

Why The Selection OF Green Coffee Beans Can Make Or Break The Outcome Of Your Roast!

A Five-Part "Roasters Tools" Green Bean Series

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These articles were written short and to-the-point specifically for busy roasters... Enjoy!

Part I: How Green Coffee Bean "Color" Impacts the Flavor Profile of the Roast

There are many factors within the stage of picking, drying, milling and grading that can affect the outcome of green coffee bean color and the quality of the roast. The resulting bean characteristics can directly affect the cup acidity, body and flavor.

In this article we are going to focus specifically on the color of the raw beans after they are processed, graded and ready for roasting.

First, the major colors* found in caffeinated Arabica green beans include:

- Grayish-blue
- Grayish-green
- Brownish-gray-green
- Brownish-green
- Brown

*These colors are those typically used in international standard classification descriptions.

There are other colors found outside the acceptable range. These include blue beans which are usually the result of very high moisture content caused by under-drying. This type of coffee will tend to bake, resulting in a flat cup. A yellowish color is also outside the boundaries for acceptable beans.

GRAYISH-BLUE

This is the most desirable color found in high quality coffee beans. A grayish-blue color is obtained by means of sun drying after washing. During the process of sun drying the coffee is allowed to receive the heat in a gradual way, while the coffee beans are set on a drying table and the air is allowed to percolate around the beans in an even manner.

Beans dried on a flat surface would be turned often to guarantee a gradual and even drying process.

The parchment coffees which produce a grayish blue color are normally found to be intact and whole, hence free from any split and open defective beans after the drying process.

The moisture content of this type of bean will range from 8.5% to 10.5%, in both parchment form and after hulling.

After hulling and grading, coffee beans retained on screens 16, 18 and 21 are coffees of high density, strictly hard beans and reflect a white center cut in every stage of the roasting profile.

At a medium roast, beans with these characteristics will produce a darkish chocolate color (without over roasting), and slightly shiny without an oily exterior (often caused by over roasting). This is the ideal.

Properly dried beans of a grayish-blue color will give a well balanced acidity, full body and a rich flavor free from any aftertaste.

These same beans if put through a rapid drying process will give a parchment that splits open in the final drying. The same process will also affect the grain, creating a brownish tinge around the edges.

In addition, some of the beans will fade, resulting in a whitish to yellowish color and light in density. In the final analysis rapidly dried coffees have characteristics of light acidity to somewhat lacking acidity, light body and a flat flavor in the cup.

Typically, you'll find some variation of color in any coffee lot and the final analysis during cupping will always determine the best fit for your specific use.

GRAYISH-GREEN

This is another category of coffee beans which are normally found to be fairly solid in formation and of high density. Grayish-green beans are usually well dried and free from open parchment.

Beans with these characteristics are commonly found within the coffees that come from South America, Central America, Papua New Guinea and Hawaii.

Grayish-green beans at a medium roast will produce a brilliant chocolate color. The cup analysis will normally reflect a rich and smooth acidity, heavy body and a mellow flavor.

BROWNISH-GRAY-GREEN
BROWNISH-GREEN
BROWN

Washed green beans which reflect a brownish-gray-green to brown color are the coffees which usually have been picked either at stages of under ripe or over ripe. This color is also formed by scorching heat during sun or mechanical drying and from over fermentation. Old warehoused coffee is another factor that can contribute to this type of color variation.

Beans of this type will generally produce a very light acidity, light body and, normally, overly dominant flavors which can include any combination of woody, earthy, fermented, nutty, slightly harsh, bitter, greenish, grassy, potato, medicinal, etc.

These characteristics are often masked by a very dark roast to add body and deaden strong undesirable flavors.

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Part II: How Green Coffee Bean "Formation" Impacts the Flavor Profile of the Roast

As a coffee professional you probably read everything about coffee roasting you can get your hands on. Even so, one thing I've found that seems to be in short supply is information on green coffee bean analysis and how the flavor profile of the roast is affected by the physical characteristics of the beans--Very useful information for coffee buyers and roasters.

One of our goals, here at Specialty Coffee Auctions, is not only to help you source Specialty coffees direct from origin, but to help you maximize the best qualities in the beans you purchase during the roasting process in order to achieve your vision. We hope you'll find this article of value.

While working as a professional coffee taster and quality controller with several of the top coffee companies in Kenya, cupping hundreds of coffees every day for many, many years, I was able to prove to myself how certain physical characteristics in the formation of the green beans consistently produced very specific and identifiable qualities in the profile of the resulting roast.

In this article we are going to share our experiences as to how and why flaws in the physical formation of green coffee beans affect the cup and, thereby, help you with your green bean purchases.

There are many factors within the various stages of plant husbandry and harvesting that cause these flaws in green bean formation which we'll identify in this article. More important, we'll speak to how these formation flaws can directly affect cup acidity, body and flavor.

To begin, the major formation flaws found in green coffee beans prior to roasting include:

- Shriveled
- Shriveled
- Boat Shaped
- Ragged
- Hollow or Shell
- Multiple Center Cuts

Since a number of these formation flaws tend to occur together in the same beans, we're going to group those flaws that have a similar cause and effect.

SHRIVELED, THIN EDGED AND BOAT SHAPED

Green beans that are shriveled are deformed beans, usually small, irregular or immature in formation; often with multiple center cuts. Thin edged and boat shaped are easily identified as the name of the flaw indicates.

Beans with these formations are lacking in nutrition, including Chlorogenic acid and magnesium during the growth process. Causes also include drought or lack of sufficient irrigation. As a result, these beans will normally be whitish to brownish-yellow in color.

The beans will sometimes open during roasting and almost always produce a soft roast. In addition, these flaws in formation often cause the beans to break during the roasting and blending process.

As a result, the roasted beans will tend to give you a smoky taste because they require over roasting to compensate for the poor quality pale beans.

More often than not, they will also have excessive hay and grassy flavors. During cupping, you'll also experience a flat cup, a harsh full body and lacking in acidity.

After hulling and grading, coffee beans retained on screens 16, 18 and 21 are coffees of high density, strictly hard beans and reflect a white center cut in every stage of the roasting profile.

Note: The excessive presence of shriveled beans will result in a high percentage of moisture loss (20% plus) during roasting.

RAGGED

These beans are not smooth, but instead have a rough and corrugated appearance. This is caused by overbearing, drought-affected cherries and immaturity while ripening, often leading to a yellow cherry when fully developed.

You'll notice that these beans will also have a sticky sliver skin which

usually can't be completely removed during the milling process.

Roasted ragged beans will result in a pale color with a lot of chaff, partially because of the sticky silver skin. The result will be a soft roast which is more permeable and, together with the chaff, will end up after grinding with very fine powdery fragments in the brewed coffee, giving a heavy and viscous body in the cup with many impurities.

HOLLOW OR SHELL

This formation flaw is sometimes caused by deficiencies of various minerals in the soil, but with a generous water supply, causing the tree to produce large beans that mutate.

This condition can also be caused when two beans are growing together followed by one that dies while the other continues to grow. These are also commonly referred to as shells, because of the resulting formation.

The resulting roast and cup of hollow or shell beans is very similar to that found with shriveled, thin edged and boat shaped beans, as described above.

MULTIPLE CENTER CUTS

These beans are identified by having two or more center lines located right next to each other or in a stepped pattern. This formation is usually found in shriveled and ragged beans, but can also be found in full solid beans.

The factors causing multiple center cuts include either overfeeding in the case of solid beans or because the coffee trees had become drought affected or from lack of nutrients in the case of shriveled, ragged and deformed beans.

Still, too many multiple center cuts, all other things being acceptable, will cause an uneven grind after the roast, negatively affecting the body in the cup.

CONCLUSIONS

High quality beans will not contain formation flaws, whereas most coffee beans that contain these flaws will remain pale and under roasted at a normal roast.

As a result, beans with these flaws require over roasting, leading to a high percentage loss at an average of 17%-20% or more. This loss in weight should be taken into account when buying green coffee and measured against higher quality alternatives.

Over the years, we've found that green bean quality and its resulting cup is not necessarily a result of origin, but primarily a result of superior plant husbandry, and proper drying, milling, grading and sorting, enabling each country to produce top quality coffees with ideal characteristics for that region.

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Part III: How The "Moisture Content" In Wet Processed Arabica Beans Affects the Flavor Profile of the Roast

In this article about the moisture content of green coffee beans, you'll find out why the ideal moisture content is so important to developing a roast that will deliver a high quality and flavorful cup.

Also, why what you buy, roast and sell is not just about taste...but, literally, can help you avoid poisoning your customers!

WET PROCESSING

In wet processing, coffee beans are harvested from the farm by selectively picking the ripe red cherries. These beans go through several stages.

The first major process occurs at the factory, where the beans are separated ripe from unripe, de-pulped to remove the outer cover, and soaked in a fermentation tank to remove the remaining mucilage.

After an adequate period of time, the coffee is soaked and thoroughly washed to remove the covering sugars and prepare for drying.

The wet beans are fully dried and taken to the hulling plant, where the parchment is removed. The ungraded beans are then put through the polisher to remove the sticky silver skin.

Next, the clean beans go through a process where they are graded by screen size. For improved quality, the graded coffee is often passed through a density separator to separate heavy beans from lights.

THE SIX STAGES OF DRYING

At the factory, after removing the outer covering (outer skin & mucilage/fruit) the parchment coffee beans will have a moisture content of 55%.

During the process of drying coffee, six stages are considered to be of prime importance:

1. Skin drying (outside moisture); moisture content of the bean goes from 55% to 45%.
2. White stage (of the bean inside the parchment); moisture content goes from 44% to 33%.
3. Soft black stage (bean is now very elastic); moisture content goes from 32% to 22%.
4. Medium black stage; moisture content goes from 21% to 16%.
5. Hard black stage (bean is very hard and goes from black to the natural color according to the quality of the bean); moisture content goes from 15% to 12%.
6. Fully dried parchment coffee before hulling; moisture content of the bean goes from 11% to 10%.

Throughout this process, the beans are in parchment form. However, after hulling when the parchment is removed, the green coffee beans should maintain the final moisture content as shown above in category six.

At the Coffee Research Foundation in Africa, experiments were conducted to test the suitability of mechanical drying at each stage in the process.

The results revealed that at stages 1, 2, 4, 5 and 6, mechanized drying had positive results, with no material affect on the quality. But, at stage 3, sun drying was found to be mandatory in order to maintain high quality beans.

WHY 9.5-10.5% MOISTURE CONTENT IS OPTIMAL

Because raw coffee beans are very susceptible to volatile environmental changes, it's been proven that a moisture content between 9.5% to 10.5% enables the beans to be resistant to negative conditions that can affect the quality (Ref: Coffee Research Institute).

During ocean transport, coffee with ideal moisture content will normally gain 1% and then go back to its original level, while still maintaining its

quality and color.

If the moisture content is too high, 11%+, the beans will gain 1.5+% which can cause the beans to become moldy, fade and lose color. As these fungal laden beans dry, they will retain the green water damage and mold-based toxins, resulting in musty and woody flavors in the roast.

An increase in moisture during transport or storage can cause the beans to become moldy, change color and become dark and mottled.

When this occurs, a chemical reaction takes place resulting in the beans becoming toxic with Ochratoxin A (OTA). Often these molds are inside the beans and not readily visible to the naked eye.

Ochratoxin A (OTA) is a mycotoxin produced by fungi and occurs naturally in moldy raw coffee beans. It's been found to be highly toxic to the kidneys and potentially carcinogenic in humans, as well as having genotoxic properties.

In coffee, it can be found in raw coffee beans that have not been dried or stored properly. It can also be found in warehoused coffee that has been stored for long periods of time.

****More important to the coffee roaster is that Ochratoxin A (OTA) can also be found in brewed coffee and isn't completely eliminated when the beans are roasted!****

IMPACT OF MOISTURE CONTENT ON THE ROAST

Roasting coffee beans with the ideal moisture content (9.5% to 10.5%) will typically give a dark chocolate color at a medium roast, with a percentage weight loss between 8% and 12%.

During the process of brewing, beans of this type will give you a proper extraction which will represent balanced acidity, body and flavor.

Beans with a high moisture content (11+%), usually take longer to roast, but more important, the beans will first "bake" prior to roasting.

This baking process creates a light colored, soft bean, which forces over-roasting, giving a light acidity, full body and negative flavors in the cup.

Beans that have been partially baked become soft and permeable. After grinding these beans will give an uneven grind that is highly solvent in water, creating dissolved impurities that build excessive high body in the cup. During this process, the beans will lose desirable acidity and natural flavors.

Brewed coffee from high quality beans with proper moisture content will be clearer to the eye, more like a thick natural honey color because of having fewer impurities. This type of coffee usually has a sweet balanced cup with good acidity, quality and taste.

WHAT CAN YOU DO?

1. Always check the moisture content of the sample during cupping before you buy and look for coffees with target moisture content from 9.5% to 10.5% as a general guideline.
2. Keep an eye out for light colored and mottled colored beans, and internal molds containing Ochratoxin A, which result in soft beans that will first bake, leaving dissolved impurities in the cup.
3. Store green coffee in the original bags in a low moisture environment where there is air circulation. Quality green coffee at the ideal moisture content should stay relatively fresh for up to twelve months in the original bags.

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Part IV: Twelve Green Coffee Bean "Defects" That Will Damage Your Roast

Continuing with our Green Bean Series, this month we're going to take on defects; their cause, how to identify them and the effect they have on the roast.

Roasters who consistently purchase strictly top grade premium coffees may have only rarely been confronted with defects, while the majority of roasters run across them much too often, even when presented with what is being sold as "Specialty" grade coffees.

The fact is, any one of these dozen defects will negatively affect the quality and alter the taste of the coffee you're producing. These defects are both identifiable and preventable.

The defects in this article are different than the "formation" defects we talked about in a previous article.

With that in mind, we aim to give you a very straightforward, to the point identification of what these defects look like, their causes, and how they can affect the profile of your roast.

THE TWELVE KEY DEFECTS TO LOOK OUT FOR:

1. Faded Beans
2. Amber Beans
3. Coated Beans
4. Green Water Damaged
5. Pulper Damaged
6. Insect Damaged
7. Immature Beans
8. Foxy Beans
9. Triple Center Cuts
10. Stinkers
11. Over-Fermented
12. Diseased

FADED BEANS

Faded beans can be a result of either over drying or absorbing excessive moisture, depending on the environment. Either way, faded beans have a low resistance to environmental factors.

The effect on the roast is that they give a dull roast regardless of the roasting profile. The result is a soft bean with musty and woody flavors in the cup. And, the percentage moisture loss will be very high. The color of these beans is pale, whitish brown.

Normally, they result from beans that have a high moisture content (11% - 13%) and when stored in a warehouse, they'll tend to dry out. In the process of drying out, and because they are not in contact with direct sunshine, these beans tend to fade.

Instead of drying, these beans are actually rotting and developing molds inside. It's these molds that cause the beans to dry excessively, producing their pale to whitish brown color.

In addition, during the drying of wet or dry processed beans, the coffee can be negatively affected if not properly exposed to sunshine at the appropriate stage in the drying process.

Another cause is when coffee has been over-hulled using a hammer mill. In this case, the beans will come out with a dull color as a result of the outer cells being bruised and microscopic dust permeating the outer layer of the beans.

One final factor that can contribute to the fading of coffee is from older coffee that has been kept in a warehouse for two to three years or more, causing the beans to dry out, develop molds and other negative consequences.

AMBER BEANS

These beans have a bright shiny gold color. The cause is due to mineral deficiencies in the soil (including iron).

When you roast these beans, the cup will be lacking in acidity, with a flat harsh body and a bitter flavor. Also, the roast produced by these beans will be very dull in color.

COATED BEANS

These beans have a sticky silver skin caused by either overbearing or from being drought affected. The characteristics of these beans look whitish, rough and display microscopic lines from the silver skin.

In the process of roasting, you'll experience soft beans with excessive chaff. The roast can result in negative effects in the cup, including excessively high grassy, hay, earthy, woody, greenish and potato flavors.

GREEN WATER DAMAGED

These are fully processed beans that, when hulled, get in contact with water where a chemical reaction takes place, turning the beans a greenish color. This situation results in the beans becoming moldy and toxic.

PULPER DAMAGED

In the process of going through the pulping machine, coffee beans can get stuck, creating excessive pressure which causes the beans to become wounded.

These wounded beans will burst and then begin to slightly oxidize, become contaminated with water and over ferment, causing molds which result in earthy, leather and musty flavors.

In addition, the roasted beans will be uneven; some will be split, while others will appear round and mixed together with the solid beans.

INSECT DAMAGED

Berry moths inject the coffee cherry in the process of laying eggs, creating a black needle-like hole.

Antestia bugs damage beans causing them to bruise, which produces rough black to yellow-like colored spots.

Beans with these types of insect damage will give a soft roast and the beans will tend to shrink, creating dominant musty, alkaline and salty flavors.

IMMATURE BEANS

Picked under-ripe, often as a result of overbearing and drought affected conditions, the characteristics of immature beans include a rough surface and greenish color with a sticky silver skin and will usually have thin edges.

The roast will be very dull, with open center-cuts, soft beans and subsequently produce no acidity, heavy body, with greenish and grassy flavors.

These beans can also lead to Quakers in the roast; visible only after roasting by their pale appearance and flat peanut butter taste. Avoiding the purchase of immature beans is the best way to avoid contamination by these defective beans.

FOXY BEANS

As you might imagine, the name comes from the color of a red fox.

This rusty-red color is generally brought about by the beans being over-ripe. These beans tend to have a dead embryo and will give you fruity fermented and nutty flavors.

TRIPLE CENTER CUTS

These are deformed beans caused by malnourishment due to either drought affected conditions or lack of minerals, creating ragged beans with multiple center cuts.

During the roast, these beans can split open at their double or triple center cuts. They are fragile, soft and very permeable; which will over roast, creating a heavy body, a flat cup and a smoky, burnt taste.

STINKERS

Stinker beans can have a normal formation, but have a dead embryo and are yellow in color caused by over-fermentation and/or over-ripe. If crushed, broken or cut open when raw, they put off an odor that's very unpleasant.

Even one or two stinkers in your roast can ruin the whole batch and give you a foul cup.

OVER-FERMENTED

These beans look soiled and have a tobacco color.

When roasted you'll get a pulpy, sour flavor and unclean, dirty cup; with a smell of rotting flesh or a cow shed aroma. If only slightly over-fermented, your roast may give sour and onion flavors.

DISEASED

These defects are brought about by the coffee being affected by various diseases like CBD (Coffee Berry Disease) and Leaf Rust.

When disease strikes a coffee farm, the mother plant will produce beans that are premature. This will affect the berry before it ripens, usually at the milk stage, and the beans will either not develop at all or only partially develop, with a very small berry or nonexistent berry inside the parchment within the cherry.

The deformed part of these beans looks somewhat brownish to very dark brown in color, often with deformities that resemble a chipped off piece where the bean is left with dark brown marks which go deep into the bean. The deformed part of these beans is generally flaky and ragged in formation.

These small diseased beans will be only partially developed, but can still be harvested and end up mixed with other beans of normal quality, then sold in the marketplace.

SO, WHAT DO YOU DO?

- First, avoid these nasty defects when you're purchasing green coffee whenever possible.
- Second, educate your customers about the tastes inherent in a quality cup. An uneducated palette can even get accustomed to over-fermented, moldy, musty, peanut-buttery and other flavor defects that are actually toxic when ingested into the human body!
- And... continue your quest to create the perfect roast!

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Part V: The Three Keys To Producing Profitable High Quality Roasted Coffee-Hint: It's In The Beans

Have you ever seen the expression on the face of someone who, for the first time, gets a taste of really good flavorful high quality coffee?

You almost always hear the universal, "Wow, ...what kind of coffee is this?"

Then, the unwary consumer goes shopping for that particular type, country, region, or quality and has a disappointing experience trying to find something that can match that same flavor and aroma.

You've most likely observed or experienced this yourself. In fact...

Just the other day, I received a newsletter from a roaster who touted a special exotic African coffee, rated 97 points, which he offered for sale at \$20.95 for 12oz, plus about a third more for shipping.

Well... I like to see what people are selling, so I thought I'd like to get a taste of that, ordered a 12oz bag and, after it arrived, promptly brewed a pot with my favorite Bonjour French press... How'd it taste?

Flat!! Completely flat taste...Almost no flavor at all. And, the roast date was from just a week before.

So... What went wrong?

Well... It could have been several different things, from over or under roasting, poor packaging, old inventory, etc. (i.e., a roaster issue), but from the look of the beans, the quality was such that they were not able to withstand the rigors of transport, storage or roasting.

The coffee may have cupped good at origin, but after roasting... it failed.

The main defense against this type of situation, is to begin with high quality beans, resulting from a combination of good plant husbandry, picking, washing, drying, milling, grading, transport and storage.

At any one of these stages, the beans can degrade, affecting the ultimate quality of the roasted coffee for the consumer, even if it passes the test in your cupping room.

So... what can you do?

KEY NUMBER ONE: Choose High Quality Beans

There are a lot of myths out there, but high quality beans are able to withstand environmental conditions much better and continue to provide a superior cup that will last longer over time, whereas average to poor quality beans may taste acceptable at one point in the process, but degrade quickly thereafter.

In short, dense beans free from defects and other faults, uniform in size and formation, with a proper moisture content and a balanced acidity, will maintain the flavor profile after the roast in a more consistent and enduring manner than inferior beans.

Why? Because these types of beans are more resistant to oxygen degradation...

High quality coffee beans will resist going flat following the degassing process after roasting, and retain its taste and aroma for a much longer period of time.

KEY NUMBER TWO: Understanding The Characteristics of High Quality Beans

Understand the characteristics of high quality beans and purchase those with as many of the following traits as possible. Each of these has a cumulative, positive effect on the taste profile of your roast:

- High percentage free from major defects.
- Moisture content between 8.5% and 10.5%.
- Color, generally grayish-blue or grayish-green with bluish tint.
- Dense beans, uniform in shape and size.

- Straight one-line center cut.
- Free from sticky sliver skin.
- Gives a better cup at a medium roast than when very dark roasted, even when your intent is to create a dark roast.
- Brilliant, shiny appearance after roasting, but not from an oily external film.
- Color and cup profiles will not change much during storage, from six to twelve months.

KEY NUMBER THREE: Enhancing Your Return On Investment

High quality beans maintain a superior return on investment in tangible ways.

When creating blends of superior quality, beans with the attributes mentioned above will typically be much more flavorful with regard to aroma, body and taste, requiring a smaller percentage used to achieve your desired flavor profile.

Also... the beans will roast faster as a result of having an ideal moisture content. And, you will experience a percentage loss during roasting of only 8% - 12%, verses 17% - 20% with lower quality beans.

Even as a single origin coffee, you can maximize the best combination of roast profiles to use with beans having different characteristics, even from the same origin (or even the same variety) and blend them together to create a very unique and fantastic single origin or single estate roasted coffee.

More on roasting & blending in future SCAuction eNews articles. To ensure you don't miss any (if you're not already signed up) go to: <http://www.specialtycoffeeauctions.com/SCAeNewsSignUp.cfm> .

And... you'll have a better chance of maintaining customer loyalty and repeat sales when the flavors in your coffee don't dissipate as readily after packaging over a reasonable period of storage.

TAKE CARE OF YOUR COFFEE SAMPLES

One thing to consider when storing coffee samples is that, over time, without proper storage your coffee samples can change dramatically, even within days.

In our experience, samples delivered and stored in plastic bags can taste much different at a later date than the same coffee cupped at origin or received in the mail.

This is caused by micro-climate changes as a result of moisture that accumulates inside the sample bag and on the beans, even when not visible to the human eye. You can prove this to yourself through a simple test:

TRY THIS EXPERIMENT

Take several 200 gram samples of high quality very flavorful coffee with good balanced acidity and put them in sealed plastic bags. Keep them stored without opening for two weeks at room temperature. After two weeks, cup them again and compare and contrast the results against a matched sample kept in porous natural fiber or paper bags... You decide.

To preserve your green bean samples as close to the original as possible, we've found that, when stored in natural fiber or paper bags, you'll experience a very similar cup as you did during your first cupping... even up to six months with high quality beans.

Our green coffee sourcing business, Intellidon Origin Direct, has had great results using this type of samples storage. We think you will too.

All the best... in your quest for the perfect roast!

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