anthranilate (labrusca grape). However, at the retronasal level, more sugar can lead to a perception

of more fruit in wine, more caramel in coffee, more of whatever our brain has constructed from the combination of the taste and smell.

Before we get too far ahead of ourselves, what do we really mean by sugar? The term refers both to one thing and many. On one hand, we could be referring to any of a class of “edible crystalline carbohydrates,” but on the other hand, “pass the sugar” means sucrose -table sugar. Sucrose is made up of glucose and fructose, the sugars -I mean carbohydrates -found in grapes. We have discussed glucose and fructose previously, but only from a fermentation/yeast preference standpoint. While yeast can metabolize both glucose and fructose, they tend to prefer glucose, and residual sugar remaining from a stopped fermentation (especially at 2% or less) will be almost entirely fructose. If sugar in the form of sucrose (table sugar) is back added, the sucrose will break down into 50% glucose and 50% fructose. This mixture, known as invert sugar, is sweeter than sucrose itself and is less sweet than pure fructose. The enzymes and acids in wine will complete this conversion in roughly a year, which is one potential cause of perceived change during the first few months in bottle and also a consideration during bench trials for sweetening. However, if sucrose is added for chaptalization to raise the final alcohol before fermentation, the breakdown will happen much more quickly (hours instead of months).

There are some aspects of sweetening that go beyond the actual sweeteners involved, however. Sweet reserve, or juice that has been prevented from fermenting and contains most if not all of its original sugar, has pretty close to equal amounts of glucose and fructose (slightly more fructose). The greatest sensory impact, especially on aroma, will likely come from the fact that it is juice, and juice and wine are different. Sauvignon Blanc is a great example of a case where the juice smells like, well, like not very much at all actually, while the wine has very distinctive aromatics. The process of fermentation creates as well as destroys volatile compounds, which brings us to fermentation arrest. A stopped fermentation, as previously discussed, will have on the order of ten times as much fructose as glucose. Besides the sugar remaining, however, the fact that the fermentation has not completed will leave compounds that would have been broken down, or a void where something would have been created had the yeast continued their work. These differences could explain a variety of aroma or mouthfeel changes that may have little or nothing to do with sugar. Finally, there are causes of sweetness that will not be measured by any of the methods detailed in the second article. Sugar alcohols and sugar-derived acids can contribute to a perception of sweetness despite not being sugars in the classical sense.

Along with acid and alcohol, sweetness plays an important role in the balance of a wine. Higher sugar in the presence of higher acid may not necessarily be perceived as sweet, hence the ratios of RS and TA proposed in the International Riesling Foundation scale. Always remember to sterile filter if you retain sugar, or the wine will change a lot more quickly than you would prefer -and not for the sweeter. One thing to take from all of this, regardless of the wines you prefer, is that neither people nor wines stand still from a sensory standpoint. Internal and external transformations are always occurring, making smell and taste dynamic experiences as opposed to static ones. The wine changes in the bottle, in the glass, and in the mouth of the taster. Meanwhile, perceptions of even a static substance will vary as receptors are filled and emptied while the brain is adding the tastes, aromas and other information (color, astringency, fizz) together. Depending on your perspective, this can either be very frustrating, part of the magic of wine, or both. Regardless, the next person who tells you he doesn't like sweet wines had better be ready to explain himself.

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