



Descriptive Cupping: Processes and Applications

Coffee is evaluated (“cupped”) professionally for many reasons. Some sensorial tests are performed to determine a relative quality based upon predefined criteria, some to determine difference or similarity of samples, and others to rank several samples in relation to each other. Most cupping forms and systems of analysis are based upon rating samples according to flavor attributes commonly found in all coffees using numerical scales. This is particularly useful in determining quality criteria for purposes of classification (“specialty” and “commercial” for instance).

Descriptive cupping goes into greater detail exploring particular flavor attributes that may be unique to the sample. The challenge of defining a coffee product in this way is that coffees from various origins are capable of a multitude of flavors.

Summary of descriptive cupping method: Descriptive cupping breaks down the stages of flavor perception into separate sessions so that cuppers can systematically evaluate a coffee. Individual flavor attributes of a product, their intensities, and the order in which they appear are examined in separate sessions using set procedures. The results from these sessions are evaluated using various statistical and mathematical methods and the test is replicated several times to ensure veracity of results.

This can be useful to the professional in many ways. Participating cuppers develop a greater understanding of the coffee samples and the process of sensorial analysis. A detailed analysis of an individual coffee can help create efficient standards of analysis. The unique attributes found can be studied in terms of the cause of those flavors (Geographic origin? Roast? Altitude?). More detailed comparisons of flavor attributes can be made between samples.

Perhaps most important, descriptive analysis can be used in combination with consumer preference testing to determine which products are most likely to be purchased. The goal of professional cupping in a business is to ultimately provide a coffee that consumers will respond to positively. Consumer testing evaluates segments of coffee consumers in terms of their preference. By having a detailed description of a coffee in combination with consumer preference knowledge, a coffee business can begin to understand what flavor qualities certain consumers desire.

Methods of Descriptive Analysis

Sensory testing is the process of putting panelists and samples together under controlled conditions. For an effective test to produce usable results, each of these aspects must be given adequate attention.

Test Design

The first stage of test design is to determine the purpose of the test. It is useful to write this down as a simple declarative sentence, such as “The purpose of this test is to determine a specific flavor profile for Fantastic Blend” or “The purpose of this test is to describe the differences between Nicaragua Nueva Segovia roasted to different degrees.” Considerations should be made as to how the information will be used. Is this meant to be a guide for the green buyer? Should it include information for those roasting or marketing the product? Is this meant to correlate with consumer perceptions or tests? These questions will determine how specific the information must be and how the samples should be prepared.

All the usual good practices for sensory testing should be included. These can be found in other literature, but in summary:

- Consistent sample preparation
- Consistently followed test protocols
- Samples disguised by 3-digit codes different for each session
- Panelists qualified and trained in the use of the chosen method
- Replication for statistical significance
- Valid methods of data analysis

The area where the test will be held is also important. It should be clean, well-lit, free from interfering aromas or flavors, and quiet. Besides the standard cupping materials, a white board, markers, and erasers are needed.

Due to the amount of time the test takes and to keep the panel fresh, it is best not to try to cup more than two or three samples in a session. It is best to schedule the various sessions on different days, rather than consecutively on one day, and panelists are at their freshest in the morning.

Sample Preparation

Securing or producing coffee samples for testing: The samples must be uniformly prepared for all sessions and should be as close as possible to an “ideal” or “gold standard” sample. A single representative sample from a recently produced batch from production would work. If the purpose is testing products as they would be perceived by the consumer, it is better to get a sample that is actually in the field, like a packaged sample on a retailer’s shelf.

A laboratory produced sample is not recommended unless the purpose of the test is product development and the coffee is not currently in production. Enough uniformly-prepared coffee should be produced to get through all phases of the descriptive test. The sample should be as close to the final product as possible in terms of roast degree, green components, and method of serving.

Sample preparation: The SCAA sample preparation procedures are recommended. They are detailed in SCAA literature, but in summary they include:

- Optimum ratio 8.25 gm per 150 ml water
- Weigh whole beans (rather than grinds)
- Grind immediately prior to cupping
- Grind particle size coarser than grinding for paper filter brewing
- Clean grinder with coffee to be cupped
- Samples should be covered with lid prior to infusion
- 5 cups per sample
- Water should be clean & odor free
- Ideal Water:
 - Total Dissolved Solids (TDS) 125 – 175 ppm
 - Total alkalinity and hardness between 100 – 250 ppm
 - pH at 7.0 to 7.2
 - Freshly drawn, aerated, poured just off the boil
- Fill cup to the rim
- Steep grinds 3-5 min. before cupping

The usual procedure of first evaluating the dry grounds, then breaking the crust to evaluate the aroma, then evaluating the liquor at 2 different temperatures is followed.

Training

A trained descriptive panel can be a valuable asset for a beverage business. A panel of 6 to 12 is recommended. The goals of training a panel for descriptive analysis is to orient panelists to thinking qualitatively about the flavors they are experiencing, to express their perceptions as precisely and accurately as possible, to develop greater sensitivity, and to be motivated towards doing a good job. A well-trained panelist should be able to recognize various flavor attributes and their relative intensities while being able to communicate their experience.

A good source for training protocols is the International Standards Organization (ISO), available through the standards store at <http://www.iso.org/iso/en/prods-services/ISOstore/store.html>. Other sensory testing protocols are also available, including those for specific descriptive methods such as flavor profiling and aroma profiling.

Qualification of panelists: Due to training and personality, some individuals who are quite good cuppers and can easily distinguish between various levels of coffee quality do not always make the best descriptive panelist; describing what is being perceived rather than rating what is perceived is more difficult for some cuppers. Those who have fixed

opinions about what a coffee is may not be able to think creatively enough to regard coffee from different viewpoints. Panelists should also be able to work well within a group, sharing their perceptions but not dominating.

Panelists must also be reasonably sensitive to different aspects of coffee. Qualifying sensory tests, those that test recognition of intensities of sweet, salt, sour, and other perceptions, can be used. A good “taste memory” is particularly useful since panelists must recall the flavor attribute experience associated with a particular verbal descriptor.

Training program: A training that will introduce the panelist to descriptive cupping and terms used should be in place so that new panelists can be trained as necessary. The use of standards, pure substances that dependably taste the same (such as sugar, salt, etc.) are useful in defining terms and developing panel recognition of flavor attributes. By the end of training, panelists should be able to demonstrate that they can discriminate and describe the differences between different flavor attributes and different sensory tests (triangle test, comparisons) can be employed to make this determination.

Many of the SCAA training programs and materials now available are useful for this training. The “Le Nez de Café” coffee aromas are useful in developing aroma recognition and memory. The “Organic Acids” training demonstrate how various acids differ qualitatively. Tests used to qualify cuppers can be used to determine if panelists are adequately sensitive to various stimuli.

Forms for Testing

Once the sample has been produced and the panel trained, the forms should be produced. There are different forms for each stage of testing.

Panelists develop their descriptions of flavor attributes in the first stage. Depending on the desired approach, one can allow the panel to come up with their own descriptions (as in “Form 1: Free Choice Descriptive Cupping Form” at the end of this handout. Some panelists find it easier if flavor attributes are suggested, as in “Form 2: Qualitative Descriptive Scoresheet.” The intensities listed in “Form 1” are meant to indicate the general intensity of that particular set of results which may be useful later in determining whether or not to include that attribute.

After two replications of the qualitative stage have been performed, the panel determines the order in which the flavor attributes occur in a separate session. The flavor attributes are listed on a new form, with a space for a number so that the order can be determined.

Once the flavors are evaluated qualitatively and order of occurrence has been determined, a form is made that will allow the panelists to evaluate the intensity of flavor attributes found. The form presented to panelists is “Form 3: Descriptive Intensities” (the “Form 4: Descriptive Intensity Measurements” is to evaluate the intensities numerically after testing).

Conducting the Test

Stage one: Term (lexicon) development: Panelists evaluate the samples using typical cupping methods in silence using either “Form 1” or “Form 2.” Instead of rating the samples using a scoring system, the panel comes up with various descriptions of the flavor attributes in as much detail as possible. After the session, panelists share their impressions in a group discussion. The group discussion leader summarizes and focuses the group as they come to a consensus about the various flavor attributes of the coffee.

Usually at least two replications of this stage should be performed since coffee is a complex beverage. By the end of the test, the panelists should agree that the set of terms developed describe the sample in adequate detail.

Stage 2: Determination of order of occurrence: The attributes found are listed and the order is determined by panelists. A discussion may be held to make final determination.

Stage 3: Determination of intensities: The attributes are listed on “Form 3: Descriptive Intensities” in the order determined. Panelists mark the relative intensity of the attributes on the linear scale. These intensities are quantified using “Form 4” (this can be copied onto transparencies for easier determination). This also should be replicated twice.

Results of Descriptive Cupping

The intensities of flavor attributes found by the panel are averaged. Computing the standard deviations of each attribute will also reveal which are most obvious to the panel. If there is serious disagreement, the sample may be resubmitted.

The result of descriptive cupping is a detailed analysis of the individual flavor attributes of a coffee. These attributes are rated in terms of the particular aspect of sensory experience (aromatics, taste, flavor, tactile and aftertaste sensations), the intensity of the attribute, and the order in which the attribute occurs. This “flavor profile” of a sample is usually illustrated with a “radar” (also called a “spider”) diagram. This method of graphing is available in Excel. An example is shown in Figure 1.

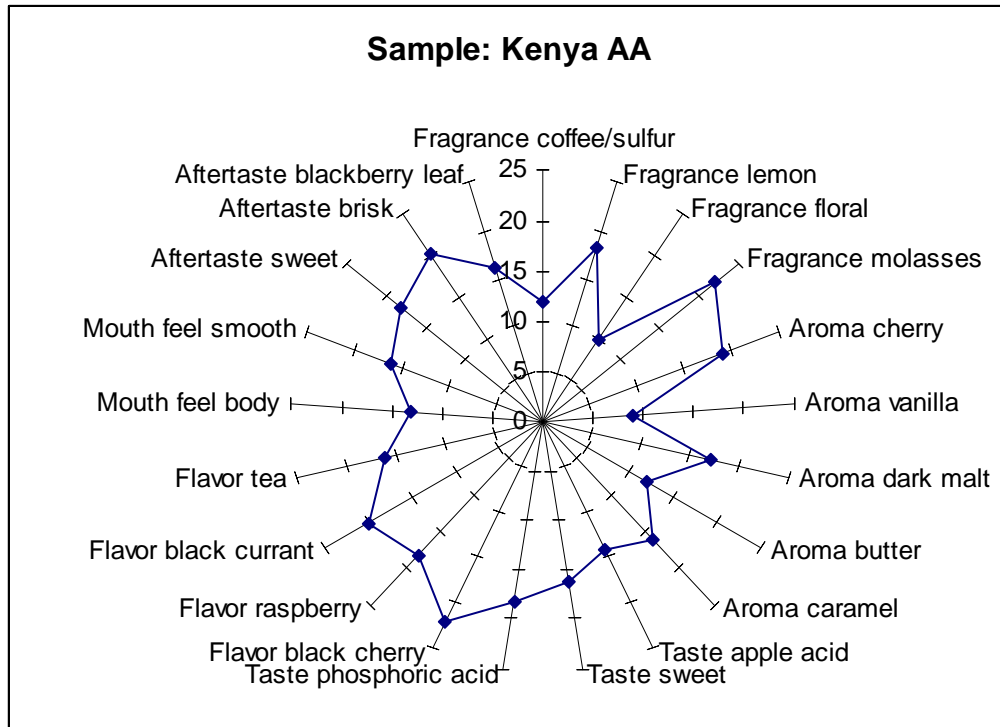


Figure 1: Flavor profile of a Kenya AA.

It is not uncommon to have 20-30 individual flavor attributes. After a detailed flavor profile has been determined, the most important flavor aspects and their intensity ranges are determined and used for quality control.

In Figure 2, some of the flavor attributes have been generalized (“red/black fruit” instead of cherry, for instance) and some eliminated that were not considered important to the quality of the product. This standard is compared to 2 different samples submitted to see how closely they conform to the flavor profile.

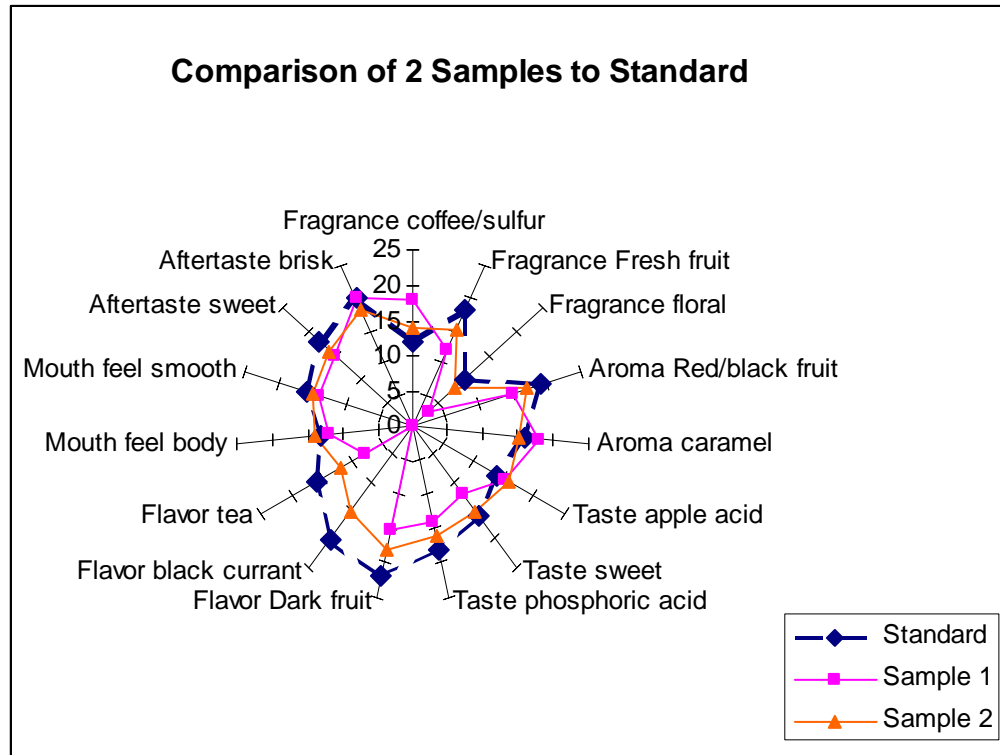


Figure 2: Comparison of standard (blue dotted line) to 2 submitted samples.

In this example, Sample 2 comes closer to meeting the standard, though sample 1 is similar in many aspects. These profiles can be used to train quality control cuppers to recognize the flavor attributes that a particular coffee must have.

Comparisons to other samples

Since the results of descriptive cupping are multi-dimensional, comparisons between coffees require more advanced statistical methods. Though these methods are complex in terms of mathematics, the resulting graphs are quite useful in observing trends and the amount of difference (distance) between coffees.

One common method of detailing differences between samples is the Principal Component Analysis (PCA). These methods of analysis are available in various statistical programs. The data is first prepared by selecting the flavor attributes that are most important to the flavor profiles of the samples. These attributes are correlated to one another. The flavor attribute correlations are illustrated in terms of angles between the components. If the angle between attributes is small, the flavor attributes correlate (when one attribute is found, the other is found as well). If the angle between two attributes is close to 180°, the attributes have a negative correlation (when one attribute is found, the other is not found). If the angle between the 2 attributes is 90°, they have no correlation.

These correlations create a two or three dimensional space on which the samples can be mapped as points. An example can be seen in Figure 3.

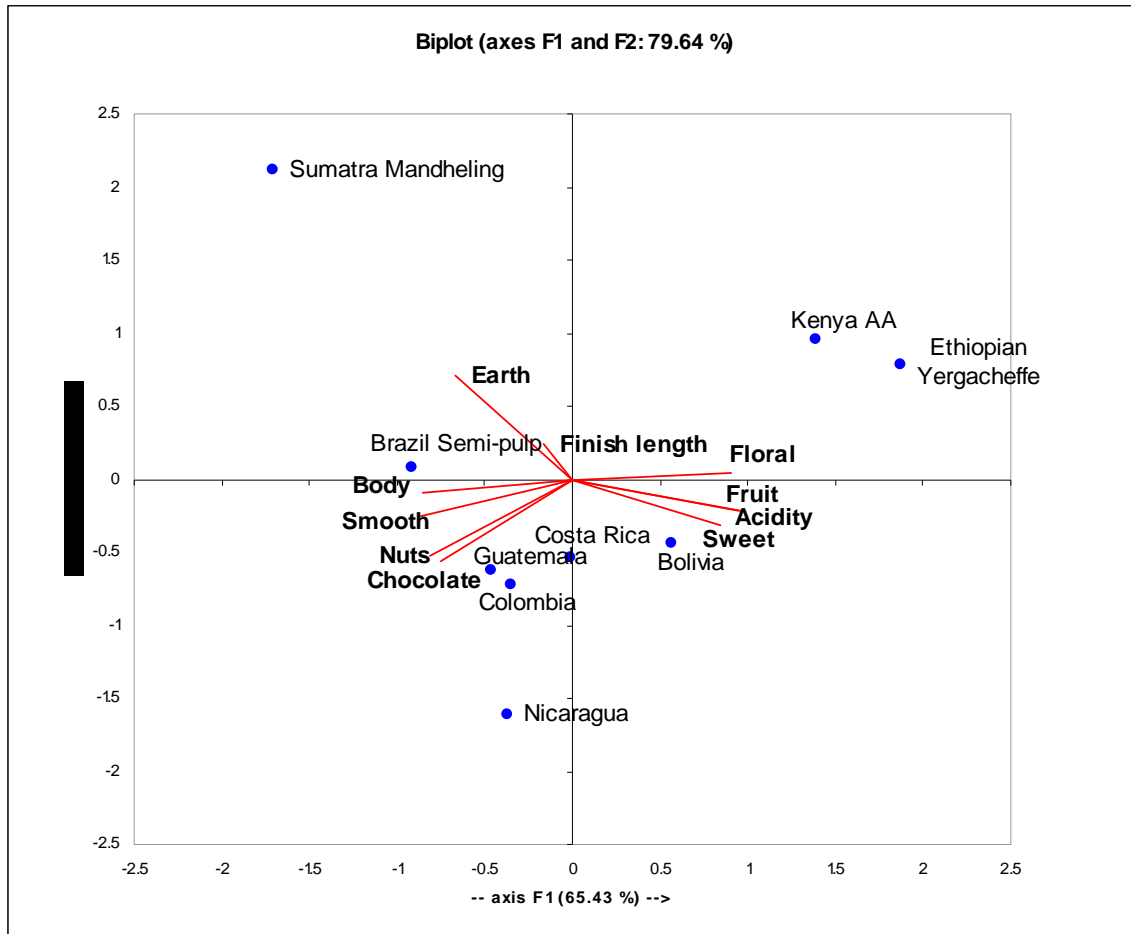


Figure 3: PCA of several samples descriptively analyzed.

Using Developed Data and Analysis

The PCA can be used to make comparisons between the samples themselves. The Ethiopian Yergacheffe and Kenyan AA samples have more in common with each other than with the Central/South American samples. The attributes themselves can also be compared. Fruit flavors and acidity correlate closely, while earthy flavor was not found in conjunction with fruit.

Other information can be integrated into the PCA, such as effects of production parameters on the flavor profile. In Figure 3, Agrtron measurements are integrated into a PCA of the same sample roasted to different degrees. This can be used to optimize the intended flavor of a coffee.

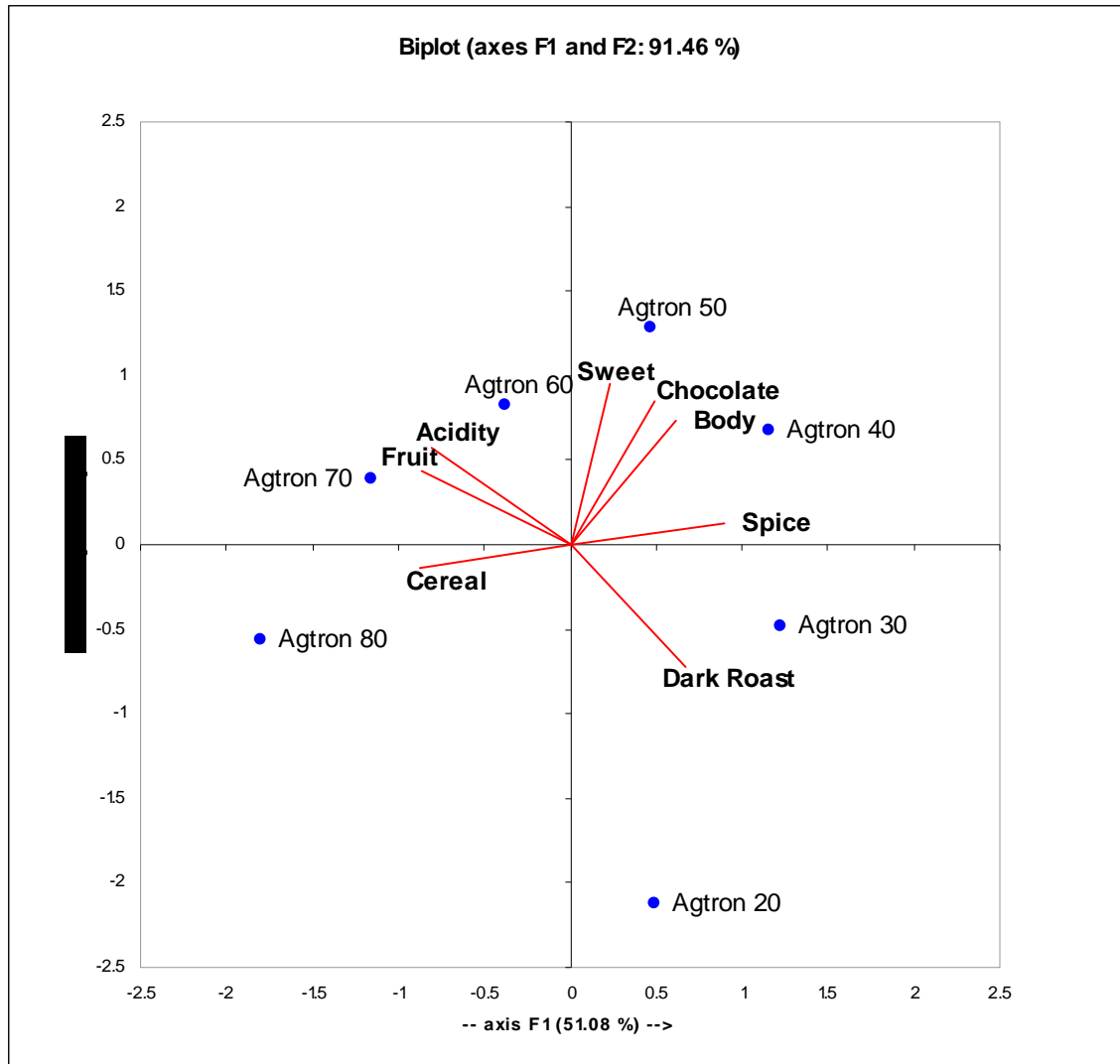


Figure 4: PCA of a single sample at different roast degrees. The coffee is roasted darker as the Agtron number decreases.

Depending on what flavor attributes the roaster wants to emphasize, the sample can be roasted darker or lighter. Seeing this visually often helps the product developer to visualize an “ideal” product that would correspond to a certain location on the PCA.

One can also integrate consumer preferences or other market information into the PCA. Figure 4 shows a roaster’s line of products (the same as shown in Figure 2) integrated with sales of those products from 4 different retail store locations to see if certain locations prefer a certain coffee. Decisions can be made about what products to introduce or eliminate, or what to promote at different locations.

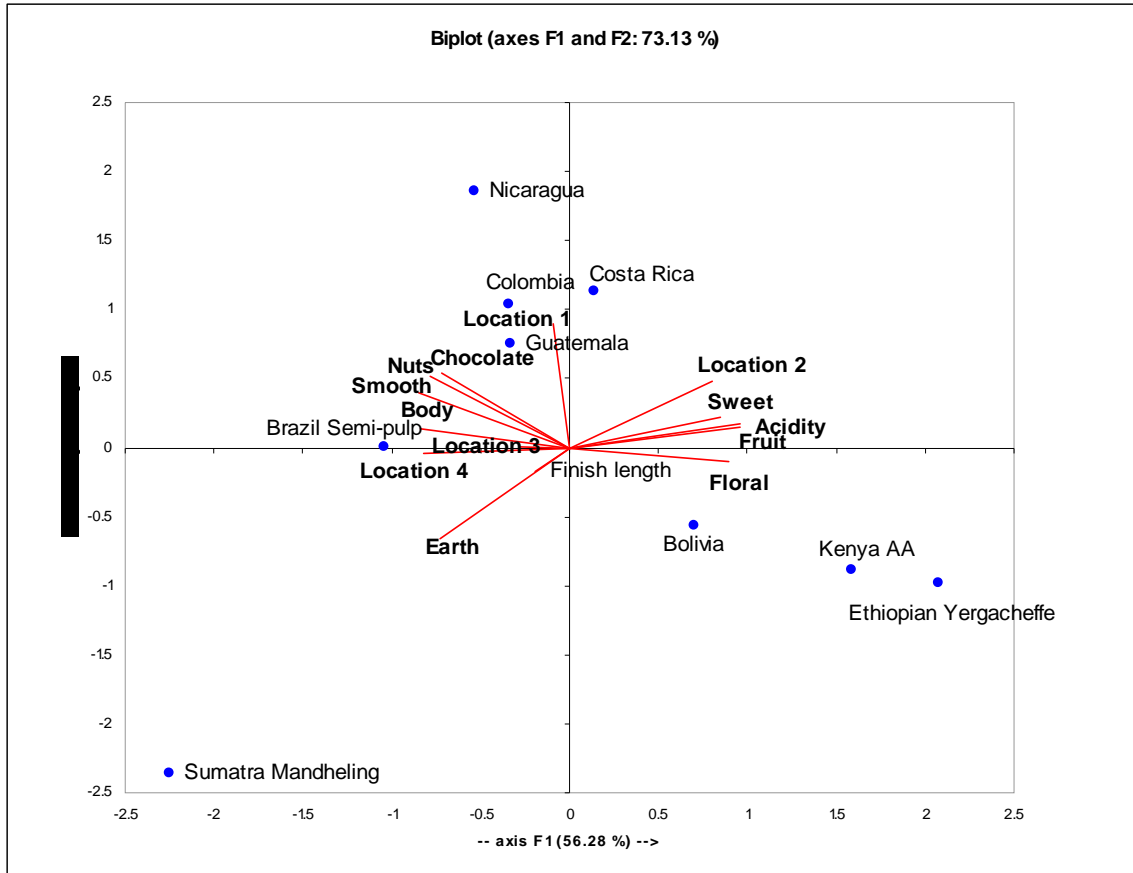


Figure 5: Flavor attributes and sales at 4 store locations.

Coffees that are more acidic and have fruit/floral/sweet profiles sell best at Location 2, Location 1 sells a larger percentage of Central and South American coffees. Customers at Locations 3 and 4 have similar preferences. This information can be used to determine what new products to introduce or promote and can be useful to profile the demographics of customers who patronize the locations to determine what will be preferred in new locations under consideration with similar demographics.

Summary

The diversity of coffee flavors creates the opportunity to sell different products to a wide variety of consumers who may have assorted preferences. Descriptive cupping can assist in this goal in many ways.

- In the roasting sector, by having a detailed analysis of flavor attributes, one can define a coffee product and the unique flavor qualities it must have. In the agricultural sector, this detailed analysis can let a grower or exporter know what they have and how it fits into what is generally available.
- Those coffee flavor attributes can be optimized by exploring how various production aspects affect flavor. One can quantify flavor attributes in terms of roast parameters, agricultural inputs, growing locations and conditions, processing parameters, presence of certain chemicals, and many other technical aspects.
- In conjunction with consumer testing and demographic/geographic analysis, the consumer segment most likely to prefer the coffee can be identified. Certain coffees and blends can be developed that appeal to certain segments. The likelihood of a coffee succeeding in the marketplace can be analyzed.

The primary disadvantage of descriptive sensory analysis is the time that is taken. The testing itself is time consuming due to the number of replications required for accuracy and it takes time to train the panel. However, a well-trained panel can develop detailed knowledge about coffees and that information properly applied can develop a profitable business.

Form 1: Free Choice Descriptive Cupping Form

Fragrance

_____	_____	_____	Intensity
_____	_____	_____	High ____
_____	_____	_____	Medium __
_____	_____	_____	Low ____

Aroma

_____	_____	_____	Intensity
_____	_____	_____	High ____
_____	_____	_____	Medium __
_____	_____	_____	Low ____

Taste

_____	_____	_____	Intensity
_____	_____	_____	High ____
_____	_____	_____	Medium __
_____	_____	_____	Low ____

Flavor

_____	_____	_____	Intensity
_____	_____	_____	High ____
_____	_____	_____	Medium __
_____	_____	_____	Low ____

Mouth feel

_____	_____	_____	Intensity
_____	_____	_____	High ____
_____	_____	_____	Medium __
_____	_____	_____	Low ____

Finish

_____	_____	_____	Intensity
_____	_____	_____	High ____
_____	_____	_____	Medium __
_____	_____	_____	Low ____

Form 2: Qualitative Descriptive Scoresheet

Fragrance

<input type="checkbox"/> Floral	<input type="checkbox"/> Jasmine	<input type="checkbox"/> Chocolate	<input type="checkbox"/> Sweet, milk
	<input type="checkbox"/> Wintergreen, minty	<input type="checkbox"/> Dutch, alkaline	<input type="checkbox"/> Baker's
	<input type="checkbox"/> Rose	<input type="checkbox"/> Dark	
	<input type="checkbox"/> Hibiscus		
<input type="checkbox"/> Fruit	<input type="checkbox"/> Citrus	<input type="checkbox"/> Earthy	<input type="checkbox"/> Peat moss
	<input type="checkbox"/> Lemon	<input type="checkbox"/> Groundy, dirty	<input type="checkbox"/> Mushrooms
	<input type="checkbox"/> Tangerine	<input type="checkbox"/> Dusty	
	<input type="checkbox"/> Grapefruit		
	<input type="checkbox"/> Raspberry	<input type="checkbox"/> Moldy	<input type="checkbox"/> Mildew
	<input type="checkbox"/> Blackberry	<input type="checkbox"/> Harsh	<input type="checkbox"/> Musty
	<input type="checkbox"/> Blueberry	<input type="checkbox"/> Baggy	
	<input type="checkbox"/> Red		
	<input type="checkbox"/> Green	<input type="checkbox"/> Roasted	<input type="checkbox"/> Baked
	<input type="checkbox"/> Cherry	<input type="checkbox"/> Roast beef	<input type="checkbox"/> Biscuity
	<input type="checkbox"/> Apricot	<input type="checkbox"/> Coffee/sulfur	<input type="checkbox"/> Skunky
	<input type="checkbox"/> Peach		
	<input type="checkbox"/> Grape	<input type="checkbox"/> Woody	<input type="checkbox"/> Dried leaves
<input type="checkbox"/> Herbal, vegetal	<input type="checkbox"/> Grassy	<input type="checkbox"/> Paper	<input type="checkbox"/> Cardboard
	<input type="checkbox"/> Cabbage	<input type="checkbox"/> Hay, straw	<input type="checkbox"/> Cedar
	<input type="checkbox"/> Peasy		
	<input type="checkbox"/> Onion	<input type="checkbox"/> Sour	<input type="checkbox"/> Acerbic
	<input type="checkbox"/> Garlic	<input type="checkbox"/> Fermented	<input type="checkbox"/> Cheesy
	<input type="checkbox"/> Bell pepper		
<input type="checkbox"/> Nuts	<input type="checkbox"/> Peanut	<input type="checkbox"/> Resinous, solvent-like	<input type="checkbox"/> Turpeny
	<input type="checkbox"/> Almond	<input type="checkbox"/> Medicinal	<input type="checkbox"/> Alcohol
	<input type="checkbox"/> Hazelnut	<input type="checkbox"/> Petroleum	
	<input type="checkbox"/> Walnut		
<input type="checkbox"/> Cereal	<input type="checkbox"/> Corn	<input type="checkbox"/> Spicy	<input type="checkbox"/> Black Pepper
	<input type="checkbox"/> Barley	<input type="checkbox"/> Clove	<input type="checkbox"/> Nutmeg
	<input type="checkbox"/> Dark Rye	<input type="checkbox"/> Cinnamon	<input type="checkbox"/> Anise
<input type="checkbox"/> Caramel, sugar browning	<input type="checkbox"/> Caramel	<input type="checkbox"/> Carbon	<input type="checkbox"/> Tar
	<input type="checkbox"/> Molasses	<input type="checkbox"/> Ash	<input type="checkbox"/> Burnt
	<input type="checkbox"/> Toffee	<input type="checkbox"/> Charred	
	<input type="checkbox"/> Praline		
	<input type="checkbox"/> Malt		
<input type="checkbox"/> Sweet	<input type="checkbox"/> Honey		
	<input type="checkbox"/> Vanilla		
	<input type="checkbox"/> Custard		
<input type="checkbox"/> Animal	<input type="checkbox"/> Barnyard		
	<input type="checkbox"/> Sweaty		
	<input type="checkbox"/> Leathery		

Liquor

Gustation

<input type="checkbox"/> Acidity	<input type="checkbox"/> Mellow	<input type="checkbox"/> Sweet	<input type="checkbox"/> Ripe
	<input type="checkbox"/> Tart		<input type="checkbox"/> Mild
	<input type="checkbox"/> Tangy		
	<input type="checkbox"/> Winey	<input type="checkbox"/> Rough	<input type="checkbox"/> Soft
	<input type="checkbox"/> Fruity		<input type="checkbox"/> Neutral
	<input type="checkbox"/> Sour		<input type="checkbox"/> Briney
	<input type="checkbox"/> Fermented	<input type="checkbox"/> Bitter	<input type="checkbox"/> Alkaline
			<input type="checkbox"/> Caustic
			<input type="checkbox"/> Creosote

Flavor

_____	_____
_____	_____
_____	_____

Mouth feel

<input type="checkbox"/> Body (viscosity)	<input type="checkbox"/> Watery	_____
	<input type="checkbox"/> Viscous	
	<input type="checkbox"/> Syrupy	
<input type="checkbox"/> Smoothness	<input type="checkbox"/> Oily	_____
	<input type="checkbox"/> Smooth	_____
	<input type="checkbox"/> Granular	_____
<input type="checkbox"/> Astringent		_____

Finish

<input type="checkbox"/> Lingering flavors	<input type="checkbox"/> Sweet	_____
	<input type="checkbox"/> Sour	_____
	<input type="checkbox"/> Rough	_____
	<input type="checkbox"/> Bitter	_____
<input type="checkbox"/> Drying		
<i>Length</i>		
<input type="checkbox"/> Short	<input type="checkbox"/> Medium	<input type="checkbox"/> Long

Form 3: Descriptive Intensities

Form 3: Descriptive Intensities consists of 12 identical horizontal scales arranged vertically. Each scale is a horizontal line with three vertical tick marks. The tick marks are labeled 'Low' on the left, 'Moderate' in the center, and 'Strong' on the right. Above each scale, there is a solid horizontal line. Below each scale, there is a shorter horizontal line that starts at the 'Low' tick mark and ends at the 'Moderate' tick mark, indicating an intensity level.

Form 4: Descriptive Intensity Measurements

