Podcast interview: Harry Klee

PNAS: I’m your host, Sandeep Ravindran, and welcome to Science Sessions. University of Florida professor and National Academy of Sciences member Harry Klee has been attempting to create a better tomato: one with more flavor, but which also has a high enough yield and shelf-life to be commercially viable. Klee studies the chemical and genetic basis for tomato flavor, and then uses plant breeding and genetics to create tastier tomato varieties. I sat down with Klee at the American Association for the Advancement of Science meeting in Boston to discuss his findings. He begins by explaining how he became interested in improving tomato flavor.

Klee: You know, I’ve been working on tomatoes as a model system for probably twenty years or more now, and we were thinking about could we make tomatoes that had extended shelf life so that we could let them ripen longer and harvest them later with more flavor potential. And we were working on that, and we actually were quite successful but we were using a genetic engineering approach and at that point I stopped and said, “Well you know, we’re trying to improve flavor indirectly, why don’t we do it directly.” And so I was lucky enough to get a grant and get started and haven’t looked back.

PNAS: Klee says there are many reasons why commercial tomatoes don’t taste as good as they could.

Klee: The commercial supermarket tomato doesn’t taste good for a number of reasons. First of all, the grower is not paid to produce tomatoes that taste good. And so, basically varieties have been selected over the last 50 years or so that just maximize yield. Flavor is just so genetically complex that the breeders have not been able to really have a handle on it. But the other side of that is because the growers are not paid to produce a good-flavored product, there has been no incentive for the breeder to actually really try and incorporate flavor into the product. The other half of the equation though that’s equally important is that a lot of tomatoes are treated very badly. Many of them are refrigerated which you should never do with a tomato. They are stored for a long time, they are shipped great distances. The lines that have been selected for extended shelf life and shippability are not necessarily the best varieties in terms of flavor. All of those things kind of come together to make a tomato that just doesn’t live up to the potential of a good tomato.

PNAS: Klee describes how he is attempting to create a better tomato

Klee: If you have a good instrument, you can detect something like 400 volatiles in a tomato fruit. It turns out that a much smaller set of them, like maybe 30, are really contributing to consumer preferences. Detecting them is relatively straightforward, but figuring out which ones of the whole set are the important ones was the real challenge.
The way that we did it in principle is very simple, in practice it’s a lot of work. We went on a hunt to collect as many of what are generally referred to as heirloom tomatoes as we could find, and what we very quickly found was that there was just an immense chemical diversity in those products. I mean, some of them taste fabulous, some of them really don’t taste very good. And we grew up about 70 or 80 different varieties that really had quite a range of differences, asked how much you like them, and then grind them up and see what volatiles and sugars and acids are in them. And when you do that, you basically can just extract out statistically essentially what correlates with good flavor, what correlates with bad flavor, and you can actually use the statistics to essentially create a recipe for what is a really good-tasting tomato.

**PNAS:** How far along is the project?

**Klee:** I would say right now we probably have identified genes that control maybe half of the important volatiles. We’ve already started the process of working to get a couple of the most important ones in, but we’re probably looking at three to four years before we can identify the suite of the most important genes that we would like. We really want to make the average tomato, the one that you buy in the supermarket, we want it to taste better. We want to improve people’s diets, and we think the way to do that is very simple. It is to make something that the consumer really wants to buy.

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