

Green Coffee Analytics: Relevance to Roasters, Buyers, and Producers.

Part II: Screen Size

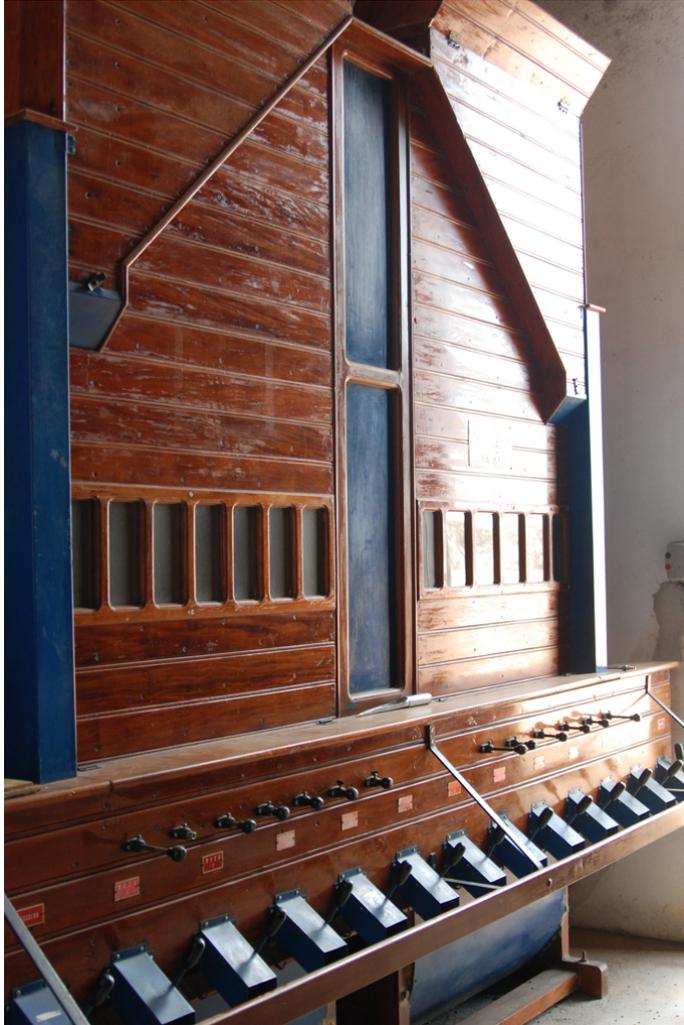
By Chris Kornman

In [Part I](#) of this series on analyzing green coffee, we focused in a lot of detail on water – specifically the relationship of a green coffee’s water content and activity to its safety, longevity, and potential for browning reactions in the roaster. This article will focus on another physical quality of coffee that has direct impact on roasting and cup quality: screen size.

The Last Step in a Long Process

Screen size separation is typically the last step in the green coffee preparation process at the dry mill before bagging and export. The machines that do the work are large, multi-tiered tables that sit atop each other at a slight downward slope. The machine vibrates as coffee enters from above, and gravity does the rest of the work. Workers will hold bags at the bottom of the machine to catch the outflow of coffee. Multiple passes through the device can increase the precision of sizing, and many of the machines can be manually adjusted. I once helped tear apart and rebuild one for a producer in Zambia. His machine had accidentally been assembled with the tables out of order, so we spent the better part of an afternoon making sure that the screens with the largest holes were on top.

Typically these sorters are not particularly pretty devices - hulking masses of metal that whir noisily and kick up a bit of dust. However, on a visit to Brazil, Henrique Sloper of [Fazenda Camocim](#), located by the incredible [Pedra Azul](#) in Espírito Santo, once showed me his painstakingly restored vintage sorter. The picture below highlights a little of its pipe-organ like beauty.



Naming Conventions

Screen size traditionally has been measured by passing coffee through circular holes. These holes are typically measured in increments of $\frac{1}{64}$ of an inch in diameter, so a coffee measuring screen size 16 means the coffee is $\frac{16}{64}$ – or a quarter of an inch – across. This sizing has generally been accepted worldwide, but a few select countries have elected to either brand their coffee based on screen size, or to rename these sizes to suit a particular interest.

Examples of unique sizing names include much of formerly British occupied East Africa (Kenya, Tanzania, Zambia, etc.) as well as India, each of which continue to use the so-called British grading system, using letters A, B, C, and T to grade coffee. Colombia has famously branded its coffees as Supremo and Excelso while terms like Fine cup and NY 2/3 are used in Brazil. Central American coffees will use the term EP (European Prep) and more rarely American Prep to indicate screen size, and either SHB (strictly hard bean) or SHG (strictly high grown) to refer to the highest grade of coffee based solely on elevation. Adding to the confusion, Brazilian high grade coffees are sold as SS (strictly soft), referring to the cup profile (i.e., no hard cups), not the physical hardness of the bean or elevation.

Each of these designations have a level of tolerance built in for oversized coffees. European Prep coffees may have up to 5% below screen size 15, while American prep is more loosely designated with 100% size 13 and a higher allowable visible defect count. Until recently, Colombia's [Federación Nacional de Cafeteros](#) self-imposed a very strict 1.5% tolerance for Excelso screen size passing through size 14. This [has since been amended](#) to allow up to 5% size 13 and 14 in Excelso coffee.

Talking about these specific definitions can get a little convoluted, so to help clarify, I've included a simple table below:

	Screen Size									
	20+	19	18	17	16	15	14	13	12	Below
Brazil			Strictly Soft Fine Cup (NY 2/3)		Strictly Soft Good Cup (NY 3/4)					
British: India, Kenya, Tanzania, Zambia	E		AA		AB		C			T
Central America			SHB (strictly hard bean) or SHG (strictly high grown) EP (European Prep)							
Colombia			Supremo		Excelso		Usual Good Quality			

Does it Even Matter?

Of course, all this information begs an important question. Unsurprisingly, you'll find the answer is more complicated than yes or no. The importance of screen size depends on a number of factors; there are some traditional trade implications as well as myriad ways that it can affect roasting... so the short answer is "Yes." But, as with all rules, there are exceptions. Let's dig in:

Bigger is Pricier

Across the globe, the size of a coffee's seeds directly relates to the sale price; there are a number of markets to whom size can be an important factor. In many cases, this seems to be tied up in an old-school traditional view of larger beans possessing higher quality. You may notice (as a prime example) that Kenya AA typically trades at higher value than AB. The viewpoint is perhaps a little outdated, but it continues to be perpetuated by organizations like the International Trade Centre (ITC) and the International Coffee Organization (ICO), the latter [claiming in their literature](#) that "the theory behind classification based on bean size is that coffees of the highest altitudes are more dense and larger in size than those produced at lower altitudes. Similarly, coffees develop more slowly at higher altitudes and often have the best flavour profiles."

As such, with rare exception, the smallest screen sizes are excluded from high-grade specialty export, and trade at lower values. Surprisingly in many cases the largest beans (sometimes called elephants) are also

sorted out and trade at lower value. However, this large size mentality has also resulted in the development of cultivars like Pacamara which regularly size 50% over Screen 19.

There are some flaws and exceptions to this line of reasoning as well. While large size coffee yields have been shown to justify high elevation and shady conditions in [some research](#), others [make claims](#) that higher elevations produce smaller seeds with more concentrated nutrients and higher density, and therefore higher quality. Anecdotally, some regions struggle to produce large sized coffee: the Nariño region of Colombia, Southern Rwanda, and Ethiopia all have quite high elevations but tend to produce relatively small seed size.

For one, Ethiopian coffees, which are generally recognized as some of the highest quality specialty coffees on Earth, are almost universally small in size. Look no further than a few of our recent [Crown Analyses](#) and [Crown Profiles](#) on high-scoring washed [Ethiopias](#) like [35989 – Ethiopia Yirgacheffe 1 Idido Gersi Kebele GrainPro](#) and [35893 – ETHIOPIA YIRGACHEFFE 2 FTO ADAME GORBOTA LOT 002 GRAINPRO](#).

In each case, over half of the coffee screens at size 15 and under. Over 20% of the lots came in at size 14 and under, and up to 36% in [one extreme case](#) ([36211 – ETHIOPIA SIDAMA 2 FTO GIDIBONA SHEICHA ECOTACT](#)). Under all the standard grading systems in most other countries, nearly a quarter of this coffee would be practically thrown out with the trash, yet it's inclusion didn't prevent these coffees from phenomenal scores on the cupping table.

Parts of the industry have turned this to their advantage. For example, in Tanzania a strong marketing push has added value to the peaberry classified beans to the point that they often trade at the highest premiums. Peaberries present an interesting anomaly when grading coffee, both by size and for defects. Technically, it's a genetic anomaly: instead of the typical two seeds per cherry, the zygote never splits and simply forms one seed. [Some folks claim](#) this means more concentrated flavor, though this is largely under-researched. Others may claim it makes roasting difficult, which is certainly true if they come mixed with standard 'flat beans' or are poorly sorted. In either case, no other genetic flaw in coffee (we'll talk a little more about these in a later article) garners such attention. They even have their own screen shape for sorting – an oval rather than a perfectly round circle.

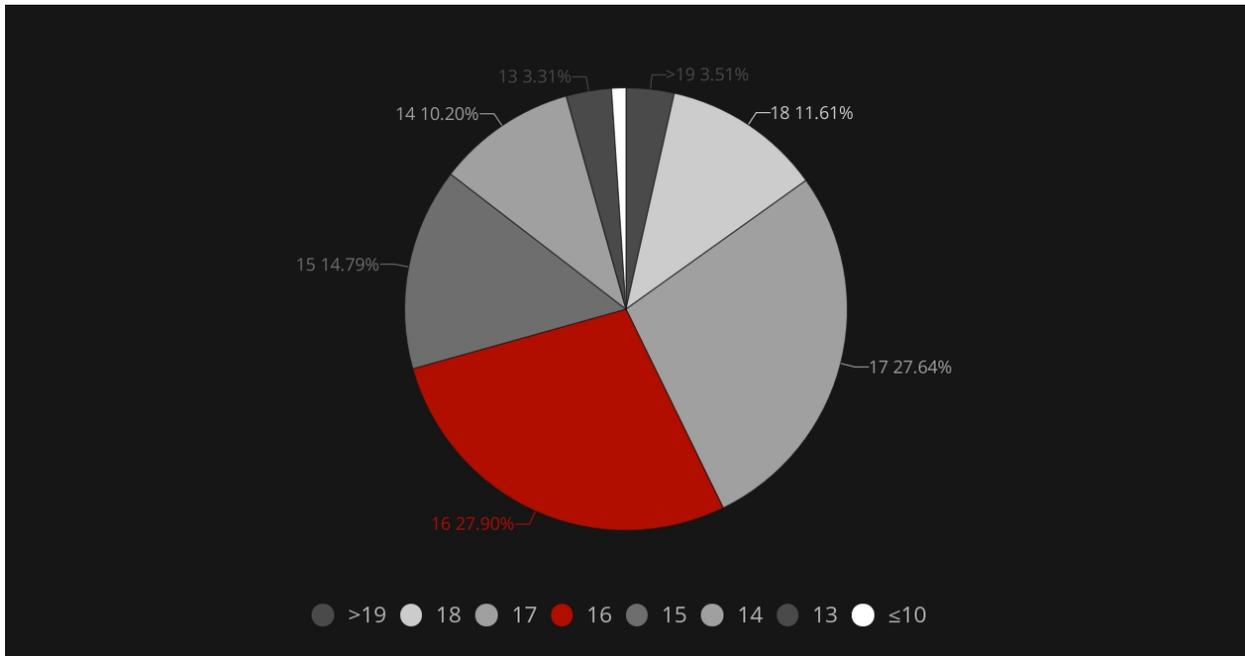


Effects on Roasting and Cup Quality – Theory & Practice

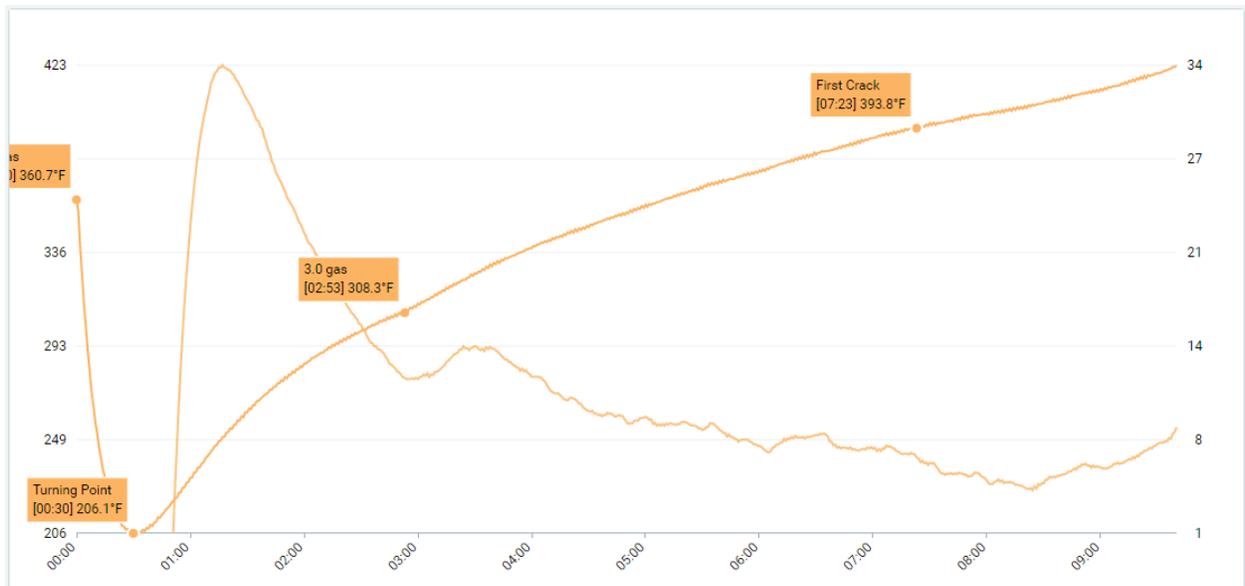
When it comes the effect of screen size on roasting, it can alter thermodynamics in a few ways. Among the most important is the way heat application and absorption may differ based on size and shape, something scientists refer to as “surface area to volume ratio.” Very simply put (because I am not a physicist, and presumably, neither are you), differences in bean size and shape react differently to heat application in a number of ways: a batch of coffee possessing predominantly large or small beans isn’t necessarily a problem – the roaster can adapt to this scenario because in both cases, the relative surface area and volumes of these two lots are fairly similar. The real problem is caused by a batch of beans of widely disparate size are roasted together. In this case, the roast degree will differ somewhat significantly based on the disproportionate relationships of volume and surface area of the coffee.

We wanted to test out some basic tenets of screen size: namely (1) is there noticeable quality difference inherent in a certain screen size in a particular coffee and (2) how significant are roast related differences due to screen size disparity?

We picked out a coffee with a wide screen size distribution from Huehuetenango Guatemala, a coffee that landed at around 87 points back at the beginning of May, despite being a little out-of-spec (roughly 11% at sizes 14 and 13) and having a slightly higher than average moisture content (12.4%). Here’s a pie chart of the screen size of the lot as it landed (we’ll refer to this lot as the ‘Unsorted’ batch from here).

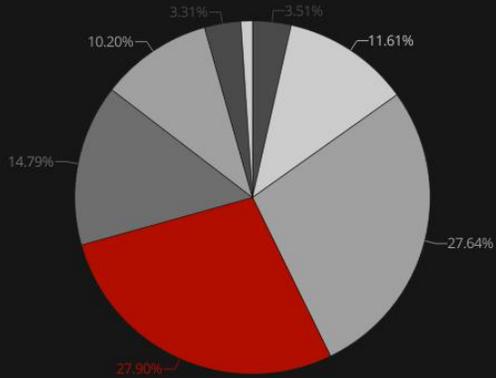


[Jen Apodaca](#) roasted a test batch, and then a control batch from the Unsorted lot making minimal gas adjustments. Here's the roast curve:

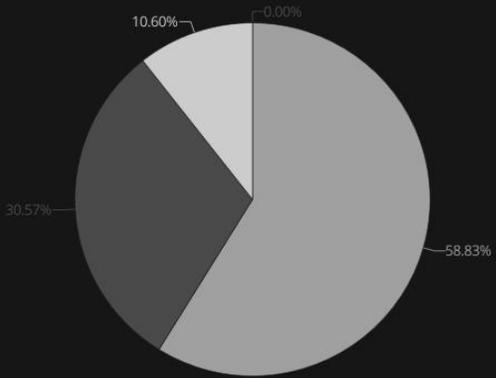


Based on this roast, Jen made an identical gas adjustment and ended each batch at similar temperatures on various sorted batches: a small sort (size 14 and below), a medium sort (size 15 – 17), a large sort (18 and up), and finally a single size sort at 16. Here are charts of the screen sizes of the various batches compared:

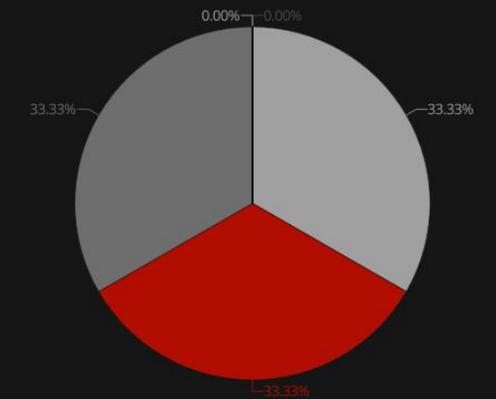
Unsorted



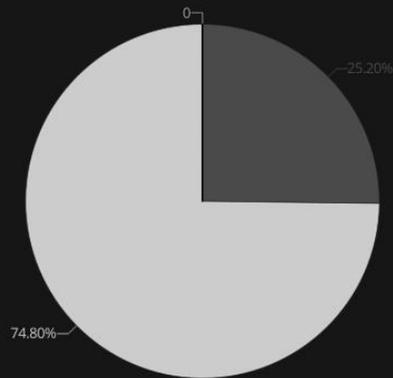
Small (0-14)



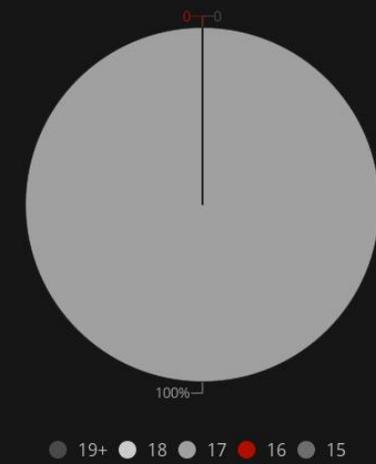
Medium (15-17)



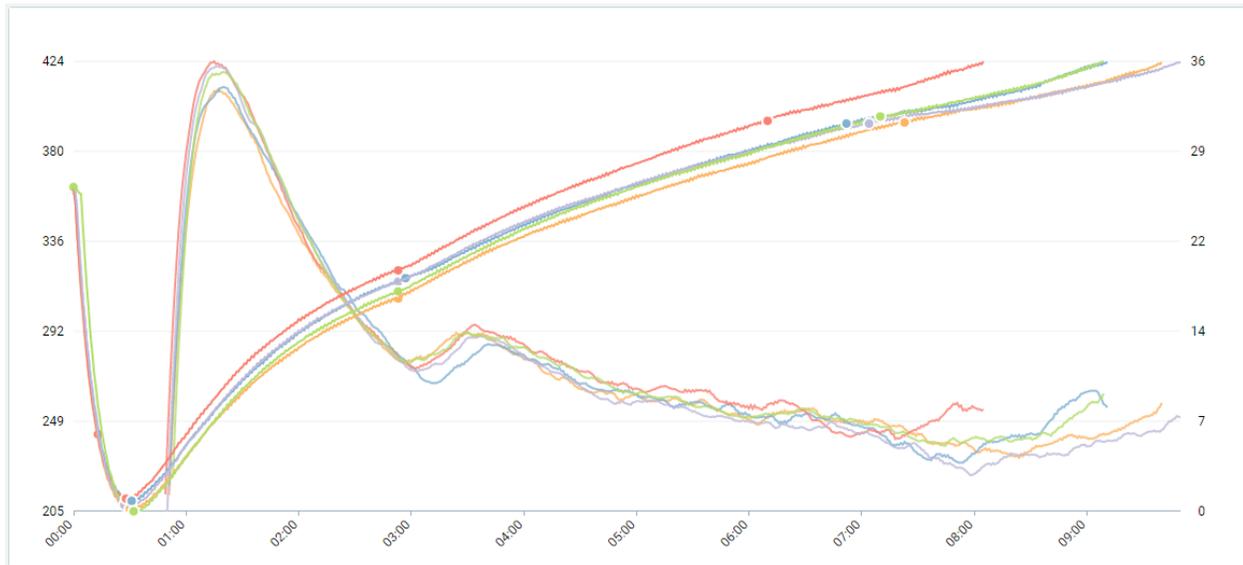
Large (18+)



16 only



And here are the 5 roasts compared:

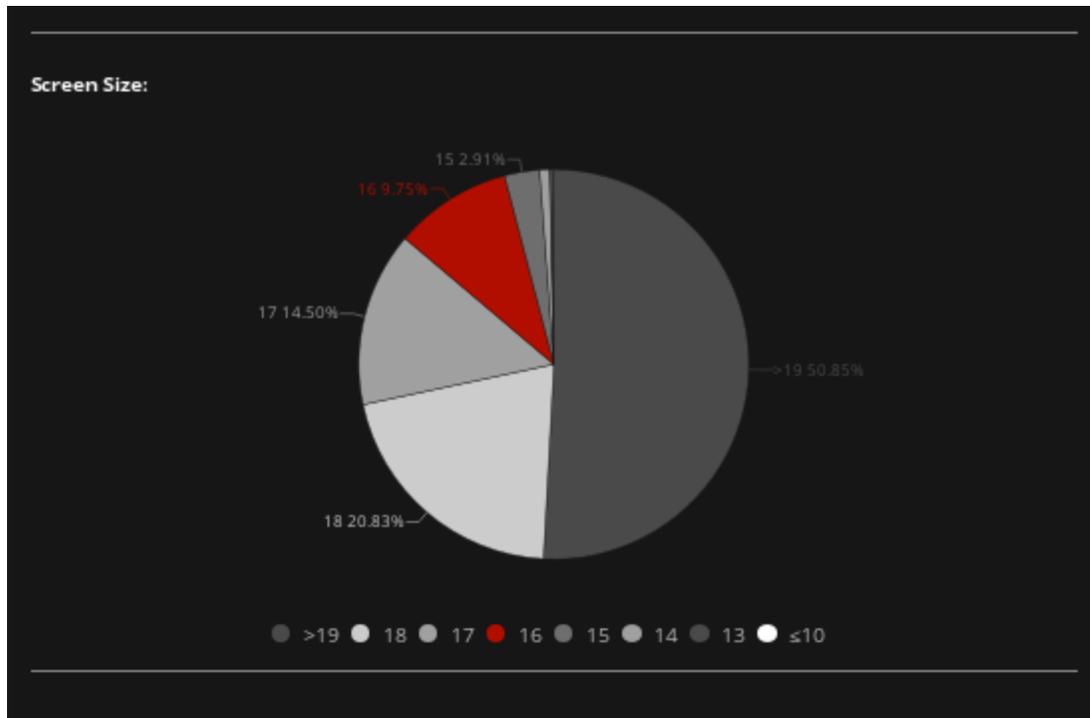


Of the five roasts, there are essentially 3 trends. Group 1 includes the Unsorted roast and the Medium sort, both of which finished at nearly identical time, and have very similar post crack development. Group 2 includes the Large and Small sorted batches, which are a little quicker and both have an uptick in rate-of-rise after first crack. And lastly, there is a severe outlier - Screen 16 - which outstripped the Unsorted coffee's roast time by more than a minute and a half. Interestingly, despite their noticeable differences, the Screen 16 and Unsorted batches have nearly identical post-crack development percentages: 23.7% and 23.6% respectively.

The differences in the way this coffee roasted likely have at least something to do with the differing screen sizes. The coffees with greater variations in size produced longer roasts, as if the outsized coffee were drag on a race car. Group 1 had the widest spread of screen size, and as a result had the slowest development under this roast profile. The screen 16 batch had little-to-no variance in size, thereby producing the least "drag" on the roast.

At the cupping table, there was a decisive preference for the Screen 16 batch by more than 1 point over the next coffee, averaged between 4 cuppers. The Large Sort and the Unsorted batch scored identically. Interestingly, the Medium Sort was our least favorite.

I was also curious about the potential effect on brewing and extraction of different sized coffee. I opted to screen the Unsorted batch (post roast) to get an idea of whether coffee from a single roast would extract differently based on screen size. Just for kicks, here's the graph of the roasted screen size on this coffee:



More than half of the coffee didn't even pass through the largest screen. I separated 6 different batches from this sort: ≥ 19 , 18, 17, 16, ≤ 15 , and a blend of all sizes in proportion, as a control. Using the exact same dose (11g), grind (8.5 on Malkohnig EK-43), and water (176 ml @ 95C), I used the new [VST LAB Coffee III Refractometer](#) to take filtered readings of the cups at around 15 minutes after the water was poured.

I was a little surprised to find no statistically significant differences in extraction or total dissolved solids. The folks behind [Socratic Coffee](#) have made some [interesting observations](#) about the filters provided by VST, so it's possible my results were slightly skewed or that the range of data might have been artificially narrowed. Evan and I informally tasted the coffees after readings were taken, and both of us expressed similar, somewhat slight preferences for the smaller screen sizes in taste. But it appears there may be little or no measurable effect, in this case, on the rate or percentage of extraction due to screen size.

Conclusions

It's definitely worth noting that my experiment was pretty informal, and it would be irresponsible to draw broad conclusions based on a single roast style of a solitary coffee, but this can serve as an example of the somewhat dramatic effect that differences in screen size may have on thermodynamics when it comes to roasting coffee. I think it's reasonable to infer that differences in screen size can affect the way a coffee absorbs heat in the roaster, but that different screen sizes from a single roasted batch might not significantly affect extraction. Regardless of the science, the way in which a coffee is sorted will ultimately affect its market value.