### Professional

#### Coffee Density

**Variety**

Variety is a classification below that of Species.

Bourbon, Typica, Caturra, Catuai, Geisha, Pacas, Villa Sarchi, Kent, Maragogype, Pacamara, are all varieties of the Arabica species.

List some known varieties!

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|  |

**Origin**

* Most to do with coffee variety and \_\_\_\_\_\_\_\_\_\_, generally growing conditions.
* Elevation has considerable impact, higher elevations → higher density.

**Processing style**

* Not impactful on bean density directly. No evidence there is a direct causative relationship between processing method and green density/roast density. Possibility of correlation due to **why** some coffees are chosen to be processed a certain way. E.g. Lower quality/lower grown chosen to be processed dry to imbue cup and coffee with more character.
* Many coffees are density sorted by oliver table, etc.

**Roast Level**

* More development results in \_\_\_\_\_\_\_\_\_density, through both expansion and loss of moisture.

**Green and Roasted age**

* Green density and age: Green coffee will lose \_\_\_\_\_\_\_\_\_\_\_\_\_ over time resulting in lower density green.
* Roasted coffee and age: Roasted coffee will degas and release CO2 over time, and will lose mass. Loss in mass will result in lower density.

#### CO2 in Roasted Coffee

Coffee releases CO2 as a byproduct of roasting. The amount left in the coffee will affect the rate of extraction and will inform changes in recipes for coffees.

Coffee that is too fresh will exhibit qualities of low extraction due to gas escaping while water is attempting to enter the coffee particles. Espresso that is too fresh will also exhibit excessive crema and extended shot times/slow flow rates.

Coffee that is too old can exhibit flow rates that are too fast, thin body, and potential low extraction from the fast flow rates.

**Maintaining coffee freshness in cafe**

* Rotate stock (FIFO)
* Use older retail bags
* Change use of coffee depending on age
* Maintain cool ambient temperatures

**Coffee Freshness and Packaging**

Use packaging that eliminates \_\_\_\_\_\_\_\_\_\_\_\_ through airtight seals.

Allows release of CO2 from degassing through a one way valve.

At the cost of additional equipment, Nitrogen flushing helps eliminate oxygen and extend shelf life.

**Activity #1 - Freshness**

*Dial in and pull shots with coffees provided. Note differences in recipes, grind size, as well as flavor and texture characteristics.*

*Coffee #1(variety, roast level, roast date):*

*Recipe/ratio:*

*Grind setting:*

*Flavor and Texture notes:*

*Coffee #2(variety, roast level, roast date):*

*Recipe/ratio:*

*Grind setting:*

*Flavor and Texture notes:*

#### Organic Acids

**Chlorogenic**

* Usually 50% or more of total Chlorogenic acid content breaks down during roast. Primarily comprised of several forms of caffeoylquinic acid. “Di-CQA” form may be responsible for metallic taste in some coffees. Breaks down into caffeic acid and quinic acid which are associated with increased levels of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (darker roasts)

**Quinic**

* Forms from Chlorogenic acids breaking down during roasting. Significant percentage of overall acid content. Possible link between quinic acid and perceived acidity as coffee cools, attributes bitterness.

**Citric**

* Content in coffee quickly falls when roasted past “medium”. High concentrations are found in unripe cherries. High concentrations lead to sour or tart characteristics in coffee, which gives importance to picking the ripest cherries during harvest. Attributes \_\_\_\_\_\_\_\_\_\_ qualities.

**Phosphoric**

* Conflicting information about the effect of phosphoric acid on perceived acidity. Potency of acid suggests higher impact. 1999 study by J. Rivera at CQI found inverse relationship between perceived acidity. Taste qualities tend to be lighter and attribute a sparkling or buzzing feeling on the palate.

**Acetic**

* Only small amounts of acetic acid will remain in green coffee as a result of post-harvest processing. Roasting significantly increases concentrations through the breakdown of small to medium chained carbohydrates like sucrose. **Higher concentrations attribute “ferment” or \_\_\_\_\_\_\_\_\_\_ quality to coffee.**

**Lactic**

* Can contribute some sour taste, and changes a lot about texture quality. Increases perception of body.

**Malic**

* Acidity similar to pears, apples, or grapes. Formed from cellular respiration.

**Activity #2 - Triangulation**

*Make and taste coffee cups spiked with solutions following instructions on separate sheet.*

#### Blending

For blending we need to evaluate differences in roast degree, origin, and processing methods. Use this information to determine potential qualities a blend can have.

**Activity #3 - Blending**

*Cup each coffee provided. Create blend according to instructions with available coffees. Dial-in coffee, and create description and tasting notes.*

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#### Decaffeination

* Solvent Processes: *Uses solvent to bind with caffeine and selectively remove it from the green coffee. With direct solvents coffee is steamed to open pores and prepare it for the solvent, then are rinsed for about 10 hours with the specific solvent.*
  + Solvents used are highly volatile and vaporize at relatively low temperatures. Examples are Ethyl Acetate and Methylene Chloride(\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_).
* Non-Solvent Processes: *Uses water or supercritical CO2 to remove caffeine.*
  + E.g. Swiss Water process soaks green coffee in water, removing many flavor compounds along with caffeine. Caffeine is removed through filtration and then the solution with coffee solubles is reintroduced to new green coffee where the majority of caffeine will dissolve out but less of the rest of the flavor compounds.
  + CO2 process uses liquid carbon dioxide at extremely high pressures to selectively dissolve only the caffeine molecules and nothing else.

Decaffeination usually leaves around 3% of the original caffeine content. Tends to be easier to extract from during brewing, often prone to high extraction qualities. (Dryness, bitterness)

#### Cafe Layout and Workspace Management

**Workflow**

Equipment and tools set up for best efficiency of drink production.

* POS → Cups → Grinder+knock box → Machine → Pitcher rinser → Handoff

Identify \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ where equipment and tools necessary to complete a task or multiple tasks are grouped together.

Ensure there is adequate space for employee movement and easily accessible storage, equipment, and utilities.

**Customer Flow**

Guest movement away from the POS, towards the handoff, and then to the exit. This enables more ticket queuing.



### Grinding, Dosing, and Tamping

**Grinders**

* Motor Speed

High speed motors: More \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ produced, more static produced, usually associated with flat burrs

Lower speed motors: Less heat produced, less static produced, usually conical burrs

* Burr Size

Larger sizes will usually improve particle consistency, less changes from heat, more resistance to heat buildup. Larger size will be rated for higher average daily use, and longer lifespan.

* Burr Type
  + Conical: Generally considered to produce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ grind distribution. Less coffee retention on/between actual burrs. Faster grinding/lower RPM than comparable size flat burrs.
  + Flat: Generally considered to produce uni-modal grind distribution. More coffee retention between burrs. Higher RPM generally used, which creates more heat/friction.

**Tamping and Distribution**

Selecting a Tamper - *What to consider?*

**Diameter** - Determine the diameter size of the portafilter basket you will be using. The closer your basket matches to your tamper piston diameter, the best coverage and compression you will have across the coffee. Tampers that don’t fit precisely will have an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ring of coffee around the edge of the basket.

**Tapered/Beveled Edge** - Some tampers are outfitted with tapered or beveled piston edges to reduce instances of suction that is caused by tight fitting tampers.

**Self-Leveling** - Some tampers are outfitted with level correction to avoid distribution issues from unlevel tamping.

**Pressure Calibration** - Some tampers are outfitted with pressure calibrated springs that collapse at precise weights with the goal to provide consistent tamping \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Distribution Tools**

Tools exist to enable more consistent distribution across espresso preparation. Can potentially increase consistency across baristas. There is however a chance for a negative impact on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Bed Depth and Dose Changes**

The bed depth of the coffee will affect \_\_\_\_\_\_\_\_\_\_\_\_\_\_ rates and can potentially lead to uneven extractions.

Bed depth that is too low will give the coffee too much space to expand in the basket, negating the coffee being compressed during tamping. This will often lead to channeling due to the coffee being too “loose”

Bed depth that is too high will not give the coffee enough space to expand as gas is released during the initial stage of brewing. Water will also not be able to evenly saturate the coffee bed. Both of these issues will likely lead to uneven flow and uneven extraction. As well, if the coffee bed is so high that it touches the filter screen, damage will occur to the surface of the coffee puck, potentially having a negative impact.

Roast development, and generally bean density, will affect the mass of coffee used based on bed depth. Lower bean density will usually result in lower mass doses. Lower masses of coffee will resist changes in heat less during brewing, or “absorb” less heat from the water. This will generally lead to higher extractions.

### Extraction and Brewing

Machines have many capabilities: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, temperature, PID systems, Pre-wetting, etc.

**Temperature Stability**

Machines use PID systems to maintain \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ stability. Changes in temperature can lead to changes in extraction. Hotter water can also lead to slower flow rates.

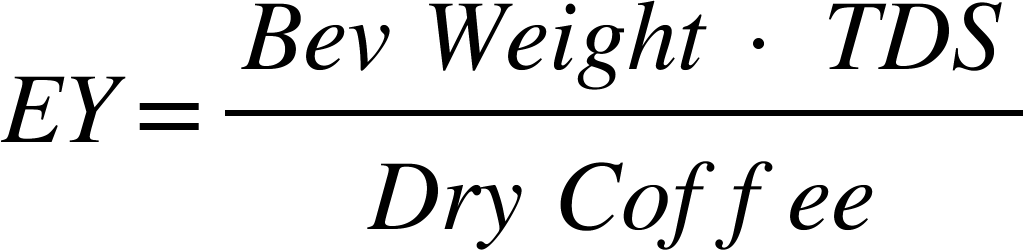
**Pressure Profiling and Pre-Wetting**

Changes in pump pressure can change the flow rate of the espresso through water being pushed through more forcefully or more gently. Higher pressures will generally extract more.

**Measuring Extraction and TDS**

TDS Meters/Refractometers

These are devices used to measure \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ levels of dissolved coffee solubles in aqueous solution. TDS measurements can be used in combination with the known brew formula to calculate average extraction estimates.



**Activity #4 - Critiquing methodology and inconsistencies**

**Activity #5 - Variable Changes and Charting Extraction**

### Milk Science

#### Heat Treatments and Homogenization

**Pasteurization** - *The process of heating milk to destroy pathogenic bacteria that cause infection and reduce spoilage bacteria and enzymes to extend the shelf life.*

**Thermization** - *Milk is heated between 135F - 154F for 15 minutes. Pasteurization at these temps does not alter the structure or taste of the milk.*

**Batch Pasteurization** - *Low-temperature-long-time, milk heated to 145F for 30 min. Causes alteration in milk protein structure and taste.*

**Flash Pasteurization** - *High-temperature-short-time, milk heated to 162F - 165F for 15 to 20 seconds. Targets Clostridium Botulinum (Botulism)*

**UHT Pasteurization** - *Milk Heated to 275F - 284F for 2 to 4 seconds. Targets Coxiella burnetii (Q-fever)*

**Homogenization** - *The breakdown of fat globules from 3-10 µm down to .2-2µm through high pressurization. Heat pasteurization also denatures cryoglobulins which tend to cause clustering of the fat globules, allowing for greater emulsion of fat globules. Non-homogenized milk tends to have separation of cream fat and liquid milk.*

#### Fat and Protein

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in milk change shape as heat is applied. This change in shape allows air bubbles (microfoam) to become trapped and keeps the foam stable for long periods of time. At higher temperatures the proteins \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_and will cause degradation of the microfoam.

There can also be other cases where proteins are damaged, resulting in less than desirable foam quality.

Fat in milk will affect the ability for the milk to create and keep foam. More fat will cause the degradation of microfoam. However, milk with too little fat will create microfoam that is too stiff and less able to be poured. It is important to latte art to have equivalent amounts of fat and protein to achieve the best balance of microfoam retention and foam liquidity. When both qualities are good, good microfoam for latte art is produced.

**Lipolysis** occurs mostly prior to pasteurization and is the breakdown of Triglycerides into Free Fatty Acids, mono-, and di-glycerides. Increasing amounts of FFAs cause decreased capacity for creating foam because they are surface-active agents.

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#### Non-Dairy Beverages

Differences in non-dairy options are a result of differences in fat and protein content. Generally there are varying amounts of compounds that make up non-dairy milk alternatives. These differences in composition affect the quality and quantity of microfoam that is created when they are steamed, usually resulting in inferior quality foam.

### Cleaning, Preventative Maintenance, and Troubleshooting

**Daily Cleaning Procedures**: Espresso Machine, Grinders, Brewers/Coffee Urns

Backflushing, using grinder cleaner, soaking coffee urns

**Common tools**: Allen key, short flathead screwdriver, detailing pick

**Preventative maintenance tasks**:

Gasket replacement

Grinder disassembly and cleaning

Changing water filters

Steam-wand rebuild

Changing drainage tubes

Adjusting pump pressure

Creating maintenance schedule for **Preventative Maintenance**

Preventative Maintenance Issues:

*What are the symptoms?*

* Water leaking from portafilters when pulling shots (Leaking gaskets)
* Steam wand low pressure (Steam wand O-rings/rebuild)
* Coffee tastes flat/chalky (Filter replacement)
* Coffee tastes stale, grinder clumping, overheating, jamming (Grinder cleaning, burr replacement)
* Low/high pump pressure (Adjust pump with tamped coffee dose in portafilter while pump running)

Tech Service Issues:

* Electrical malfunctions
* Water flow issues

Identify when an issue is fixed with common PM vs. unexpected issues that require service calls to Technicians.

#### Water Chemistry

**TDS**

TDS measurements are a gross reading of the quantity of dissolved minerals in the water. Can give you an estimation of the water’s quality and its potential for producing scale. These measurements are easily taken with the use of an electrolyzer which measures the electrical conductivity of the water.

**Alkalinity**

Alkalinity is the water’s ability to buffer acids and bases and resist change in pH values. It is determined by the availability and quantity of HCO3⁻ (bicarbonate) in the water. This is measured with a “drops kit” or titration kit. Alkalinity’s effect on coffee will be that coffee brewed with lower alkalinity will tend to taste more acidic, while higher alkalinity brews will taste flatter and duller.

**Total Hardness**

Total Hardness is the concentration of Magnesium and Calcium in the water. It is measured using a titration kit. Coffee brewed with water at higher hardness levels will have a heavier, thicker mouthfeel, and vice versa at lower levels.

**pH Value**

The pH value of the water will affect the taste of the coffee in a straightforward way. Lower pH values (more acidic) will taste more acidic. Higher pH values (more alkaline) will taste more dull, flat, and bitter.

Deciding what types of water filtration is needed will be based on the quality of water that you are starting with.

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#### Cafe Management

Managing profits around cost of beverages

* Cost of Goods
* Labor + general overhead
* Taxes

Beverage gross profit should aim to be around 75% including COGS.

**Break Even**:

When \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is greater than or equal to fixed costs including taxes. Otherwise known as the amount needed to survive.

**Managing Profit Loss**

* Spoilage
* Theft
* Waste

**Evaluating Product Suppliers**

* Quality
* Price
* Reliability