Exploring Distinctive Characteristics & Virtues of Coffee Varieties: The Bourbon & Pacamara Case

Overview:

This document explores from different angles the Bourbon variety, one of the heirloom Arabica species and the Pacamara varietal, a very intriguing hybrid. Here you will find their botanical characteristics, agricultural practices, and how their versatility and cup profile fit within the fastest growing specialty "espresso-based beverage" and exotic coffee niches.

Brief Botanical Description of *C. Arabica*

Typification:
It is necessary to establish a *normal* variety or *type* variety, in order to compare against it the different mutations. In *C. Arabica*, the "Typica" variety had been chosen as the *blueprint* or pattern *(Kramer)*. When compared to some Ethiopian types it appears that "Typica" was chosen for growing purposes because of its resistance and productivity characteristics.

The word "Variety" and its equivalent "Cultivar" have been applied to coffee, as for other plants, referring to variations due to two reasons:

Mutations: These are expressed as more or less abrupt changes, such as a marked deviation in height or leave shape, etc. Mutated plants are descendants from a normal one and are considered as such when they permanently keep the new type after being propagated by seed. (i.e.: Maragogipe, Pacas, Caturra, etc.)

Hybrids: These are natural or artificial crosses between varieties or species. When these plants are propagated by seeds they don't maintain the new type uniformly, rather segregation of characters is common. Two types found include:

> *Intraspecific Hybrid*: They take place between the same species. (i.e.: Mundo Novo is a natural hybrid between Sumatra and Bourbon; Pacamara is an artificial hybrid between Pacas and Maragogipe)
>
> *Interspecific Hybrid*: They are the result of a cross between different species. (i.e.: between *C. Arabica and C. Liberica* like the Kawisari; or the Timor Hybrid which resulted from a natural cross between *C. Arabica* and *C. Canephora*).

Within the *Coffea Arabica* species natural hybrids are relatively scarce due to a high degree of self-pollination (between 85% and 95%). Whereas within the C. Canephora and C. Liberica most of the plantations are hybrids.

Some coffee varieties are also the result of continuous selection of specific plants from a specific variety. (i.e.: Pluma Hidalgo is a "Typica" progeny obtained in Mexico). A very lengthy and elaborated work in this area known as "Improvement by Continuous Mass Selection" was performed in El Salvador with the Bourbon variety, resulting in the Tekisic variety (the word Tekisic comes from the indigenous Nahuat tongue "*Tekitl*" which means "work" and *ISIC*, "Salvadoran Institute for Coffee Research – ISIC in Spanish" resulting on "Work of ISIC"). Its selection began in 1949 and it was released in 1977. This variety was a natural result of phenotypic and productivity evaluations, it was also known as "Bourbon Mejorado or Improved Bourbon".

Introduction of Coffea Arabica in the American Continent

The wild Coffea Arabica discovered in ancient Ethiopia was brought to Arabia between 575 and 850 by African tribes and the Sufis – known as "whirling dervishes". Thanks to the Dutch this wonderful bean began to spread widely. In 1706, they broke the Arab monopoly by taking the first harvest and a coffee plant from a Javanese plantation to the Netherlands. This specimen gave birth to the Universal Coffee Nursery at the Hortus Botanicus in Amsterdam. Eventually, coffee beans would be traveling into the New World.

By 1714, the Dutch people had already sent coffee plants to Surinam (Dutch Guyana) while the French closely watched the success of the Dutch. After the Treaty of Utrecht, Amsterdam's burgomaster decided to offer a coffee plant to King Louis XIV. This plant prospered in the Paris Nurseries. Later, France obtained coffee plants from the Yemen Sultan in 1715 and some of them were taken to Bourbon Island (now Reunion Island) east of Madagascar. Coffee was then introduced into the French Guyana and from there to Martinique Island in 1723.

Two distribution poles arose from these two places of origin: Dutch Guyana propagated coffee into South America, while Martinique distributed coffee to the Caribbean, Central America and Mexico.

Bourbon History in the American Continent

Coffees from Yemen gave birth to the oldest coffee varieties known in America. The *C. Arabica var. Arabica,* known as Typica, (genetic base for the first coffee plantations grown in America and Asia) and *C. Arabica var. Bourbon,* which propagated from the Bourbon Island. Botanists suggest that the Bourbon variety is possibly a natural mutation derived from a number of Arabica types from Yemen and Ethiopia which was later brought to Reunion Island (formerly known as Bourbon Island) as mentioned above.

It was then introduced in East Africa, Brazil and other Latin American countries. All the varieties found in Latin America grown through the mid XX century shared the same genetic base of the first "Typica" coffee grown successfully in the Amsterdam Nursery.

Between 1860 and 1870 Bourbon coffees from this Island were introduced into Brazil. A very similar story is applicable to Central America. By 1936, the first Salvadoran Coffee Census estimated that nearly 45% of total hectares (82,000 Ha) were grown to Bourbon. During the XIX century until the 40's, coffee plantations in Central America were Typica and to a smaller degree Bourbon and Maragogipe, and a few less important ones. These plantations had a lot of uniformity due to genetic factors and reached a prominent size due to the absence of common pruning practices.

It wasn't until then, that coffee professionals in Central America began research aimed at developing healthier plants through the selection of the most productive ones. In the 1930's, a selection program was initiated in Brazil using Bourbon plantations, the best lines were more productive than Typica, among these trees, Bourbon Amarello or Yellow Bourbon stand out producing 40% more than the Bourbon Vermelho (Red Bourbon). In Guatemala, successive selections produced a variety baptized as "Bourbon Chocolá".

Natural Mutations from Bourbon, New Varieties & New Growing Techniques.

In 1935, a smaller size tree was discovered in Brazil among a Bourbon plantation. This specimen was called "Caturra". The smaller size allowed for an easier harvest and higher densities of trees per hectare. With the advent of sun grown coffee technologies in the 60's and 70's in Costa Rica and

Colombia densities were raised further. These changes were embraced to some extent in many other countries, but in different magnitude from one to another depending on factors such as temperature, soil type, solar radiation, as well as socio-economic developments. By that time, in Guatemala, Nicaragua, Honduras and El Salvador many growers didn't change to smaller-sized varieties because of one or various factors indicated before. The same "Caturra gene" appeared in El Salvador when a Bourbon plant mutated into the "*Pacas*" variety which was discovered in Santa Ana in 1949 and a similar event occurred when the "*Villa Sarchi*" variety appeared in Costa Rica, popular between the 50's and 60's.

Between the 70's and early 80's generic research resulted in new varieties and new techniques that pushed many growers to substitute the old traditional ones. A popular one was the Catimor hybrid, a crossing between Caturra and the Timor Hybrid developed in Portugal. The introduction of this variety into Central America coincided with the spread of the "coffee leaf rust", since this cultivar claimed to be resistant to fungus diseases. Nearly all coffee research agencies around America received lines of Catimor. It was probably distributed sooner than recommended because most of these lines were not yet screened enough to fit each country conditions. Some other varieties like the Catuai, which is a cross between Mundo Novo and Yellow Caturra also made an appearance in the coffee arena in America.

Although many varieties appeared later in the past century some real bourbon plantations are still kept in Latin America from Mexico to Brazil. Today traditional varieties are the pride of many origins and on the other hand specialty coffee buyers are constantly searching all the way down the coffee chain to secure a product with the characteristics they consider best suitable for their business. According to research, in Central America, Guatemala and El Salvador are probably the main sources of Bourbon Coffees.

A gourmet coffee project implemented in El Salvador between 1994 & 1997 developed a quality standard that later evolved into a label known as Itzalco Premium which required that coffee bearing this brand be 90% Bourbon. More recently, a 100% Salvadoran Bourbon Certification seal, audited by BCS Öko-Garantie, was launched in 2005 by the Specialty Coffee Association of El Salvador.

In El Salvador the prolific research carried out for many years in the variety selection field put a lot of emphasis in the Bourbon variety itself, which along with certain socioeconomic factors explain why Bourbon coffee plantations still cover almost 70% of the total planted area. One research presented in 2002 by experts from CATIE, IICA-PROMECAFE and IRD using molecular markers confirmed that the genetic base of the bourbon variety was spread in the 18th century, starting from Holland and France and then into the Bourbon Island. Using RAPD markers, no differences were found between the Salvadoran and the original African samples studied, confirming the homogeneity of C. Arabica's genetic make-up due to its self pollination. In other words, the varieties grown these days for this country have not undergone genetic changes over time, therefore it can be stated that they have the same characteristics as the first known variety.

The Bourbon variety

Description: The bourbon coffee tree is a tall plant with long branches, long internodes spacing, open architecture and deep red berries. Some other general characteristics also include:

- Bourbon's silhouette has lighter conic shape than Typica;
- It has more secondary branches than Typica
- Lateral branches have a more acute angle.

- New leave shoots are predominantly green colored.
- The leaves are wider than Typica and their edges are wavier
- The bean is a little bit smaller and shorter
    - Length 0.95cm
    - Width: 0.70cm
    - Thickness: 0.36cm

Cultural practices

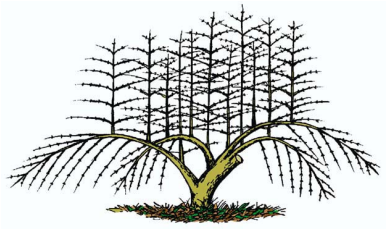
Cultural practices vary significantly from country to country; they are influenced by many variables, including altitude, topography, and variety selection, among others. The Bourbon variety as pointed out is a traditional one that is also associated with other traditional practices, some of the most important are detailed below.

Coffee tree pruning

Pruning allows for the renewal of vegetative area with increased productive potential. It also improves the distribution of light and air circulation around the coffee tree. This practice is normally carried out soon after harvesting ends and extends for around three months until the rainy season starts. Coffee plantations gradually lose their productive capacity and become less productive after 4 o 5 crops. The new branches that emerge after being pruned begin producing cherries within 18 months. The selection of the various pruning systems that are used depends on the age of the tree, variety, tree density and altitude.

Multiple stem (Parra) system

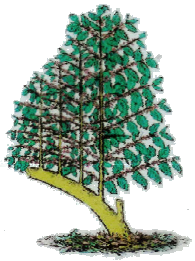
This system is practiced from the first years of growth and is done by bending the main stem and later bending the new emerging branches until the tree achieves a dense bush like structure. The system is maintained by pruning exhausted offshoots on top of the tree and bent stems.



The bourbon variety is very well suited for this pruning method because its stems and branches are very flexible. In addition its longevity and high sprouting capability allows for multiple bends. Thanks to this system it is quite common to see coffee trees that are older than 70 years and still very productive.

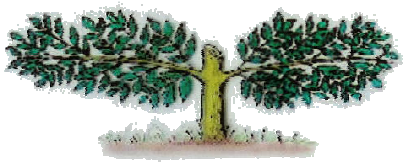
Multiple vertical branches

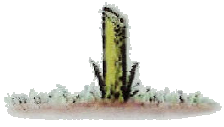
When the plant is 2 or 3 years old the main stem is bent. New vertical branches sprout and the best 3 are selected, the rest are removed. The top of the main stem, called the tail when bent, is pruned; this is done 3 years after having been bent when the new offshoots are in full production. Maintenance is done through annual pruning based on visual judgment (appraisal pruning). This system is also very well suited for the bourbon variety and is normally chosen when a higher density is desired by the producer.



Stump system

The tree is completely cut down 30 to 40 cm. above the soil. The incision is done at a slight angle in order to prevent water accumulation. This system provides for a more uniform vegetative growth, facilitates mechanization and intercropping.





This system is used for high density plantations and is widely used for most dwarf and mid size varieties, but it is also

used for old bourbon trees that could later be managed under a multiple stem or multiple vertical branch system. Many producers usually stump a plantation by rows in cycles of 3 or 4 years (one row every three or four rows), but there are different variations to this.

Offshoot thinning

Although this is not a pruning system it is one consequent activity. Abundant offshoots sprout after pruning. Depending on the pruning system practiced and tree density, many of these have to be removed, an activity which is normally done by hand. This is critical to achieve good vegetative development of the remaining offshoots. Some dwarf varieties are pruned at the end of the stem to induce growth of the mid and lower branches.

Although there's not enough information related to the correlation between cultural practices (weed control, tree density, thinning and pruning) and total coffee quality, it has been observed that coffee grown under good growing conditions, have a better size and flavor.[1]

Coffee and shade

Shade trees play a fundamental role in regulating the microclimate of coffee plantations; including sunlight, especially in latitudes where it is very abundant and intense. It also regulates agronomic conditions such as vegetative growth and bean development. Other activities affected by shade include fertilization, pruning and pest control. One crucial role is protection of biodiversity protection and natural resources such as water and soil[2]. Coffee beans that grow under shade synthesize their sugars in a gradual and natural way; which according to many experts is important for the bean to express its full quality potential.

Shade tree density varies from 70 trees per hectare in high altitude areas to 155 in low altitude areas. It normally takes from three to five years for a permanent shade tree to reach maturity and provide adequate shade[3]. In the interim producers rely on fast growing temporary or semi permanent shade trees and shrubs[4].

Shade tree pruning

The tree is gradually formed into an umbrella like shape by leaving one main stem at a height of 2 to 4 meters. Maintenance pruning is carried out by removing vertical branches and those that develop on top of other branches. In high altitude areas where sunlight is needed during the rainy season the "skeleton pruning method" is practiced, which is done by striping the leaves of the tree. The wood provided by shade and coffee trees is an important energy source for drying coffee in mills and for cooking purposes in many rural areas[5]

Soil conservation practices

Coffee plantations in Central America are generally grown on the slopes of hills and mountains where it is hard to grow other crops that provide significant environmental benefits quite as similar as those provided by shade grown coffee. Despite the considerable tree density of both shade and coffee trees it is always necessary to carry out soil conservation practices because of the recurrence of heavy rains during the rainy season.

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[1] *Factors that influence coffee quality*, Jean Wintgens, 1992.
[2] The abundance of shade has prompted many growers in El Salvador to seek the Rainforest Alliance certification for example, which requires among its environmental criteria that the percentage of shade after pruning be at least 40%, provided by a minimum of 70 shade trees per ha. (Including at least 12 different native trees).
[3] The most common shade trees used in El Salvador are those belonging to the Inga species
[4] Such as: Crotalaria longirostrata, Cajanus Cajan, Ricinus communis, Solanum sp. Cassia siamea, etc.
[5] The availability of firewood from coffee plantations decreases the pressure to cut down trees for this purpose

Pit digging has been one of the most popular soil conservation practices in El Salvador. These holes on the ground are normally 60 cm. long; 40 cm. wide and 30 cm deep and are dug between rows or within them. The number will depend on the economic conditions of the producer. These holes decrease water runoff, accumulate organic matter and in some cases coffee pulp is placed inside, thereby improving soil structure and fertility. Other practices include individual and continuous terraces. These are very common when planting new trees. In wind prone areas windbreak barriers are planted; these are very flexible trees with a strong root system and a very compact leave and branch system[6].

Plant hedges are also planted along contours to reduce the speed of water runoff, retain soil and protect existing terraces. The plants used are perennials[7] exhibiting dense and fast vegetative growth; small in size but with a deep root system.

Some bourbon advantages:

In Central America, it is normally recommended that tall varieties such as Bourbon be shade grown with densities ranging from 2000 to 3,500 coffee trees per hectare; while some other varieties such as Caturra and Catuai could be shade grown or open sun grown with densities ranging from 4,000 to 7,000 coffee trees per hectare.

The bean size has obviously certain commercial value. According to some studies Bourbon beans are normally 65% above screen 17. In comparison "Typica" beans are generally 80% above the same screen. Bourbon beans are slightly larger than Caturra and larger than Catuai. However, these studies are not conclusive since the bean size depends a lot on nutrition, stress and load of the tree. If the stress is severe or if the production of a tree is abundant, the bean size tends to be smaller. The presence of defects like floaters is also dependant on these factors. The production of peaberries is also related to variety and nutrition variables.

Nonetheless, Bourbon trees face some agronomic shortfalls. Due to its narrow genetic base they are more susceptible to diseases and pests than those varieties that have a wider base.

Quality by the books

Coffee Quality is very hard to define and agree on. Although, there is no scientific way to prove it, many coffee buyers indicate that traditional varieties such as Bourbon are superior to the rest regarding cup quality and bean physical appearance (Lingle, 1995). This variety is almost exclusively shade grown and very often there have been comparisons to Caturra and Catuai grown without shade. One study performed in 1995, *Guyot et al. (1996)* demonstrated that altitude and shade are two factors that improve quality for Bourbon and Catuai. However, altitude was more important for Catuai. At the end, the authors were not able to establish a clear superiority.

In 1997 (Figueroa), a similar approach found a notorious lead of Bourbon when compared to Catuai and Caturra. The same evaluation also proposes a quality hierarchy that places Typica as the most desirable, followed by Bourbon, then Caturra and Catuai; whereas the ranking regarding productivity is exactly the opposite. In any case, it is generally claimed that Bourbon enjoys a high intrinsic quality profile to the point of being considered as an international benchmark that any new variety should aim to reach in order to be considered as suited for the specialty coffee market especially when finding the right beans for espresso.

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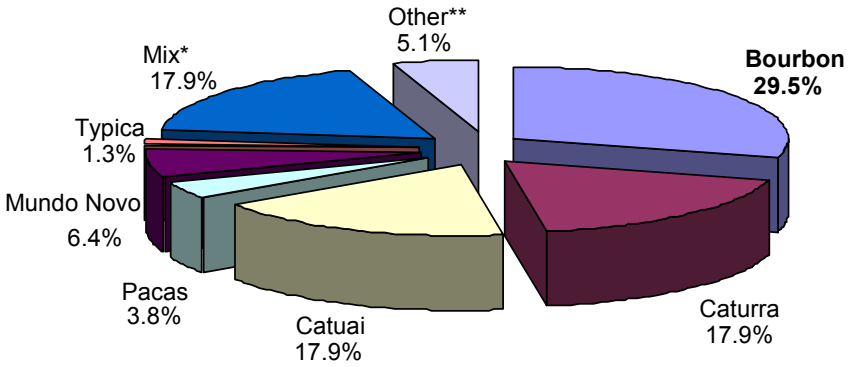
[6] In El Salvador commonly used trees include Croton reflexifolius, Eugenia jambos and Cupressus betamii
[7] Such as Yucca elephantipe, Vetiveria zizanioide, Cymbopogon citratos, etc.

Quality coffee competitions and Bourbon Performance

According to the Cup of Excellence® web site and BSCA data, from 1999 to 2005, Brazil has had 189 COE award winning coffee lots, 29.6% of which were of the Bourbon variety (including Yellow or Red Bourbon). It is important to remark that in Brazil bourbon coffee not even represents 1% of its total production. In spite of this, nearly one third of the winners were bourbons. It is also significant to mention that during the same period 17 out of 34 (50%) lots that scored over 90 points were straight Bourbons too.[8]

Furthermore, 29.5% of all Cup of Excellence® coffees that scored above 90 from 2000 to 2005 are of the Bourbon variety, followed by Caturra (17.9%) and Catuai (17.9%) as shown on the pie chart.[9]



In the November 2004 issue of "The Coffee Review" which featured the prize-winning coffees from Central America the bourbons also showed an outstanding performance since 4 out of the 9 coffees which scored over 90 points, were straight Bourbons, 2 were Pacamaras, 2 Caturras and 1 a combination between Pacamara, Caturra and Bourbon.

In the 2004 Guatemala's Exceptional Cup, 10 out of 23 auctioned coffees were straight Bourbons (43%), and another 6 (26%) included Bourbon on a varietal combination (mainly Bourbon and Typica, Pache and Caturra). In the 2005 edition, 12 out of 25 (48%) were straight bourbons and other 8 (32%) included Bourbon on a varietal combination (Bourbon and Caturra mainly). In El Salvador, from 2003 to 2005, 80% of COE winning coffees were Bourbons

In the 2004 and 2005 "Q" Auctions held in Costa Rica, Honduras, Nicaragua, Guatemala and El Salvador, 33 out 84 coffees with "Q" grade (39%) were Bourbon or included Bourbon on their combination with other varieties.

Genesis of an exotic superstar – Pacamara Varietal

The breeding of this hybrid was masterminded inside the Genetic Department of the Salvadoran Institute for Coffee Research (ISIC) back in 1958 when the institute began a coffee breeding improvement program using hybridization among many varieties, one of these experiments derived into an outstanding hybrid by artificially crossing the Pacas and Red Maragogipe varietals at their fourth generation (F4). After evaluation and selection it was named PACAMARA using the first four letters of each parent.

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[8] Data for 2000 to 2005. Info on scores N/A for 1999.

[9] Brazil, Nicaragua, El Salvador, Colombia, Honduras and Bolivia. * Main combinations include: Caturra/Typica(7), Caturra/Typica/Catuai (1), Caturra/Colombia(1), Catuai/Mundo Novo(2), Caturra/Catuai(1), Bourbon/Kenia (1), Bourbon/Pacas/Catuai (1) ** Other: Acaiá (2) and Icatú (2). 2002 data for Nicaragua N/A.

With the conception of this *intraspecific hybrid* researchers sought to combine the desirable characteristics of the Pacas variety such as its shorter size, shorter internodes, higher productivity, adaptability to local conditions and its ability to resist wind, sunlight and droughts with the plant vitality, the lushness of its big leaves and bigger bean size of the Maragogipe, as well as its better cup quality.

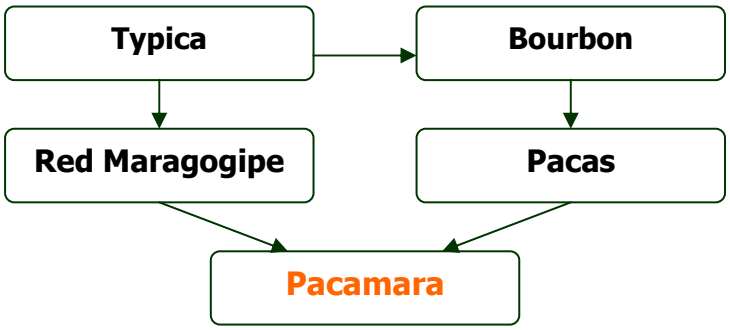
Meet the Parents

Pacas

It is a natural and spontaneous mutation of Bourbon, similar to Caturra in Brazil and Villa Sarchi in Costa Rica. This variety was discovered in 1949 in the San Rafael farm - in the Ilamatepec/Santa Ana Volcano – which belongs to a family last named Pacas, acquiring their last name as its own. By that time, some people thought that it was a hybrid between Typica and San Ramón, but later it was confirmed that it was a natural mutation because of its progeny did not show any phenotypical variations.

Red Maragogipe

It is a mutation of Typica, it is also known as the Arabica coffees giant, it shows a very tall size, large leaves, cherries, etc. In general, its architecture is open and messy, it is not a high yield producer but the cup quality is notable. This variety appeared in 1870 in the Maragogipe province in Bahia, Brazil.

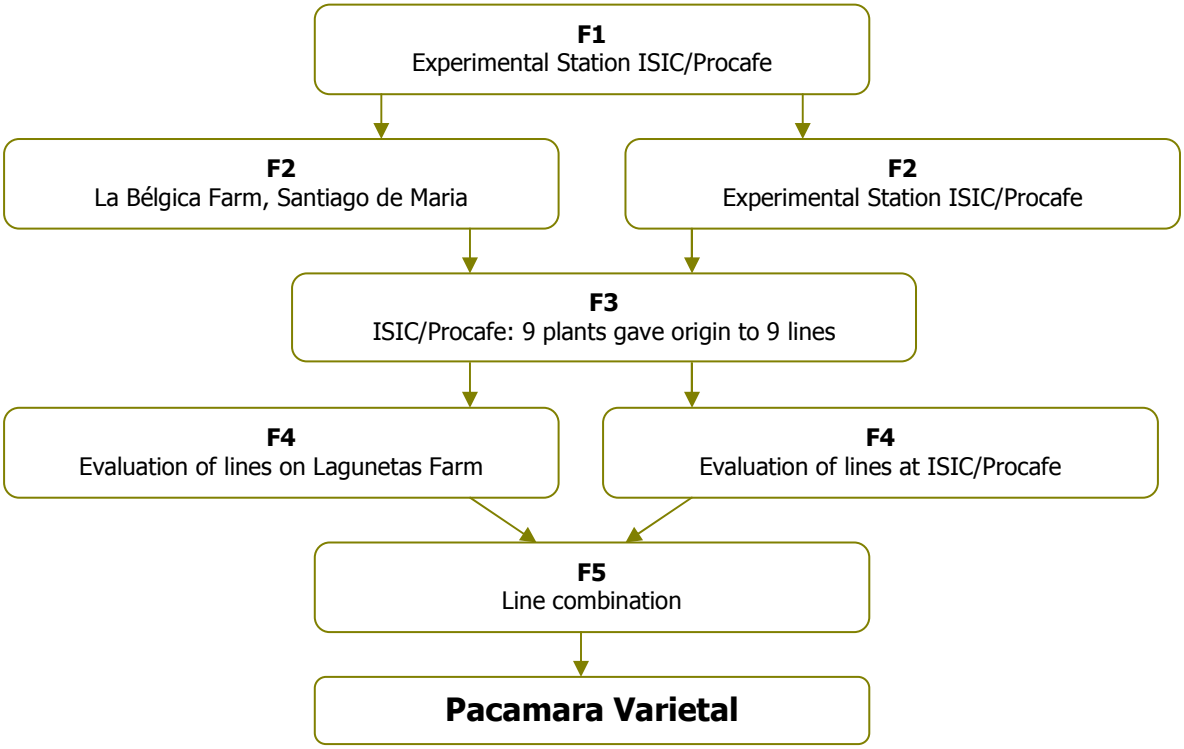


A lengthy yet rewarding process

This work involved individual selection until researchers obtained mother plants which gave birth to 9 lines, which were evaluated according to their phenotypic aspect, productivity, yield, fruit size and adaptability to different coffee growing areas in the country, then selected lines were combined to obtain a new cultivar, the Pacamara varietal.

After some 30 years evaluating the progeny, the ISIC begun distributing the fifth generation (F5) of this particular hybrid to coffee growers, however it still segregates back to Pacas or Red Maragogipe in quantities ranging from 12% to 15%, but this problem is feasibly solved with proper plant selection and removal at the nursery stage. The reason behind this latter issue lies in the fact that both parents have dominant genes.

As mentioned above, the hybrid was evaluated in different regions of El Salvador, showing better results at high to strictly high grown conditions, ranging from 900 to 1,500 meters above sea level, but expressing better qualities and adaptability above 1,000 meters. This varietal tolerates wind and cultural practices such as tree stumping. Some of the experiments yielded from 68 to 117 46 kg. bags per hectare. Below is the road map in the process of obtaining Pacamara at the ISIC.



The Pacamara varietal

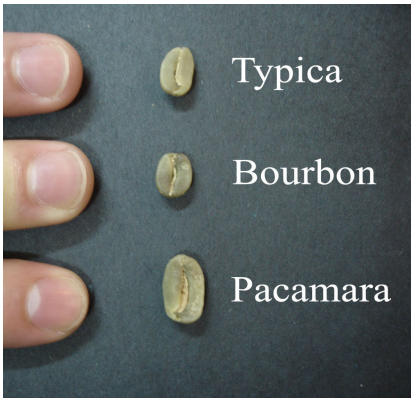
Description: A medium-tall size tree; short internode spacing; large, corrugated and dark green leaves, new leaves could be either green or tanned (brown). Wider and rigid stalk, thick foliage.

- The tree has an intermediate size as compared to Pacas and Maragogipe but it is taller than Typica.
- More lateral branches than Typica, similar to Pacas.
- From the middle down it shows more secondary branches.
- The leaves are wider and larger than Typica and their edges are corrugated and wavier.
- The cherry has a small protuberance in the floral disc (navel).
- The bean is big and oval shaped (longer than wider).
  - Length 1.03cm
  - Width: 0.71cm
  - Thickness: 0.37cm
- Beans will show more than 70% similar size with Maragogipe (depending on altitude)
- In general, 100% of the beans above screen 17 and 90% above screen 18.
- Some 12% of the beans are Peaberries (very suitable for highly specialized niches)

Harvest and Processing recommendations

- No mixing with other varieties.
- Shade and fertilization
- Depulp separated
  - Calibration for larger beans
  - Use of rubber pulpers (pecheros)
- Natural fermentation. Mechanical removal of mucilage is not recommended since it tends to break too many beans.

- Important to wash it at the right fermentation point since it could easily post-ferment, deteriorating the acidity profile and expressing an acetic taste.
- 100% Sun drying in patios.
- Shade should be used according to altitude conditions, with higher altitudes it requires less shade trees and vice versa.
- Coffee tree pruning could be: appreciative, cyclical by furrows, Full stomp or by plots.



Limitations

Some limitations of this varietal include:

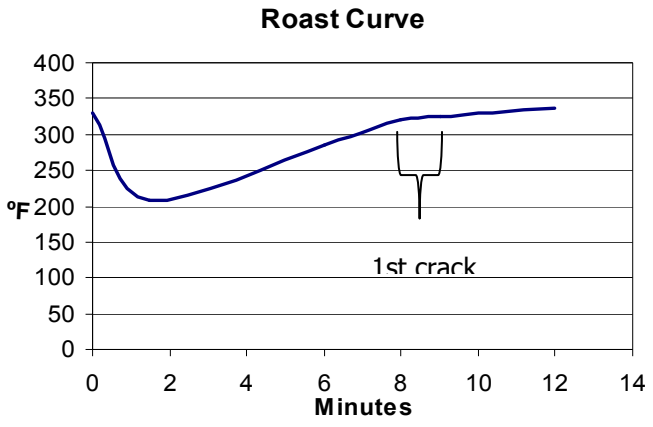
- High altitudes to express its optimum production and yield
- Stability and segregation (tending a little more to Pacas than to Maragogipe, but manageable)
- Slightly susceptibility to "derrite or requemo" (*Fusarium* or *Phoma costarricense*)
- Susceptibility to Coffee leaf rust (*Hemileia vastatrix)*
- Late maturation when compared to other commercial varieties (however, this becomes a positive condition since it allows for a separate milling and thereby the milling process can be adapted to the bean size)

Cultural practices

In El Salvador Pacamara is also shade grown and with the exception of the multiple stem type of pruning the cultural practices described above for the bourbon variety also apply to Pacamara.

How to roast Pacamara for cupping purposes – Our point of view

Because of the bigger size of its beans (nearly 100% above screen 18), resulting on a higher density due to its specific bean weight (around 0.215 grams/bean on average) but with a slightly softer cell structure of Pacamara beans, roasting can easily affect its final flavor profile if not done properly. The experience derived from quality competitions in El Salvador has shown that Pacamara develops its best profile when roasting is done starting at a temperature of 160ºC - 165°C (320ºF to 330ºF), a normal drop to 98ºC – 100ºC (208ºF – 212ºF) follows and the endothermic stage begin. After some 6 minutes, the bean will exhibit a light brown color, by this moment, when temperature reaches around 140°C – 145ºC (285ºF – 295ºF), a reduction of 10% to 15% of the heat source is recommended to avoid excessive heat absorption so that the first crack occurs around the 8th or 9th minute. This will allow the beans to roast homogenously, if not performed properly the acidity profile will be way too intense and extreme with an unpleasant note.



When the first crack begins the measuring device should read somewhere between 160ºC – 163ºC (320ºF – 325ºF). This first exothermic stage should last about two minutes. The ideal roast point is achieved after 11 to 12 minutes with a temperature of 168ºC – 170ºC (334ºF – 338ºF), and nearly 40 seconds after finishing the first crack. This roasting protocol should lead to a 55 Agtron (E20-CP) in whole bean and 60 Agtron in ground coffee.[10]

[10] Roast profile for cupping using Pacamara beans with 11.5% to 12.5% humidity and 1 kg. sample

When roasting Pacamara for commercial purposes, it is recommended to follow the previous cupping protocol, until the start of the second crack, which should happen when 14 to 15 minutes have elapsed. At this time, temperature should be between 180ºC - 185ºC (356ºF – 365ºF) resulting on an Agtron reading of 47 - 48 in whole bean and 53 - 54 in ground coffee.

As mentioned by many Pacamara buyers and roasters this varietal is very tricky when finding the perfect roast, but once the right profile is established the results will be unique and outstanding. With the recommendations mentioned above, this document is only trying to suggest one possible way of roasting these beans. However, because of the different flavor and taste preferences from the consumers, roasters would clearly use diverse roasting profiles for their blends or straight coffees.

Cupping profile

Although this variety shows some of the typical characteristics observed for other coffees when grown between 1,100 to 1,200 meters above sea level (3,630 and 4,000 feet above see level), characteristics such as aroma and floral flavor are enhanced and perceived more intensively when grown at higher altitudes. Cleanness and fineness are also enhanced. Flavors such as grassy and roughness disappear.

The floral aroma and flavor is probably one of Pacamara's main characteristics, developing other attributes such as chocolate (milk, dark, sweet) and fruit flavor (apricot, peach, berry, green apple, etc) and expressing a long and sustained aftertaste with nutty and spiced notes, usually clove and cinnamon with creamy full body.

What you might expect with Pacamara

Aroma	**Penetrating floral aroma (jasmine like)**
Body	**Medium to full body with a creamy character**
Acidity	**Medium to high acidity (crisp, juicy and bright)**
Flavor	**Very complex, with different flavors including: chocolate, clove, cinnamon, vanilla, berry-like.**
Aftertaste	**Pleasant and long aftertaste with a sweet final note.**

Practically unknown outside of El Salvador for many years, but because of its reputation Pacamara is now spreading into Mexico, Nicaragua, Honduras, Guatemala and Peru. In Nicaragua, a crossing between Caturra and Maragogipe is identified as Maracaturra or Maracatu but this cross was not performed with the complex process done in El Salvador. El Salvador's Pacamara has been also very popular for many years in Germany, for pastry and dessert making purposes due to its huge size.

Comparative Charts

Variety	Botany	Size	Fruit Size	Predominant Color*
Typica	Pattern variety	Tall	Big	Red/Yellow
Bourbon	Natural mutation (Typica)	Tall	Big	Red/Yellow/Pink
Tekisic	Bourbon selection	Tall	Big	Red
Mundo Novo	Natural hybrid	Tall	Big	Red
Kenya	Natural mutation (Typica)	Tall	Big	Red
Maragogipe	Natural mutation (Typica)	Tall	Very Big	Red/Yellow
Pacamara	Artificial hybrid	Medium	Very Big	Red
Caturra	Natural mutation (Bourbon)	Short	Normal	Red/Yellow
Pacas	Natural mutation (Bourbon)	Short	Normal	Red
Villa Sarchi	Natural mutation (Typica)	Short	Normal	Red
Catuai	Artificial hybrid	Short	Normal	Red/Yellow

** It is possible that in Arabica coffee plantations appear yellow, pink or even orange cherries, since the "xanthocarpa" gene, which rules the yellow color of the fruit, is present in this species.*

Variety	Growing altitude	Planting (Trees/Ha)	Recommended Spacing (mts)
Typica	> 800	3,333 3,585 4,790	2.00 x 1.50 1.67 x 1.67 1.67 x 1.25
Bourbon	> 800		
Tekisic	> 800		
Mundo Novo	> 800		
Kenya	>1,000		
Maragogipe	>1,000		
Pacamara	>1,000	3,333 3,585 5,988	2.00 x 1.50 1.67 x 1.67 1.67 x 1.00
Caturra	>500	3,333 3,585 5,988	2.00 x 1.50 1.67 x 1.67 1.67 x 1.00
Pacas	>500		
Villa Sarchí	>500		
Catuai	>500		

Quality from the consumer point of view

The information presented above is only intended to provide some insight and facts regarding Bourbon and Pacamara varieties as it relates to cultural practices and its quality profile that make them very particular and intriguing. It is not intended to prove the pre-eminence of any varietal over another, or trying to compare traditional vs. hybrid varieties. As Mr. Kenneth Davis said: "*There is no doubt that coffee from different varieties tastes different, even when the trees are grown on the same soil under the same conditions*".

Fortunately enough, coffee beans vary widely in quality according to the countless microclimates, cultural practices, varieties, milling, drying methods and the myriad combinations among them involved in producing this fascinating crop. The real value of coffee lies in the fact that like wine, the consumer has the opportunity of choosing among numerous quality options. The discerning coffee drinker is the final judge of quality.

Bibliography

- Agronomical issues and their influence in coffee quality, Angel Cabrera, El Salvador, 2004.
- Central America's Coffee Growing Challenges, ed. Bertrand & Rapidel – IICA-PROMECAFE-CIRAD-IRD-CCCR. FRANCE, 1999.
- Factors that influence over coffee quality, CMC – IICA, 1992.
- Coffee Species and Cultivars, Leon 1962
- Coffee growing techniques workshop, El Salvador- ISIC, 1979
- El Salvador Land of Coffee – PROCAFE, 2003.
- Coffee Grower's manual – PROCAFE, 2003.
- Coffee Dictionary – Dr. Alfonso Rochac, El Salvador, 1977.
- Coffee Growing Manual, ANACAFE
- Various Documents – ICO
- www.ico.org
- www.mendelweb.org/Mendel.html
- www.coffeereview.com
- www.procafe.com.sv
- www.cupofexcellence.org
- www.coffeeinstitute.org
- www.coffeedna.net
- www.scaa.org
- www.coffeeresearch.org
- www.salvanatura.org
- www.ra.org
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