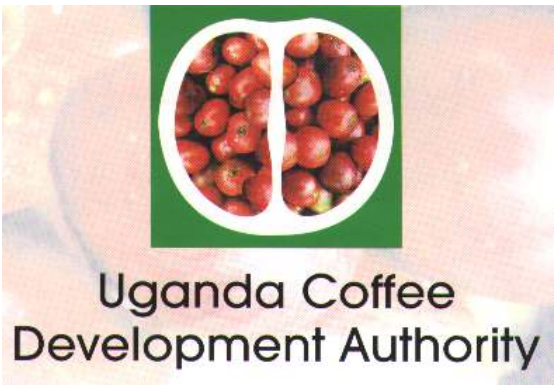
Fine Robusta Standards and Protocols

A compilation of technical standards, evaluation procedures and reference materials for quality-differentiated Robusta coffee



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Definitions and Abbreviations

Agtron	Maker of spectrophotometer analysis devices used to evaluate and quantify the color of roasted coffee
Arabica	Coffea arabica; the primary species of coffee commercially cultivated for consumption, accounting for approximately 60% of worldwide production.
Arabusta	Hybrid of Arabica and Robusta coffee
CBB	Hypothenemus hampei; a coffee pest known as the Coffee Borer Beetle or Broca del Café
CBD	Coffee Berry Disease; a pathogen affecting coffee caused by Colletotrichum coffeanum
Conilon	A Brazilian synonym for Robusta coffee
CQI	Coffee Quality Institute; an independent nonprofit cooperation originally established by the Specialty Coffee Association of America that provides specialized technical and training services that improve the quality of coffee and ensuing quality of life for coffee producers.
Die back	A condition in a plant in which the branches or shoots die from the tip inward, caused by any of several bacteria, fungi, or viruses or by certain environmental conditions
Equivalent Defect	The number of imperfections that when combined are recorded as one Full Defect
Fine Robusta	Robusta coffee that is free of primary defects and exhibits unique and desirable characteristics unique to a microclimate of origin
Full Defect	A full defect is composed of one or more individual defective beans, corresponding to the impact each type of defect has on the cup character
ICO	International Coffee Organization; established by the United Nations in 1963, the ICO is a intergovernmental body of coffee producing and consuming nations established to administer the International Coffee Agreement (ICA), an instrument for development cooperation.
Peaberry	A coffee cherry in which one single coffee seed (bean) develops rather than two
Ochratoxin A (OTA)	A food toxin and possible carcinogen associated with contaminated grain and pork, as well as coffee and grapes.
Primary Defect	Category 1 full imperfections that impact the cup character of coffee
Quaker	An unripe bean that appears pale when roasted with a cereal or bitter flavor
Robusta	Coffea canephora – the secondary species of coffee commercially cultivated for consumption.
SCAA	Specialty Coffee Association of America; world's largest coffee trade association with over 3,000 company members
Secondary Defect	Category 2 full imperfections that impact the appearance of coffee but not necessarily cup character
UCDA	Uganda Coffee Development Authority; a public authority established in 1991 by an act of Parliament, UCDA conducts research, promotes farming, sets and oversees quality standards and markets Ugandan coffee abroad to maximize value and income for the country's farmers

Introduction

Robusta coffee has historically been considered inferior to Arabica coffee and subsequently not enjoyed the same price premiums and motivation for quality improvement seen in the specialty Arabica market. Much of Robusta's poor market reputation, however, is as the result of correctable defects in cultivation and processing rather than qualities inherent to the species.

As proven by success in the specialty Arabica market, differentiation of fine quality Robusta may lead to increased consumer value and consumption, as well as better earnings for Robusta coffee farmers and provide the incentive needed for further advancement of the greater coffee industry.

This document is the coffee industry's first comprehensive guide of compiled standards and procedures that define Fine Robusta coffee, a class of defect-free Robusta equivalent to Specialty Arabica, in which coffees exhibit unique and desirable characteristics resulting from a combination of varietal genetics, microclimate of origin, accentuated by best cultivation and processing practices.

Acknowledgements

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Botanical information[1]

Coffee is a member of the botanical family Rubiaceae, which has some 500 genera and over 6,000 species. Most are tropical trees and shrubs that grow in the lower story of forests. Other members of the family include gardenias and plants that yield quinine and other useful substances, but Coffea is by far the most important member of the family economically.

There are probably at least 25 major species of coffee, all indigenous to tropical Africa and certain islands in the Indian Ocean, notably Madagascar. Difficulties in classification and even in designation of a plant as a true member of the Coffea genus arise because of the great variation in the plants and seeds. All species of Coffea are woody, but they range from small shrubs to large trees over 10m tall; the leaves can be yellowish, dark green, bronze or tinged with purple.

The two most important species of coffee economically are Coffea arabica (Arabica coffee) - which accounts for over 60 percent of world production - and Coffea canephora (Robusta coffee). Two other species are grown on a much smaller scale: Coffea liberica (Liberica coffee) and Coffea dewevrei (Excelsa coffee).

Comparison of Arabica and Robusta Species[2]

	Arabica	Robusta
Date species described	1753	1895
Chromosomes (2n)	44	22
Time from flower to ripe cherry	9 months	10-11 months
Flowering	after rain	irregular
Ripe cherries	fall	stay
Yield (kg beans/ha)	1500-3000	2300-4000
Root system	deep	shallow
Optimum temperature (yearly average)	15-24° C	24-30° C
Optimal rainfall	1500-2000 mm	2000-3000 mm
Optimum altitude	1000-2000 m	0-700 m
Hemileia vastatrix (coffee leaf rust or roya)	susceptible	resistant
Koleroga	susceptible	tolerant
Nematodes	susceptible	resistant

[1] *International Coffee Organization*. Nov. 2014 http://www.ico.org/botanical.asp?section=About_Coffee

[2] *International Coffee Organization*. Nov. 2014 http://www.ico.org/botanical.asp?section=About_Coffee

Tracheomycosis	resistant	susceptible
Coffee berry disease	susceptible	resistant
Caffeine content of beans	0.8-1.4%	1.7-4.0%
Shape of bean	flat	oval
Typical brew characteristics	citric acidity	bitterness, full-bodied
Body	1.2% avg	2.0% avg

Coffea canephora - Robusta coffee

The term 'Robusta' is actually the name of a widely grown variety of this species. It is a robust shrub or small tree growing up to 10 meters in height, but with a shallow root system. The fruits are rounded and take up to 11 months to mature; the seeds are oval in shape and smaller than those of C. arabica. Robusta coffee is grown in West and Central Africa, throughout South-East Asia and to some extent in Brazil, where it is known as Conilon.

Plant breeding[3]

Coffea arabica

C. arabica is a tetraploid (44 chromosomes) and is self-pollinating. There are two distinct botanical varieties: arabica (typica) and bourbon. Historically, typica was cultivated in Latin America and Asia, whereas bourbon arrived in South America and, later, East Africa via the French colony of Bourbon (Reunion). Because C. arabica is self-pollinating, these varieties tended to remain genetically stable. However, spontaneous mutations showing desirable characteristics have been cultivated in their own right, as well as being exploited for crossbreeding purposes.

Coffea canephora

C. canephora is diploid and self-sterile, producing many different forms and varieties in the wild. The identification of cultivars is confused, but two main forms are recognized:

- 'Robusta' - upright forms
- 'Nganda' - spreading forms

[3] *International Coffee Organization*. Nov. 2014 http://www.ico.org/botanical.asp?section=About_Coffee

Arabica / Robusta hybrids

Coffee has been selectively bred to improve characteristics of growth and flowering, yield, bean size and shape, cup quality, caffeine content, disease resistance and drought resistance. Crosses between Arabica and Robusta aim to improve Arabica by conferring disease resistance and vigor or to improve the cup quality of Robusta.

- Hibrido de Timor is a natural hybrid of Arabica x Robusta which resembles Arabica coffee and has 44 chromosomes.
- Catimor is a cross between Caturra and Hibrido de Timor and is resistant to coffee leaf rust (Hemileia vastatrix).
- A new dwarf hybrid called Ruiru Eleven, developed at the Coffee Research Station at Ruiru in Kenya, was launched in 1985. Ruiru 11 is resistant to coffee berry disease and to coffee leaf rust. It is also high yielding and suitable for planting at twice the normal density.
- Icatu hybrids are the result of repeated backcrossing of interspecific Arabica x Robusta hybrids to Arabica cultivars Mundo Novo and Caturra.
- Arabusta hybrids are fertile interspecific Fl hybrids from crosses between Arabica and induced auto-tetraploid Robusta coffee.

Standard references

Clifford M.N. and Willson K.C. (Editors) - Coffee; botany, biochemistry and production of beans and beverage. London, Croom Helm, 1985
Wrigley G. - Coffee. London, Longman, 1988

Green Coffee Standards

Grades

Fine Robusta
To be considered *Fine Robusta*, green coffee shall have zero (0) primary defects and no more than five (5) secondary defects sample.

Premium Robusta
To be considered *Premium Robusta*, green coffee shall have no more than eight (8) combined primary and/or secondary defects sample.

Off-Grade Robusta
Coffees containing more than eight (8) combined primary and secondary defects per sample shall be considered commodity or off-grade coffee.

Sample Color
Samples must be blue, blue-green or green in color to be considered Fine Robusta.

Odor
Samples must be free of all foreign (non-coffee) odors to be considered Fine Robusta.

Samples

Sample Size
Each green coffee sample shall be exactly 350g.

Moisture Content
Moisture content must be within 10-12% for fully washed coffee and 10-13% for natural processed coffee.

Bean Size
Bean size must not deviate more than 5% from contract specification, measured by retention on traditional round-holed grading screens.

Grading Environment

Lighting
When grading green coffee, the light level on the tabletop and grading mat shall be full spectrum and at least 4000 Kelvin (K) / 1200 Lux (lx) / 120 foot-candles (fc).

Surface
The green grading surface must be a black grading mat of no less than .18581m^2 (2 ft^2).

Green Grading Protocol

Fine Robusta Classification System

This Fine Robusta green grading protocol is based on the UCDA Fine Robusta coffee classification system and corresponding handbook. Any coffee imperfection not found in the classification handbook, shall not considered a defect for purposes of evaluation.

Principles

- Imperfections are recognized as either Primary (Category 1) defects or Secondary (Category 2) defects
- Only full equivalent defects are used when determining the grade of green coffee, as calculated using the Table of Equivalent Defects found in this document
- The number of imperfect beans identified for each calculation of equivalent full defects must be recorded
- Fine Robusta samples must have zero (0) Category 1 full defects and no more than five (5) Category 2 full defects
- Premium Robusta samples must have no more than eight (8) combined Category 1 and Category 2 full defects
- Grading requires a 350g green coffee sample
- Imperfections must appear similar to and meet the written criteria shown in the Fine Robusta defect handbook in order to be classified a defect
- Defect count must be recorded in whole numbers; fractional number or decimals are not acceptable
- In beans containing more than more than one observed imperfection, only the more severe by Category, then Equivalent Defect shall be recorded

Green Grading Form

Proper use of the Green Grading Form requires each grader to:

1. Write his or her name, date and the sample identification code number in the field provided
2. Clearly specify a grade of the coffee where provided on the form stating one of the following:
    - Fine Robusta
    - Premium Robusta
    - Off Grade
3. Show all calculations used to determine the number of Equivalent Defects
4. Identify the total number of Category 1 and Category 2 defects in the provided fields
5. Evaluate and categorize the color of each sample as blue, blue-green, green, greenish, yellow-green, pale yellow, yellowish or brown.
6. Evaluate each sample for foreign odor

Green Coffee Color Assessment

Assessment should be performed in an area away from direct sunlight or other bright artificial illumination. A tabletop light fixture should provide the light projected on each sample. The procedure requires a minimum of 180g from each 350g sample.

Required Equipment

- Level work-surface (table) at least 2'L x 2'W (600 mm x 600 mm)
- 42-watt full-spectrum fluorescent tabletop fixture
- Coffee bean tray
- Flat-black poster board / 2' x 2' (600 mm x 600 mm)
- Wooden straight-edge (ruler) approximately 12" (300 mm) long

Procedure

1) Align the black poster board along the forward edge of the table
2) Place the base of the light fixture along the edge of the poster board furthest away from the forward edge of the table
3) Adjust the fixture head so that it is perpendicular to the tabletop
4) Turn the light fixture on and at the brightest setting at least 5 minutes prior to use
5) Overfill the deep side of the bean dish with the green coffee to be evaluated. Use the flat side of the straight-edge (ruler) to displace excess coffee and level the top surface so that it is even with the edge of the dish
6) Place the dish containing the sample on the poster board, so that it is centered directly under the lamp head

   Note: If the sample is being compared to a second reference sample, both the sample and the reference must have the same surface area and shape. Place both the sample and the reference so that they are side-by-side and equally positioned under the lamp head.
7) Evaluate the sample(s) by adjusting your position so that your eyes are approximately 16" (400mm) above, and 16" (400 mm) away from the top surface of the sample(s).

Green Coffee Defects

Defects are categorized as Primary (Category 1) and Secondary (Category 2)

Primary Defects

Primary (Category 1) defects direct impact the cup character of coffee. These defects include: Full Black, Full Sour, Fungus or Mold Damage, Foreign Matter, Whole Dried Cherries or Pods and Severe Insect Damaged beans.

Secondary Defects

Secondary (Category 2) defects impact the appearance of coffee but not necessarily its cup character. These defects include: Partial Black, Partial Sour, Slight Insect Damage, Broken, Cut and Chipped, Immature, Withered, Shell, White or Chalky, Floater or Spongy, Parchment covered beans or Husk pieces.

Full Defects

A full defect may be either Primary or Secondary and is composed of one or more single defects corresponding to the impact each type of defect has on the cup character.

Equivalent Defects

The ratio of equivalent defects determines the number of imperfect single beans of any type that when combined are recorded as one Full Defect.

Table of Equivalent Defect Ratios

Primary Defects	Full Defect Threshold
Full Black	1
Full Sour	1
Dried Cherry or Pod	1
Fungus or Mold	1
Foreign Matter	1
Severe Insect Damage	5

Secondary Defects	Full Defect Threshold
Partial Black	3
Partial Sour	3
Immature	5
Withered	5
Floater or Spongy	5
Chalky White	5
Broken, Chipped or Cut	5
Parchment Bean	5
Shell	5
Hull or Husk	5
Slight Insect Damage	10

Green Coffee Defect Guide

Full Black / Partial Black

Español: Negro completo / parcial

Français: Fève noire / Fève demi-noire

Full Black

Partial Black

Full Black is a Primary (Category 1) defect: 1 black bean (> 50% damaged) = 1 full defect

Partial Black is a Secondary (Category 2) defect: 3 partially black beans (< 50% damaged) = 1 full defect

Black beans are identified by an opaque color; however, Robusta immature beans tend to oxidize and grow dim -- from bright green to grey-greenish, grayish, gray-brownish, dark brown- blackish and finally deep black. As a result, you must assess whether or not coloring continues beneath the skin. If only the skin is dark, the bean is classified immature. If the bean itself is discolored then it is either a partial or full black defective bean. See also IMMATURE, UNRIPE

Cup:	moldy, soil, ferment, stinker, fishy and or phenolic taste
Consideration:	Ochratoxin A (OTA) risk
Cause(s):	**AGRICULTURAL:** Blackening may result from *die back* oxidation of green beans, disease-related bean injury (CBD, anthracnose, etc.), insect damage and / or frost. In most cases, pigmentation is associated with micro-organism activity (aerobic and anaerobic over-fermentation)
Remedies:	**AGRICULTURAL:** Prevent the development of black beans with good plant nutrition and moisture, proper aeration and drainage. Selectively pick ripe cherries and always avoiding contact with soil, contaminated tools or harvesting utensils. **PROCESSING:** Black beans begin as injured or contaminated beans and are usually slightly less dense than unaffected beans, therefore may be removed by screening and density sorting. The most effective method is to remove using an electronic color sorting machine or manual (hand) sorting.

Full Sour / Partial Sour

Español: Agrio o fermento completo / parcial

Français: Fève sure / Fève demi-sure

	
Full Sour	**Partial Sour**

Full Sour is a Primary (Category 1) defect: 1 sour bean (> 50% damaged) = 1 full defect

Partial Sour is a Secondary (Category 2) defect: 3 partially sour beans (< 50% damaged) = 1 full defect

Sour beans are recognized by a yellow or yellowish-brown to reddish-brown color and sometimes-waxy texture. It is often possible to see a dark or black spot (sometimes hollow) in the tip of the seed, which represents a dead embryo. When cut or scratched, a sour or vinegar-like smell is released. Do not confuse sour beans with amber or foxy beans, which are only discolored on the surface and not considered defective.

Cup:	Varies depending on the degree of bean fermentation: when slight, partially sour beans may exhibit pulp, sour and mellow flavors. When strong, full sour beans may produce biting and pungent sourness, ferment, rotten fruit, onion, sweat, rancid, foul and stinker tastes.
Consideration:	Affects aroma and physical appearance of the green beans.
Cause(s):	**AGRICULTURAL & PROCESSING:** Sour beans are caused by the death of its internal embryo, which may result from over-fermentation (extended microbial activity) and high temperatures at multiple points during harvesting and processing. Specific causes include: picking of overripe cherries, picking of fallen cherries, contamination of water during processing, over-fermentation in the fruit still attached to trees under humid conditions and drying up at high temperatures (>45°C).
Remedies:	**AGRICULTURAL:** Harvest ripe cherries only and sort/remove over-ripe cherries, do not collect fallen cherries, always use clean bags, and do not cultivate coffee in low altitude areas near lakes, rivers or dams. Avoid sour beans in **PROCESSING** by: 1. pulping cherries immediately after harvesting, avoiding storage of the cherries for extended periods; 2. (in natural processing) spreading and drying up of cherries in 1 to 2 inch layers; 3. (in fully washed coffees) maintaining cleanness of patios, raised beds, fermentation tanks and water and appropriate fermentation time when in tanks 4. maintaining best practices during the drying process: cleanness, proper aeration and temperature control, avoiding interruptions, contact with and protection from rain or condensation; and 5. using an electronic color sorter to remove full sour beans.

Fungus or Mold Damage

Español: Daño por hongos

Français: Fève avariée sèche

	
Washed Process Fungus or Mold Damage	**Dry Process Fungus or Mold Damage**

Fungus or Mold Damage are Primary (Category 1) defects: 1 affected bean = 1 full defect	
Fungus damaged washed processed beans are recognized by white to yellow or gray "powdery" spots (spores) in early stages of the attack, which grow in size until covering the entire bean. Fungus damaged dry processed beans show a moldy pattern on the whole bean surface. Fungus damaged beans release spores that may contaminate other beans.	
Cup:	May produce moldy, earthy, dirty, over-fermented and phenolic tastes
Consideration:	Ochratoxin A (OTA) risk
Cause(s):	**AGRICULTURAL & PROCESSING**: Fungus damaged beans are commonly caused by fungi from the *Aspergillus, Penecillium, and Fusarium* genus, which can infect beans at any point from the field, harvesting, processing and storage, particularly where high environment temperatures and relative humidity induce fungus growth and/or bean moisture is excessive. Fungi growth is likely if substantial fungus spores are present and beans posses a high rate of water activity.
Remedies	**AGRICULTURAL:** Since coffee is grown in tropical humid regions that favor fungal growth, effort must be made to limit the sources from which the fungus spores originate. Avoid picking cherries from the ground, excessive broca (CBB)-damaged beans and unused beans, skins and/or pulp juices in harvesting bags or containers.
	PROCESSING: Infection can be prevented by implementing best practices at dry and wet processing facilities. Causes of infection include: cut or chipped beans during the pulping process, uncontrolled fermentation, beans lodged or otherwise left in pulpers, fermentation tanks, pipes or any other part of the washing station, delay or interruptions during the drying process, severely broca (CBB)-damaged beans and storing coffee in cherry or parchment under conditions of high humidity and temperature. Fungus damaged beans can be recognized in coffee cherries and parchment from their powdery dark or whitish spots, as well as a soil aroma but are more visible when husked in the dry mill. When husked, color sorters can remove the most critically fungus-damaged coffee but slightly fungus damaged beans can only be removed through hand sorting.

Foreign Matter

Español: Materia extraña, impurezas

Français: Matière étrangère

	
Organic Foreign Matter	**Inorganic Foreign Matter**

Foreign matter is a Primary (Category 1) defect: 1 piece of foreign matter = 1 full defect

Foreign matter includes all organic and inorganic non-coffee material found in green coffee bags, such as: sticks, glass, stones, nails, wire, etc., which represent a health hazard and give the green beans a bad appearance. The presence of non-coffee material is a clear sign of poor processing and grading. Foreign matter can seriously damage equipment, specifically grinders.

Cup:	Contamination from foreign matter represents a health hazard and can affect the green coffee, causing various off-flavors.
Consideration:	Affects appearance of the green coffee and can cause damage to roasting and grinding equipment.
Cause(s):	Various: Foreign matter can be accumulated at any step in the process.
Remedies:	**PROCESSING:** Foreign matter can be removed and/or avoided by: 1) selective picking and with the use of a flotation tank; 2) (washed process) maintaining cleanness in the wet mill, drying patios and work clothing; and 3) using proper equipment such as de-stoners, catadoras, bean sorters, gravity tables and magnets to remove foreign matter.

Dried Cherry or Pod 	**Español:** Bola, guayaba, capulín, cereza seca, **Français:** Fève en cerise
	Dried cherries or pods are a Primary (Category 1) defect: 1 piece = 1 full defect
	Dry cherries that escape all wet and dry mill sorting devices are usually small peaberry cherries and they are difficult to hull. These small pods may originate from old trees, over-bearing or dead branches and therefore frequently contain defective beans: immature, sour, frozen, diseased fungus damaged and black beans.
Cup:	There is commonly a defective bean inside the pod: underdeveloped, immature, overripe or otherwise diseased bean (often peaberry), which can transfer pulp, ferment, and moldy, dirty or phenolic tastes.
Consideration:	Affects the appearance of green beans: if roasted, the dried husk may burn, creating smoky aromas and charcoal-like and bitter flavors
Remedies:	**AGRICULTURAL:** Avoid picking dried cherries from the ground or trees, particularly from dead branches. Continuous pruning and renovation practices in combination with sound fertilization and soil management will reduce the incidence of underdeveloped and deformed beans.
	PROCESSING: Both wet and dry mills must maintain properly calibrated sorters at every stage, from flotation tanks and/or green bean separators to catadoras, size and gravity sorters. Size sorters are the most efficient machinery to remove small pods. When hulling naturals, proper machinery must be used; traditional parchment hullers and dry mill facilities do not perform well with dried naturals.

Severe / Slight Insect Damage

Español: Granos con daños por insecto o brocados graves / ligeros

Français: Fève piquée ou scolytée grave / légère

	
Severe	**Slight**

Severe Insect Damage (3 or more perforations) is a Primary (Category 1) defect: 5 affected beans = 1 full defect

Slight Insect Damage (less than 3 perforations) is a Secondary (Category 2) defect: 10 affected beans = 1 full defect.

Broca damaged beans are identified by small (0.3 - 1.5 mm Ø) dark or clear holes. The path can be at any angle including longitudinally. Some beans may have three or more perforations, causing sometimes extended damage, chipping and fungi infestations visible as greenish or black spots

Cup:	Varies. Impacts the appearance and yield of green and roasted beans and can result in dirty, sour, rioy (phenolic) or moldy flavors, especially when a female borer has excavated deep inside the bean, spreading fungus
Consideration:	Ochratoxin A (OTA) risk
Cause(s):	Insects feeding on coffee cherries and beans: worms, hoppers and beetles. The berry borer (Hypothenemus hampei) is a tiny beetle highly adapted to coffee and is the most serious pest in coffee agriculture. The female borer burrows into the unripe cherry, tunneling into the soft seed to lay eggs. Larvae tunnel out of the bean, creating additional holes. The incidence of broca is higher in hot climates and tends to decline as altitude increases.
Remedies:	**AGRICULTURAL:** Integrated pest management techniques have proven successful at controlling broca damage. Doing so requires an understanding of coffee borer's biological cycle to eradicate conditions that favor its propagation including a thorough harvesting and the removal of last pickings and fallen cherries. Second, employing use of natural predators such as the fungi Beauveria bassiana and/or African wasps (C. stephanoderis). Third, by deploying hanging traps made from water bottles or other containers, where alcohol and/or coffee extract is used as a lure.
	PROCESSING: Severe insect damaged beans can be separated at the washing station by using the flotation tanks or by skimming pulped beans in fermentation tanks. Once delivered to the dry mill, catadoras and density sorters can easily remove severe insect damaged beans. Slightly damaged insect damaged beans may not be detected by machinery and may need to be removed by hand.

Broken, Chipped or Cut 	**Español:** Grano partido, mordido, cortado, **Français:** Cassé, brisé, fissure **Broken, chipped and cut** beans are a Secondary (Category 2) defect: 5 beans = 1 full defect Beans cut or chipped during the pulp and mucilage removal process may have a dark reddish color due to oxidation of the injured area. This can lead to bacterial activity (fermentation) or mold development, resulting in a wide variety of cup defects (e.g. partial sour or partial black). Beans chipped or broken during the dry mill process are usually clean with no signs of oxidation.
Cup:	May cause earthy, dirty, sour, or fermented tastes
Consideration:	Affects the appearance of the green beans and cause uneven roasts
Cause(s):	**PROCESSING:** Broken, chipped or cut beans usually occur during the mechanical removal of pulp, mucilage and parchment from dry cherries. If pulpers or hullers are improperly calibrated, they will exert excessive pressure and friction on beans resulting in smashed, cut and chipped beans. Additionally, if parchment or cherries are processed at high or low moisture levels, hulling may smash, split and fracture the beans.
Remedies:	**AGRICULTURAL:** Avoid pulping mixed large and small screen size cherries at one time. Pick only ripe cherries, as partially ripe cherries do not pulp correctly. Never pulp green cherries. **PROCESSING:** Wet mill: 1) adjust pulpers no less than three (3) times during the harvest, as first and last pickings are usually smaller than mid-harvest; 2) sort cherries into size groupings if a wide variation in screen sizes occur; 3) use adequate supply of water as lubricant; 4) use roller pulpers with rubber guides and wider size tolerance; and 5) use green bean separators. Dry mill: 1) ensure that parchment or dried naturals are correctly dried before hulling; 2) adjust the huller machine to avoid friction; 3) remove small size broken, chipped or cut beans with screening and density sorting machines; and 4) clean density sorting machines frequently for optimal efficiency.

Immature 	**Español:** Inmaduro, **Français:** Immature Immature / Unripe beans are a Secondary (Category 2) defect: 5 beans = 1 full defect Immature or unripe beans are identified by shape, texture and color of the tegument or silver skin. They are often smaller and curved inward in a concave shape with sharp edges; the texture is usually rough and fibrous with a color ranging from bright greenish, yellow-greenish, grayish or brownish to almost black. The silver skin of an immature bean is tightly attached to the bean and is difficult to scratch with a fingernail. In many cases, one may need to use a piece of sand paper to determine if the interior is affected, in which case it may be a black or partial black bean.
Cup:	Generally imparts grassy, greenish, straw-like, cereal or bitter flavors and is the main source of astringency in coffee.
Consideration:	Primary source of quakers, a defect in roasted coffee
Cause(s):	**AGRICULTURAL:** Strip or mechanical picking are the primary causes of immature beans. Uneven flowering may cause inconsistent ripening schedules that complicate proper selective picking of ripe cherries. Even in those cases where an immature bean has reached full size, it will often lack the density and sugar content of a fully mature bean.
Remedies:	**AGRICULTURAL:** Immature beans can be avoided through sound crop planning, by introducing appropriate varieties to each microclimate and by selectively picking only fully ripe cherries. Cultivating early maturing varieties at medium to high altitudes and the use of irrigation to synchronize flowering will minimize the presence of unripe cherries a picking times. **PROCESSING:** Some immature beans can be removed during both wet and dry processing. At the wet mill, some non-pulped cherries containing immature beans can be separated with screens immediately after the pulping process (green bean separators). Lightweight immature beans can be removed by a density sorter or gravity table at the dry mill; however, full size, near-full weight immature beans cannot be removed by a gravity table. Sensitive color sorting equipment can be used to separate some gray, brown and black unripe beans.

Withered

Español: Averanado, arrugado, **Français:** Desséché

Withered / shriveled beans are a Secondary (Category 2) defect: 5 beans = 1 full defect

Withered beans are usually smaller in size than fully developed beans and are malformed with wrinkles that resemble a raisin.

Cup:	Weed-like, grassy, straw-like taste and astringent aftertaste depending on severity of damage and quantity of beans.
Consideration:	Affects the appearance of the green beans and the uniformity of roast coffee.
Cause(s):	**AGRICULTURAL:** Withered beans are caused by lack of water (drought) during the development. The severity of damage depends on the timing, intensity and duration of the drought. The proportion of damaged beans can be quite high if coffee plants are weak or in poor health.
Remedies:	**AGRICULTURAL**: Shade and soil management techniques combined with appropriate fertilization reduce the severity of the damage. Deep-rooting leguminous shade trees, mulching, terracing, water harvesting and irrigation may reduce the incidence of withering; however, too many of the wrong type of shade trees can compete with coffee for available ground moisture during dry periods. **PROCESSING:** Severely withered beans are less dense than unaffected beans and may float to be skimmed from water tanks. At the dry mill, density sorting equipment may be used to separate small withered beans. Larger withered beans may be removed by hand.

Shell

Español: Concha, oreja, **Français:** Coquille (dite "Oreille")

Shells are a Secondary (Category 2) defect: 5 beans = 1 full defect

Shells are malformed, hollow beans and consist of an inner compact molar and an outer hollow part (the shell), either loosely joint or separated. One or both pieces may be found and in some instances they will be joined, in which case it does not count as a defect. The outer section has a seashell shape. The inner section may be conical or cylindrical. *Note: TWO MATCHING PIECES FOUND SEPARATE ARE TO BE RECORDED AS ONE DEFECTIVE BEAN.*

Cup:	Although not known to have an off-flavor, shell beans may roast unevenly and char due to low density, producing burnt flavors
Consideration:	May cause uneven roasting
Cause(s):	**AGRICULTURAL:** This is a naturally occurring phenomena, caused by genetics; however, old and undernourished trees may produce more deformed beans, including so-called elephant beans, of which part becomes a shell.
Remedies:	**AGRICULTURAL:** At planting, select varieties with less than 7% deformed beans. **PROCESSING:** At the dry mill, size sorters may separate elephant beans and split shells, which are further separated by a density sorter.

Chalky / White 	**Español:** Calcáreo, **Français:** Fève blanche **Chalky / White** beans are a Secondary (Category 2) defect: 5 beans = 1 full defect Chalky white beans are pale in color with dark greenish or grayish silver skin. Often, chalky beans are large but with low density.
Cup:	Woody, cardboard, straw-like or cereal flavors and astringency
Consideration:	Affects the appearance of green coffee and tends to char when roasted with normal beans
Cause(s):	**AGRICULTURAL:** It is theorized that chalky beans are the result of overproduction, water stress, poor nutrition and/or high temperatures during drying.
	PROCESSING: The presence of chalky whites indicates also poor drying and milling procedures.
Remedies:	**AGRICULTURAL:** Genetic selection, proper fertilization, pruning, renovation/replanting and soil management practices reduce the occurrence of chalky white deformities. **PROCESSING:** Gravity tables may be used to separate chalky white beans at a dry mill.

Floater / Spongy 	**Español:** Vano, flotador, blanqueado, **Français:** Fève blanche spongieuse
	Floater beans are a Secondary (Category 2) defect: 5 beans = 1 full defect
	Floater beans are lightweight, underdeveloped beans; spongy beans are distinctively white and faded, giving green bean samples a mottled appearance. If in doubt, place floater and spongy beans in a glass of water, they will float.
Cup:	Woody, cardboard, weed-like, straw-like, cereal flavors. May dilute coffee flavor without causing off-flavors
Consideration:	Affects the appearance of green coffee and tends to char when roasted with normal beans
Cause(s):	**AGRICULTURAL:** Undernourished, diseased, water stressed and old plants tend to produce more floater beans than healthy plants. Excess moisture, high temperatures, injuries and microbiological activity may cause spongy beans (dead embryo, degradation of organic matter, whitening, bean elongation and weight loss). Although floater and spongy beans are not technically the same, they are similar enough to represent them together in one category.
	PROCESSING: Spongy beans are caused by improper drying and storage, namely residual parchment or cherry beans remaining in drying machines and patios or when stored in excessively humid conditions.
Remedies:	**AGRICULTURAL:** Selection of varieties with defect count of less than 7% in addition to proper fertilization, pruning, replanting and soil management practices reduce the number of floaters and deformed beans.
	PROCESSING: Most deformed small and low-density floaters can be removed using size and density sorters. Depending on the extent of damage, spongy beans may be sorted by density and color sorters.

Parchment 	**Español:** Pergamino, **Français:** Fève en parche **Parchment** beans are a Secondary (Category 2) defect: 5 beans = 1 full defect Parchment beans are partially or fully enclosed in a thick papery cellulose husk that is ivory-white or yellowish in color.
Cup:	Parchment may burn if roasted causing smoky and bitter flavor and also possibly contain an immature or other defective bean.
Consideration:	Affects the appearance of green coffee and tends to char when roasted with normal beans; indicative of poor grading
Cause(s):	**AGRICULTURAL:** Non-hulled parchment beans may conceal an immature or deformed bean (triangle, peaberry), strongly attached to the parchment.
	PROCESSING: This defect is indicative of incorrect calibration of the hulling machine and poor screen / density sorting.
Remedies:	**AGRICULTURAL:** Selection of varieties with defect count of less than 7% in addition to proper fertilization, pruning, replanting and soil management practices may reduce the number of parchment beans. **PROCESSING:** Properly calibrated dry hulling equipment will remove parchment from beans. Density sorters may be used to separate improperly hulled beans.

Hull or Husk

Español: Cascarilla de pergamino o pulpa seca

Français: Peau, coque ou parche

	
Wet Parchment Husk	**Dry Cherry Husk**

Husks are a Secondary (Category 2) defect: 5 husks = 1 full defect	
Husks are fragments parchment or dried cherry skins, sometimes containing remnants of fungi and soil	
Cup:	Husks may cause dirty, earthy, moldy, ferment or phenolic tastes
Consideration:	Affects the appearance of green coffee and tends to char when roasted
Cause(s):	**PROCESSING:** Improper cleaning of dried natural coffee or incorrect calibration of pulping machinery.
Remedies:	**PROCESSING:** Skim dry cherries and pulp skins in flotation and fermentation tanks. Use green bean separators, blowers and catadoras.

Robusta Cupping Standards

Coffee to Water Ratio

When cupping, the ratio of 8.75 grams (whole bean) coffee (± 0.25 grams), to 150 ml (~5 fluid ounces) water shall be used. When adjusting due to vessel size, a ratio of 0.058 g coffee (whole bean) per 1 ml water or 1.73 grams per 1 fluid ounce of water shall be used.

Cupping Vessel

Cupping vessels shall be of tempered glass or ceramic material. They shall be between 210 ml and 265 ml, (7 and 9 fluid ounces), with a top diameter of between 75 - 90 mm, (3 and 3.5 inches). All cups used shall be of identical volume, dimensions and material of manufacture with lids.

Water Temperature

Cupping water temperature shall be 92 – 94.5°C (200°F ± 2°F) when poured on grounds.

Cupping Water

Cupping Water shall meet all the requirements listed in the SCAA Standard 'Water for Brewing Specialty Coffee,' as shown below:

Characteristic	Target	Acceptable Range
Odor	Clean/fresh, odor free	
Color	Clear color	
Total Chlorine	0 mg/L	
TDS	150 mg/L	75 - 250 mg/L
Calcium Hardness	4 grains (68 mg/L)	1-5 grains (17 mg/L - 85 mg/L)
Total Alkalinity	40 mg/L	At or near 40 mg/L
pH	7.0	6.5 - 7.5
Sodium	10 mg/L	At or near 10 mg/L

Coffee Grind

The coffee used for cupping shall be ground so that 70-75 percent of the grinds pass through the #20 mesh sieve.

Roast for Cupping

The roasting of coffee for cupping shall take between 9 and 14 minutes and shall be used for cupping within 8 and 24 hours after roasting.

Roast Level

The roast for cupping shall meet Agtron gourmet color score of 48 for whole beans, 78 for ground coffee, ± 1 unit, or between the scores of 50 and 55 on the 'standard' Agtron scale. If an Agtron machine is not available, roasted whole bean coffee shall match Agtron roast tile #50.

Cupping Room Size

Cupping room minimum dimensions (for exactly one cupping table) shall be no smaller than 10 m2 (~110 square feet).

Cupping Spoons

Cupping spoons shall hold 4-5 ml (0.135 – 0.169 fluid ounces) of coffee sample and should be of non-reactive metal.

Cupping Tables

Cupping tables (for 6 people) shall have a surface area of at least 1 square meter (~10 square feet), and be between 107 - 117 centimeters (42 and 46 inches) tall.

Robusta Cupping Protocols

Equipment

Roasting Preparation	Environment	Cupping Preparation
Sample roaster	Well lit	Balance (scale)
Agtron or similar color reading device	Clean, no interfering aromas	Cupping glasses with lids
Grinder	Cupping tables	Cupping spoons
	Quiet	Hot water equipment
	Comfortable temperature	Forms and other paperwork
	Limited distractions (no phones, etc.)	Pencils and clipboards

Sample Preparation

Roasting:

The sample should be roasted within 24 hours of cupping and allowed to rest for at least 8 hours.

Roast Profile:

- Robusta beans are typically more dense than most Arabica beans and present greater resistance to heat. For this reason, the surface of Robusta whole beans must be roasted considerably darker than Arabica whole beans in order to achieve similar flavor development and internal roast color (after grinding).
- Robusta whole bean roast color should be *medium to medium-dark*, not *light to medium-light* as is common for Arabica cupping roasts. On the M-Basic (Gourmet) Agtron scale, a Robusta whole bean reading of approximately 48 is needed to produce a ground M-Basic (Gourmet) Agtron reading of approximately 78, +/- 1 point (Agtron/SCAA tile #45 for whole bean and Agtron/SCAA tile #75 for ground). Cupping panel testing has suggested this lighter roast profile is the optimal ground roast color for Robusta cupping.
- Comparable color readings for ground Robusta would be approximately 54 on the Agtron E10/E20 commercial scale or approximately 110 on the Probat colourette scale, and approximately 115 on the Neotec-Neuhaus scale.
- Those accustomed to sample roasting Arabica should note that the first crack is not as pronounced or dramatic in Robusta as it is in Arabica. With Robusta, the first crack seldom reaches a crescendo and the second crack is also very subdued at its onset. Those who time their roast by the sound of the crack must wait until the first crack has completely concluded before considering terminating the roast. If the roast is terminated a few moments (10 seconds or so) before the second crack, the optimum roast development for Robusta as determined by panel cupping should be achieved.
- The roast should be completed in no less than 9 minutes and no more than 14 minutes. Scorching or tipping should not be apparent.
- Sample should be immediately air-cooled (no water quenching).
- When the beans reach room temperature (approximately 75º F or 20º C), completed samples should then be stored in airtight containers or non-permeable bags until cupping to minimize exposure to air and prevent contamination.

- Samples should be stored in a cool dry place, but not refrigerated or frozen.

Measurement:

- The optimum ratio is 8.75 grams per 150 ml of water
- Determine the volume of water in the selected cupping glass and adjust weight of coffee to this ratio within +/- .25 grams

Cupping Preparation:

- Sample should be ground immediately prior to cupping, no more than 15 minutes before infusion with water. If this is not possible, samples should be covered and infused not more than 30 minutes after grinding.
- Samples should be weighed out AS WHOLE BEANS to the predetermined ratio (see above for ratio) for the appropriate cup fluid volume.
- Grind particle size should be slightly coarser than typically used for paper filter drip brewing, with 70% to 75% of the particles passing through a U.S. Standard size 20 mesh sieve.
- At least 5 cups from each sample should be prepared to evaluate sample uniformity.
- Each cup of sample should be ground by running a cleansing quantity of the sample through the grinder, and then grinding each cup's batch individually into the cupping glasses, ensuring that the whole and consistent quantity of sample gets deposited into each cup. A lid should be placed on each cup immediately after grinding.

Pouring:

- Water used for cupping should be clean and odor free, but not distilled or softened. Ideal Total Dissolve Solids are 125-175 ppm, but should not be less than 100 ppm or more than 250 ppm pursuant to SCAA water quality standards for cupping.
- The water should be freshly drawn and brought to approximately 200º F (93ºC) at the time it is poured onto the ground coffee.
- The hot water should be poured directly onto the measured grounds in the cup to the rim of the cup, making sure to wet all of the grounds.
- As the coffee degasses, the *cap* may sink below the rim of the cup. When this occurs immediately pour additional water into the cup so that the cap again rises to the rim of the glass
- Allow the grinds to steep undisturbed for 4 minutes before evaluation.

Sample Evaluation

Sensory testing is performed for three reasons:

1. To determine the actual sensory differences between the samples
2. To describe the flavor of the samples
3. To determine the cupper's preference for the samples

No single test can effectively address all of the above, but they do have common aspects. It is important for the evaluator to know the purpose of the test and how results will be used. ***The purpose of this cupping protocol is the determination of the cupper's preference***. The quality of specific flavor attributes is analyzed, and then drawing on the cupper's previous experience, each flavor attribute is rated on a numeric scale. The scores between samples can then be compared.

Coffees that receive higher scores should be noticeably better than coffees that receive lower scores.

The Robusta cupping form provides a systematic means of recording 10 important flavor attributes for Robusta coffee: Fragrance/Aroma, Flavor, Aftertaste, Salt/Acid Aspect Ratio, Bitter/Sweet Aspect Ratio, Mouthfeel, Balance, Uniform Cups, Clean Cups, and Overall. Defects, both Taints and Faults, may also be recorded on the form.

Quality Scale

Specific flavor attributes are positive scores of quality reflecting a judgment rating of the cupper; the defects are negative scores denoting unpleasant flavor sensations; the Overall score is based on the flavor experience of the individual cupper as a personal appraisal. These are rated on a 16-point scale representing levels of quality in quarter point increments between numeric values from 6 to 10.

These levels are:

Quality scale:			
6.00 - Good	**7.00 - Very Good**	**8.00 - Fine**	**9.00 - Outstanding**
6.25	**7.25**	**8.25**	**9.25**
6.50	**7.50**	**8.50**	**9.50**
6.75	**7.75**	**8.75**	**9.75**

The above scale theoretically ranges from a minimum value of 0 to a maximum value of 10 points. The lower end of the scale (.25 to 5.75) is applicable to commercial coffees, which are cupped primarily for the assessment of defect types and intensities.

Evaluation Procedure

Samples should first be visually inspected for roast color. This is marked on the left hand side of the form and may be used as a reference during the rating of specific flavor attributes, particularly if the sample is roasted too light or too dark pursuant to roast preparation standards. The sequence of rating each attribute is based on the flavor perception changes caused by decreasing temperature of the coffee as it cools:

Step 1: Fragrance/Aroma

Within 15 minutes after samples have been ground the dry fragrance of the samples should be evaluated by lifting the lid and sniffing the dry grounds.

- Both the type and intensity of the dry fragrance is rated on a scale of 1 to 6, and then marked on the *vertical* scale in the box provided.
- The cupper should also note the type of dry fragrance on the small horizontal line. The type of dry fragrance will range from flowery to fruity to herbal.

After infusing with water, the crust or cap is left unbroken for at least 3 minutes but not more than 5 minutes. Crust breakage is performed by shallowly stirring 3 times, then allowing the foam to run down the back of the spoon while gently sniffing.

- Both the type and intensity of the wet aroma is rated on a scale of 1 to 6, and then marked on the vertical scale in the box provided.

- The cupper should also note the type of wet aroma on the small horizontal line. The type of dry fragrance will range from fruity to herbal to nut-like. In addition caramel and/or cocoa may be detected in the wet aroma.

The score of the dry fragrance and wet aroma are totaled and the combined Fragrance/Aroma score is then marked on the form, with the maximum score being 10.

Step 2: Flavor, Aftertaste, Salt/Acid, Bitter/Sweet, and Mouthfeel

When the sample has cooled to ~160º F (about 70º C or 8-10 minutes from infusion), evaluation of the liquor should begin. The liquor is aspirated into the mouth in such a way as to cover as much area as possible, especially the tongue and upper palate. Because the retro nasal vapors are at their maximum intensity at these elevated temperatures, Flavor and Aftertaste are rated at this point.

- Flavor represents the coffee's principal character, the mid-range notes combining taste and aroma.
- Aftertaste is defined as the length of positive flavor (taste and aroma qualities emanating from the back of the palate and remaining in the mouth after the coffee is expectorated or swallowed.

As the coffee continues to cool (160º F - 140º F), the Salt/Acid Aspect Ratio, Bitter/Sweet Aspect Ratio and Mouthfeel are rated.

- Salt/Acid Aspect Ratio is the relative balance between the salt sensations, principally driven by the higher potassium levels of Robusta coffees in contrast to the normally lower levels of organic acids, particularly citric acid. Fine Robusta coffees are noted for their lower levels of salt, producing a *harsh* taste in the cup and their higher levels of organic acids producing a *soft* taste in the cup. Low saltiness is rated on the vertical scale of 1 to 6, with the higher number representing a low saltiness perception. High acid is rated on the vertical scale of 1 to 6, with the higher number representing a perceived high level of acidity. The two scores are added together for the total Salt/Acid rating, with the maximum score of 10.
- Bitter/Sweet Aspect Ratio is the relative balance between the bitter and sweet taste sensations, with the optimum result coming from a low bitterness and high sweet combination. Low bitterness is rated on the vertical scale of 1 to 6, with the higher number representing a low bitterness perception. High sweet is rated on the vertical scale of 1 to 6, with the higher number representing a high sweet perception. The two scores are added together for the total Bitter/Sweet rating, with the maximum score of 10.
- Mouthfeel is a combination of weight and texture. The weight comes from micro-fine fiber particles swept off the ground up beans and the texture comes from the oils extracted from the coffee particles and suspended in the brew. Both the weight (heft on the tongue compared to pure water) and texture (slipperiness compared to pure water) are rated on the vertical scales from 1 to 6. The two scores are added together for the total Mouthfeel rating, with the maximum score of 10.

The cupper's preference for each of the attributes is evaluated at several different temperatures (2 or 3 times) as the sample cools. To rate the sample on the 16-point scale circle the appropriate tick-mark on the cupping form. If a change is made (if a sample gains or loses some of its perceived quality due to temperature changes), re-mark the horizontal scale and draw an arrow to indicate the direction of the final score.

Step 3: Balance, Uniform Cups, and Clean Cups

As the brew approaches room temperature (below 100º F) Softness, Uniform Cups, and Clean Cups are evaluated.

- Balance is the cupper's assessment of how well the Flavor, Aftertaste, Mouthfeel, and Bitter/Sweet Aspect Ratio harmonizes in a synergistic combination. All four attributes should be present in equal intensities in order to achieve *balance* in the cup. The greater the intensity, while still maintaining balance in the cup, the higher the rating.
- Uniform Cups and Clean Cups are rated on an individual cup basis. For these attributes, the cupper makes a judgment of each cup, awarding 2 points per cup for each cup Uniform to the others and 2 points per cup for each Clean cup (10 points maximum score).

Step 4: Overall and Total Score

Evaluation of the liquor should cease when the sample reaches 70º F (16º C) and the Overall score is determined by the cupper and given to the sample as cupper's points based on the desirability of all of the combined attributes.

All of the scores from each of the ten attributes are then totaled and entered into the box on the right hand side of the form marked Total Score.

Step 5: Final Score

Once the Total Score has been calculated, points are deducted for defects in the following manner:

- Taints are minor defects commonly found in the aromatic properties of the coffee. Each cup is evaluated and any cup in which a taint is found has 2 points deducted from the total score.
- Faults are major defects commonly found in the taste properties of the coffee. Each cup is evaluated and any cup in which a fault is found has 4 points deducted from the total score.

The Final Score is calculated by deducting any taints or faults in any of the five cups and recorded in the box marked Final Score.

Individual Component Scores

On some positive attributes, there are two marked scales. The vertical (up and down) scales are used to rank the *intensity* of the listed sensory component and are marked for the evaluator's record. The horizontal (left to right) scales are used to rate the panelist's *preference* of the particular component based upon their perception of the sample and experiential understanding of quality. The attribute score is recorded in the appropriate box on the cupping form.

Each of these attributes is described more fully as follows:

Fragrance/Aroma: The aromatic aspects include *Dry* Fragrance (defined as the smell of the ground coffee when still dry) and *Wet* Aroma (the smell of the coffee when infused with hot water). One can evaluate this at three distinct steps in the cupping process: (1) sniffing the grounds placed into the cup before pouring water onto the coffee; (2) sniffing the aromas released while breaking the crust; and (3) sniffing the aromas released as the coffee steeps. Specific aromas can be noted under *qualities* and the intensity of the dry fragrance, break, and wet aroma aspects noted on the 6-point vertical scales. The score finally given is calculated by summing the vertical scales and should reflect the preference of all three aspects of a sample's Fragrance/Aroma.

- Enzymatic notes commonly found in Fine Robusta coffees include: Tea Rose, Lemon, Coffee Blossom, and Honey; while those commonly found in commercial (off-grade) Robusta coffees include Potato and Garden Peas.
- Sugar Browning notes commonly found in Fine Robusta coffees include: Vanilla, Butter, Caramel, Cocoa and Walnuts; while those commonly found in off-grade Robusta coffees include Toasted Bread and Roasted Peanuts.
- Dry Distillation notes commonly found in Fine Robusta coffees include Malt; while those

commonly found in off-grade Robusta coffees include Pepper, Cedar, and Pipe Tobacco.

- Aromatic Taints commonly found in Fine Robusta coffees include Coffee Pulp; while those commonly found in off-grade Robusta coffees include Earthy, Medicinal, Smoke, Rubber, and Straw.

Flavor: Flavor represents the coffee's principal character, the mid-range elements, in between the first impressions given by the coffee's first aroma and taste to its final aftertaste. It is a combined impression of all the gustatory (taste bud) sensations and retro nasal aromas that go from the mouth to nose. The score given for Flavor should account for the intensity, quality and complexity of its combined taste and aroma, experienced when the coffee is slurped into the mouth vigorously so as to involve the entire palate in the evaluation.

Flavor notes found in Fine Robusta coffees commonly include:

- Fruit-like: cherry, black currant, raisin, raspberry, berry, dry fig, lemon, and prunes.
- Nut-like: walnut, almond, and malt
- Spice-like: clove, coriander and allspice
- Sweet-like: molasses, syrupy, caramel, honey, dark chocolate, cocoa, and buttery
- Overall: rounded, complex, complete, mellow, deep and delicate.

Flavor notes found in off-grade Robusta coffees commonly include:

- Vegetable-like: grassy, hay, grain-like, barley-like, legume, potato, pea-like, silage, jackfruit, popcorn, and biscuit-like
- Phenol-like: medicinal, metallic, rubbery, smoky, burnt, woody
- Astringent-like: uric, salty, briny, brackish
- Overall: dull, lifeless, flat, uneven, neutral, harsh, soapy

Aftertaste: Aftertaste is defined as the length of positive flavor (combined taste and aroma) qualities emanating from the back of the palate and remaining after the coffee is expectorated or swallowed. When an aftertaste is short or unpleasant, a lower score is appropriate. In Robusta coffees, aftertaste is often underscored by the potassium level found in the coffee, with high levels resulting in *brackish* (high saltiness and displeasing aromas) aftertastes and with low levels resulting in *savory* (low saltiness and pleasing aromas) aftertastes.

Salt/Acid Aspect Ratio: *the Salt/Acid Aspect Ratio* is responsible for the pleasing and delicate taste that is derived from distinguishable acidity and sweetness in Robusta coffees, stemming from the presence of fruit acids and sugars. It is also recognized because of lower levels of potassium and caffeine that make the Robusta coffee tastes coarse or harsh are absent from Fine Robusta coffees. This attribute is comparable to the strictly soft or strictly hard categorization of Brazilian coffees. The noticeable perception of acidity is one of the striking taste differences between Fine Robusta and off-grade Robusta coffees.

Bitter/Sweet Aspect Ratio: Both *bitter* and *sweet* taste sensations are present in Robusta coffees. The bitter component stems principally from the caffeine and potassium levels present in the coffee, while the sweet component is derived from the fruit acids, chlorogenic acid, and sugars levels in the coffee. Fine Robusta coffees have a low bitter and high sweet aspect in their taste, which Commercial Robusta coffees have a high bitter and low sweet aspect in their taste. In determining the Bitter/Sweet Aspect Ratio Score, the cupper rates the relative bitterness on a scale of 1 to 6, giving the higher score to the lower perceived bitterness, while at the same the cupper rates the relative sweetness on a scale of 1 to 6, giving the higher score to the higher perceived

sweetness. The two scores are then added to determine the Bitter/Sweet score.

Mouthfeel: The quality of Mouthfeel is based upon the tactile feeling of the liquid in the mouth, especially as perceived between the tongue and roof of the mouth. Most samples with heavy Mouthfeel may also receive a high score in terms of quality due to the presence of brew colloids. Brew colloids are formed as the oils extracted from the ground coffee coagulate around the micro-fine bean fibers suspend in the brew. Mouthfeel has two distinct aspects: weight and texture.

Balance: How all the various aspects of Flavor, Aftertaste, Salt/Acid Aspect Ratio, Bitter/Sweet Aspect Ratio, and Mouthfeel of the sample work together and complement or contrast to each other is "Balance." As the intensity of each of these attributes increases, it is more difficult for all the attributes to remain in balance. If each attribute increases equally in intensity, then the Balance score is high. If the sample is lacking in one or more attributes or if some attributes are overpowering, the Balance score would be reduced.

Uniform Cups: Uniform Cups refers to consistency of flavor of the different cups of the sample tasted. If a single sour, ferment, phenolic or other off-tasting bean is present in any of the cups, one or more of the cups will exhibit a different taste. This inconsistency in the flavor of the coffee is a very negative attribute. This type of inconsistency should be so distinct that the cupper can easily identify the off-cup in a triangulation with the other cups in the sample set. The rating of this attribute is calculated on a cup-by-cup basis. 2 points are awarded for each cup in the sample that is uniform (tastes like the other cups), with a maximum of 10 points if all 5 cups are the same.

Clean Cups: Clean Cups refers to a lack of interfering negative impressions from first ingestion to final aftertaste, a "transparency" of cup. In evaluating this attribute, notice the total flavor experience from the time of the initial ingestion to final swallowing or expectoration. If a single moldy, dirty, and baggy or other off-tasting bean is present in any of the cups, one or more of the cups will exhibit a non-coffee taste. Any *non-coffee like tastes or aromas* will disqualify an individual cup. 2 points are awarded for each cup in the sample that is free from a non-coffee like taste or aroma.

Overall: The "overall" score attribute is meant to reflect the holistically integrated rating of the sample as perceived by the individual cupper. A sample with many highly pleasant attributes, but not quite "measuring up" to the cupper's expectation would receive a lower rating. A coffee that met expectations as to its character and reflected particular origin flavor qualities would receive a high score. An exemplary example of preferred characteristics not fully reflected in the individual score of the individual attributes might receive an even higher score. This is the step where the cuppers make their personal appraisal of the coffee. Good cuppers do not allow their personal preference for a coffee to interfere with the rating of the other flavor attributes of the sample.

Defects: Defects are negative or poor flavors that detract from the quality of the coffee. These are classified in 2 ways. A *taint* is an off-flavor that is noticeable, but not overwhelming, usually found in the aromatic aspects. A "taint" is given a "2" in intensity. A *fault* is an off-flavor, usually found in the taste aspects, that is either overwhelming or renders the sample unpalatable and is given an intensity rating of "4". The defect must first be classified (as a taint or a fault), then described ("sour," "rubbery," "ferment," "phenolic" for example) and the description written down. The number of cups in which the defect was found is then noted, and the intensity of the defect is recorded as either a 2 or 4. The defect score is multiplied by the number of cups in which it is found and subtracted from the total score in calculating the Final Score, following to directions on the cupping form.

Final Scoring

The Final Score is calculated by first summing the individual scores given for each of the primary attributes in the box marked "Total Score." Defects are then subtracted from the "Total Score" to arrive at a "Final Score." The following Scoring Key has proven to be a meaningful way to describe the range of coffee quality for the Final Score, with scores above 80 equating to Fine Robusta coffees.

Total Score	Quality Description	Classification
90-100	Outstanding	Very Fine
80-90	Fine	Fine
70-80	Very Good	Premium
60-70	Average	Usual Good Quality
50-60	Fair	Usual Good Quality
40-50	Fair	Commercial
< 40		Exchange Grade
< 30		Below Grade
< 20		Off Grade
< 10		Triage

Appendix

Robusta Cupping Scoresheet

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Robusta Green Grading Form

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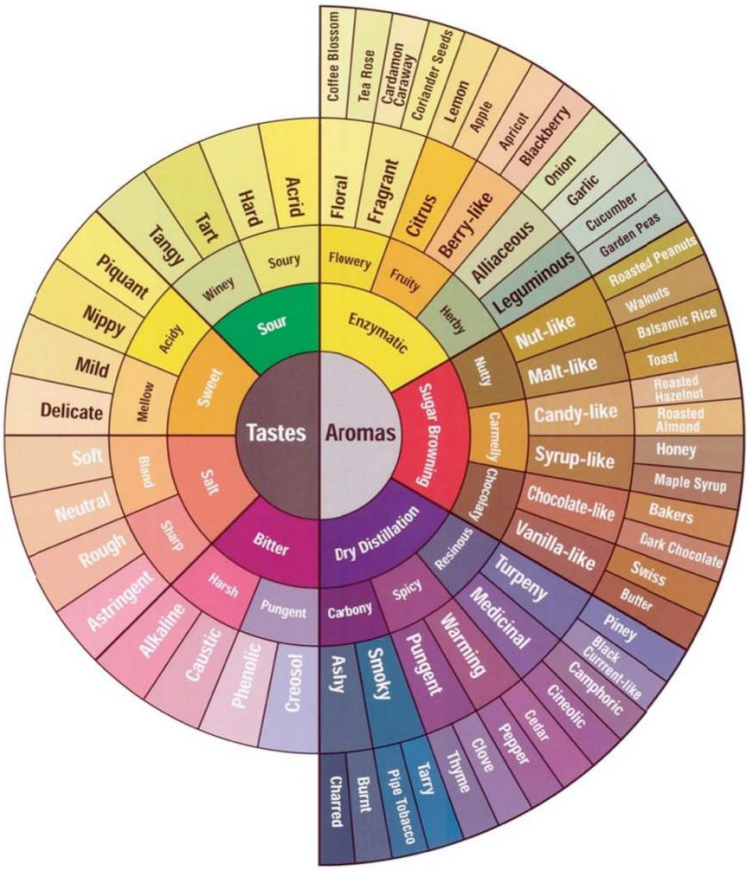
SCAA Flavor Wheel



Published Articles

T. Lingle: Creating a Viable Future for Robusta Producers

During the past five years there has been a growing price disparity between Arabica and Robusta coffees. In November of 2007, the average ICO indicator price for Other Mild Arabica coffees was $1.31, while the same indicator price for Robusta coffees stood at $0.92, a differential of $0.39. In November of 2010, the average ICO indicator price for Other Mild Arabica coffee had risen to $2.33, a gain of $1.01, but the same indicator price of Robusta coffees remained at $0.92, showing no gain at all and increasing the differential to $1.41, three and a half times higher. Today that gap has narrowed somewhat with the Other Mild Arabica price in November of 2012 standing at $1.64 but with the Robusta price still down at $0.99, a differential of $0.65. ***Why do Robusta coffees have such difficulty breaking out of the $1.00/lb range?***

This large and persistent ***gap*** in price differentials between Arabica and Robusta coffees during the past five years strongly suggests that programs aimed at establishing benchmarks for top Arabica qualities, such as the Q Coffee System established by CQI and the Cup of Excellence program developed by ACE, have enjoyed considerable success and have given the Arabica growers a tremendous push toward sustainable economic viability. Unquestionably these programs have led to improved qualities across the entire Arabica production chain, pulled by the success of Guatemala, Costa Rica and the other Central American coffee producers, which other Arabica producing countries are now seeking to emulate. The other significant impact from these activities has been a general heightening of the awareness of the importance of quality among coffee consumers, as evidenced by the movement of major foodservice chains, such as McDonalds and Burger King to high quality coffee programs and by the continued rapid expansion of the specialty coffee industry in new markets in Asia and Eastern Europe. The unintended consequence of the success of this effort has left the Robusta producers ***"in the lurch,"*** a vulnerable and unsupportable position as indicated by the disparity in price levels between Arabica and Robusta coffees.

"Standards – Education – Ethics" have been the driving force behind the success of the Arabica producers' efforts. It is now time to apply this same formula for success to the Robusta coffee market. As a starting point, there is a critical need to address quality issues across a broad range of processing standards for Robusta coffees. The establishment of a bona fide standard for "Fine Robusta Coffees" to meet the marketplace requirements for this category of coffee will build quality awareness among all Robusta producers. More important, the establishment of a reliable Robusta supply chain that makes available

regular and consistent supplies of high quality Robusta coffees will encourage roasters to offer this category of coffee to their consumers, thereby creating the consumer base needed to make the Robusta market economically viable. This connectivity is particularly important in Asia and Eastern Europe where Robusta type coffees are often in the greatest demand.

For the past 10 years during the time of coffee oversupply, USAID and other international governmental agencies invested heavily in quality and processing improvements for washed Arabica coffees. By enhancing the value-add attributes of the top Arabica qualities, the marketing capacity and connectivity for these coffees were measurably strengthened, particularly the premium prices paid by consumers as reflected in the 2010 price levels. Projects like the RATES/Chemonics program in East Africa that supported the East Africa Fine Coffees Association (EAFCA), and the CADR/Coffee Quality Institute program in Central America that supported CQI are good examples of the success of increasing producer incomes through quality improvement programs. ***A similar quality improvement program was desperately needed for Robusta producers.***

Recognizing this need, USAID, through the LEAD program in Uganda (Susan Corning) supported by the COMPETE program in East Africa (Steve Walls), took the first and essential step. Beginning in 2009, four Robusta Fine Coffee Workshops were held in Kampala (August 2009, March 2010, and June 2010) and Ghana (November 2009) with the primary objective of establishing high quality standards for Robusta coffees that would be universally recognized and accepted by the coffee trade. This work was led by the Coffee Quality Institute (CQI) and was based on the lessons learned from building the Q Coffee System in Arabica producing countries. The program also received invaluable support from the Uganda Coffee Development Authority (Henry Ngabirano).

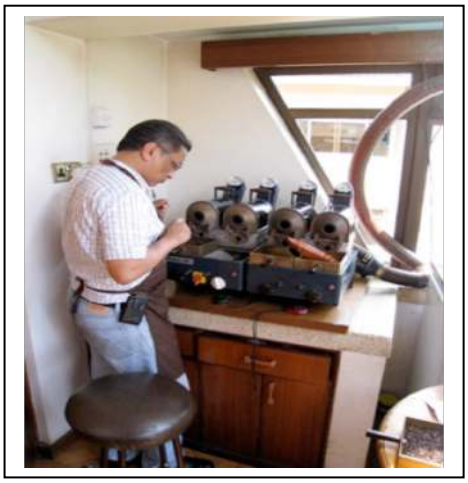
Sixty-three (63) coffee professionals representing eighteen (18) different countries, including Brazil, Colombia, India, Indonesia, and Mexico participated in one or all of the four workshops over the 24 month long program, totaling over 3,500 man-hours of effort.

Samples from all of the major Robusta producing countries were cupped, graded and evaluated. And seven different testing methodologies for evaluating Robusta cuppers were studied, evaluated, and perfected.

During this process a number of key objectives were met: 1) a protocol and cupping form for Fine Robusta Coffee were developed; 2) standards for physical grading of Robusta coffees were

established along with a Robusta Green Coffee Defect Classification System; 3) roasting profile methodologies for Robusta coffees were determined; 4) an extensive cupping flavor vocabulary for Robusta coffees was created; and 5) the first eight Fine Robusta "R" Graders in Uganda were certified.

There were a number of significant lessons learned during this process. The first and most important was that Fine Robusta coffees can in fact be differentiated by their country of origin, just like Arabica coffees. The second and most surprising was that Fine Robusta coffees can have appealing cup characteristics that yield cupping scores above 80+ points on a 100-point scale. The third and most appealing was that Fine Robusta coffees have a complexity in their taste profiles that far surpasses Arabica coffees due to their "Bitter/Sweet" and "Salt/Acid" taste attributes. And the fourth and most interesting was that Fine Robusta coffees are more difficult to roast properly due to the need to develop a wider color spread between the whole bean and ground color measurements in order to bring out the full potential of their flavors.



The success of the Fine Robusta Coffee Workshops cannot be overstated. It clearly identified the potential for huge growth in the market place for this category of coffee; ***growth based on quality not price***. The success also clearly identified the roadblock to improved Robusta prices: DEFECTS. All of the coffees cupped during the Workshops had been cleaned and graded so that the defect counts were comparable to those for specialty Arabica grades, and consequently the flavor improvements in the Robusta coffees were striking. As a by-product of these Workshops, the coffee industry now has a set of training materials to use in a systematic approach for quality improvement in the Robusta coffee supply chain. ***So where did we go from here?***

The second major step was to expand the R Grader training program outside of East Africa. This was accomplished through private sector programs in Brazil and Indonesia. To date through Conilon Brazil three R Grader Workshops were conducted in Brazil, two in 2011 and one in 2012. In the process, 28 R Graders have been trained and certified in Brazil, and this year Conilon Brazil will be conducting the first ever Robusta cupping competition in Brazil. Their vision is to create a viable export market for high quality, Conilon Robusta coffees for Brazil's Robusta producers. Robusta R Grader Workshops have also been conducted in Indonesia, one in 2011 and one again in 2012. The result was the training and certification of 21 R Graders in Indonesia. The highlight of this effort was the cupping competition and auction conducted in October 2012 in Surabaya that included "Fine" Robusta coffees for the first time. The high scoring Robusta coffee was a washed coffee from Flores and received an "R" score of 84.05 and sold for a record price of $7.00/kg.

The third major step was in building "trials and awareness" for high quality – high value Robusta coffees. This has been accomplished across a number of different fronts. In June 2012 Brazil hosted the world's first International Conference on Robusta coffees with more than 200 people participating. It was a great opportunity for Brazil to showcase the tremendous advancement it has made in the technology of farming Robusta coffees. CQI held its first R Grader Robusta Workshop at SCAA Headquarters in Long Beach in September 2012. The class was taught by one of CQI's new R Grader Instructors, Andrew Hetzel. Six people participated in the course and three became licensed R Graders. September 2012 also saw Miles Small in a *Coffee Talk Magazine* editorial begin a lively debate on the merits of bringing Robusta coffees in the "specialty coffee arena," as if there should be some unwritten prohibition against them. In October 2012 Let's Talk Coffee conducted their first Robusta workshop and attracted participants from around the world to meet, discuss, and cup "Fine" Robusta coffees. The high point for CQI was posting our first certified Robusta coffee on our Website, which was a very high quality India Robusta coffee, Kaapi Royale Coffee from Sethuraman Estate RKR, which is now selling for $2.50/lb FOB India.

"Will Fine Robusta Coffee Measure Up in the Cup?" From the very beginning of the project, the cuppers involved were committed to holding the standards for "Fine" Robusta coffees to the same standards established for "Specialty" Arabica coffees. This was true for both cupping scores and defect counts – "Fine" Robusta coffees must score 80 or more points in their cupping score and contain 8 or fewer full defects per 350-gram sample. As anticipated, the greatest problem in conducting the Workshops was finding a large selection of high quality Robusta coffees. However, many good tasting Robusta coffees were found, particularly in Brazil, Guatemala, India, Indonesia, Mexico, Tanzania, and Uganda. And more surprisingly, most of these coffees have already found their way to South Korea, whose large community of small roasters have discovered their quality and variety appeals to a large segment of their "specialty coffee consumers," which means CQI has found a source of "Fine" Robusta coffees for our workshops, thanks to Steven Kil of the Specialty Coffee Appraisers Institute of Asia.

"Is building a market for high Robusta coffees possible?" **YES,** but it won't be easy. Cooperation is needed from the private sector exporters in Uganda, Brazil, India, and Indonesia in order to develop the volumes of high quality Robusta coffees needed to establish a market niche. And just like the early beginnings of the Specialty Arabica market, it will take time to develop the appropriate supply chains. Fortunately, the steps will be similar:

Program Steps:

#1 Establish High Quality Standards
#2 Identify Existing Value-Added Robusta Coffees
#3 Make Technology Assessment of Current Production Schemes
#4 Offer Producer Technical Assistance
#5 Develop Competition/Programs to Recognize Excellence
#6 Provide Market Access through Internet Based Trading

The time is right to take this step and the process is now underway. Congratulations to everyone involved in the program. Like the advent of the specialty coffee industry was for the Arabica coffee farmer, the ultimate success of this program will be a ***"Game Changer"*** for the Robusta coffee growers.

A. Hetzel: Robusta: The Other Coffee

I remember being confused about the coffee that was put in front of me on the cupping table: sweet but with almost a bittersweet salt caramel taste, some woodiness, a huge rich body and a delicate lemony acidity, the combination and intensities of which were unlike anything I had tried before. What was this stuff?

It was May of 2007; I was in Long Beach, California for the annual Specialty Coffee Association of America (SCAA) conference and had just tasted my first Fine Robusta, as it would be defined five years later.

All that I knew about Robusta at the time was probably the same as most others working in specialty coffee: it has lots of caffeine, produces thick crema in espresso and is generally pretty awful with a sort of rubbery, petroleum taste found mostly in instant coffee. But this coffee was not awful at all! It was surprisingly pleasant, which made me wonder: "What else don't I know about Robusta?" A friend and mentor who had organized the cupping, was having dinner with the farmer that same evening and invited me to come along.

Nishant Gurjer and I became fast friends. Over dinner, he told me how he was a mechanical engineer working in Bangalore at the time he was thrust into his family's coffee farming business by the untimely death of his father. New to the industry and bringing with him a process-driven methodology, he started to question everything about how his plantation was run. Why, for example, if his land was ideally suited to growing Robusta, was his family struggling to grow Arabica for five generations? Why settle to be another mediocre Arabica grower, he thought, when the soil and weather conditions are right to be one of or perhaps *the* world's best Robusta farmer?

In India, as in most places around the world that grow coffee, farmers choose Robusta as an option of last resort only where Arabica will not grow, due to its substantial price discount set by the NYSE London financial exchange (LIFFE). The LIFFE Robusta contract allows for up to 450 defects per 500g sample, more than 10 times its Arabica "C" contract counterpart for exchange quality coffee, so it's understandable why Robusta coffee is generally worth less than half of commercial Arabica.

Shocking his family and neighboring farmers, Nishant pulled out 6 hectares (15 acres) of prized Arabica coffee plants on his Sethuraman Estate and planted new rows of Robusta, his first plot of what would eventually become 350 acres. He recognized that it was the artificially low market standards that are holding back the value of Robusta, not the plants potential at all.

Since there is no economic incentive for most Robusta farmers to improve cultivation and processing quality standards, most treat it as a secondary crop and take the absolute minimum care and make the lowest possible investment necessary to bring it to market. Lacking a specialty coffee market outlet similar to Arabica that rewards achievement, Robusta farmers remain caught in a race to the bottom, in which the lowest quality product receives the highest short-term economic gain in a perpetual downward spiral.

This economic imbalance has also stifled scientific progress in Robusta coffee, despite its genetic potential to do so much more than Arabica. Robusta cultivars have wide ranges of

characteristics, grow in highly variable climate conditions and are cross pollinating, unlike Arabica, which means that they develop complex regional gene pools that allow for natural evolution of the species without human intervention. Even before considering Robusta's wider tolerance for high temperatures, natural pest resistance and higher yield per plant, its genetic diversity allows the species greater adaptability to our real world challenges of stressed global coffee supply and the looming dangers of climate change.

The Coffee Quality Institute (CQI), a charitable trust of the SCAA, saw these issues and potential for wide-sweeping improvement long before my tasting event in 2007. Using its Q Coffee System designed Arabica coffees as a template and working with the assistance of Robusta producer associations, CQI proceeded to create standards for a new class of Fine Robusta. The resulting R Coffee System is now in place and beginning the monumental task of educating the world's coffee producers and buyers; a first step toward improving the quality and value of all Robusta – today nearly 40% of the world's total coffee supply.

CQI is not alone – organizations interested in advancing food security programs among coffee farming communities have taken notice of Robusta's possibilities too. Since Robusta has a preference for higher temperatures than Arabica and conveniently takes 2-3 months longer to ripen each season, it can be planted at lower elevations on existing farmlands and offer a second harvest. The additional funds earned using available land and known coffee farming skills can provide valuable extra income where it is most needed to buy food and clothing during the lean months between seasons.

When you visit Nishant's Sethuraman Estate, as I did for the first time a little more than a year after our dinner meeting, at a glance it's not easy to tell from the sophistication of the operation or condition of its facilities whether you're approaching an Arabica or Robusta farm. From its carefully manicured rows of coffee or meticulously clean drying decks, it could be any top Cup of Excellence™ producing estate anywhere in the world that employs carefully orchestrated land management, uses cutting edge farming technology like computer controlled drip irrigation and advanced environmentally friendly practices for conserving water and producing 100% of its own organic compost fertilizer.

Nishant's efforts to grow Robusta not only been vindicated by what you taste in the cup or by becoming CQI's first certified and commercially available fine R Coffee earlier this year, but by his company's performance. In direct trade with coffee buyers around the globe, his Robusta coffees consistently sell at higher prices than commodity grade Arabica and in a price territory typically reserved for specialty coffee. I started to wonder again: "If high quality Robusta production at Sethuraman Estate produces a pleasant tasting Robusta that sells at a market premium like specialty Arabica coffee, why have we been ignoring Robusta for so long?"

CQI Q Robusta Course Instructor Guides v2.2 (2011)

[see attachment Q Robusta Instructor Guide v2.2 Public Version]