

Coffee Bourbon Pointu of Reunion Island: How to Define a Terroir to Obtain a «Gourmet» Coffee

F.DESCROIX¹, P. AGUILAR², L. BERTHIOT²

¹CIRAD, UMR Qualisud (Démarche intégrée pour l'obtention d'aliments de qualité),
7 chemin de l'IRAT, BP180, 97455 St Pierre, Réunion Island, France

²CIRAD, UMR Qualisud, TA B-95/16, 73 Rue J.F. Breton, 34398 Montpellier cedex 5,
France

SUMMARY

New ways of coffee consumption have emerged with the development of specialty coffees and terroir coffees. Producing coffee in a European country is a challenge according to the cost of labour. Nevertheless, farmers of the Reunion Island, the French island in the Indian Ocean, decided to grow coffee helped by a development project (“Café Bourbon pointu de la Réunion”) with the aim of producing a high value coffee for a niche market. Producing coffee on the Reunion Island is not new: the first coffee plants were introduced in the 18th century from Yemen. Coffee cultivation has contributed to develop the island. “Bourbon pointu” is the result of a natural mutation of a Yemen Arabica coffee plant, discovered in 1771 in a plantation near the village of Sainte Marie. The coffee Bourbon pointu, caffeine low, is well known for its special citrus fruity taste.

MATERIAL AND METHODS

In 2002, 27 coffee Bourbon pointu stocks (*Coffea arabica* [Laurina]) are selected among the 2400 coffee trees found in the “creole” gardens. In 2003, 113 plots are planted all around the island to put across experiments in various ecological conditions.

Coffee plots are georeferenced (longitude, latitude, altitude).

Different soil types can be found in the zone of coffee cultivation (according to the FAO World Reference Base for Soil Resources classification):

- type 2: Acrisols,
- type 3: Andic Cambisols on ashes,
- type 4: Silandic Andosols on ashes,
- type 5: Hydric Andosols on ashes,
- type 8: Leptic Cambisols on ashes,
- type 11: Hydric Andosols (Skeletal).

The climate variables have been collected from “Meteo France sites” close to the plots, adjusted according to the altitude for the temperatures¹ and for the sun radiance².

¹ Calculated Temperature = Temperature meteo site – (coffee plot altitude-meteo site altitude)/100* variation factor, this factor swings from 0.72 in February (summer) to 0.81 in August (winter).

² Calculated decade global radiance in MJ= meteo site decade global radiance in MJ + (coffee plot altitude - meteo site altitude)* global radiance factor according to the altitude for the decade in MJ/100m.

The collected variables are:

- monthly mean temperature,
- monthly minimal temperature (mean, absolute),
- monthly maximal temperature (mean, absolute),
- monthly wind speed (km/h),
- monthly cumulative rainfall,
- monthly sun radiance.

The cherries are collected by the project and are processed in the project workshop. Sensory evaluation of the coffees is done by a 12 coffee experts. The samples are prepared and tested according to the ISO 6668 standard. The sensory attributes are: Aroma strength, Body, Acidity, Bitterness, Astringency, Sour, Metallic, Harshness, Grassy, Dusty, Woody, Persistence and Fruity) completed with 2 hedonic variables (Aroma quality, Preference).

Cup testing done on 3 harvest periods enable the setting up of three marketing classes built from the Preference score. Statistical analyses carried out on all the sensory data show that some correlations exist between Preference and other sensory attributes (Fruity, Aroma quality...) (Table 1). "Grand Cru" is the upper class with a Preference score of 3.50 or more.

Table 1. Links between marketing classes and sensory attributes (from ANOVA and Fisher tests results).

	Authentique	Sublime	Grand Cru
Aroma quality	Score ≥ 2.75	Score ≥ 2.85	Score ≥ 3.00
Persistence	$2.50 \leq \text{Score} \leq 3.50$	Score ≥ 2.50	
Acidity	$1.75 \leq \text{Score} \leq 3.50$	$1.75 \leq \text{Score} \leq 3.25$	$2.25 \leq \text{Score} \leq 3.25$
Body	$2.00 \leq \text{Score} \leq 3.25$		$2.50 \leq \text{Score} \leq 3.25$
Fruity	Score ≥ 1.25		Score ≥ 2.00
Preference	Score ≥ 2.75	Score ≥ 3.00	Score ≥ 3.50

NB: The scale of the sensory scores is from 0 to 5.

Are downgraded in Original (coffee non marketed), the lots not suiting to all the standards defined for the marketing classes.

The statistical analyses are carried out with XLSTAT[®] software. Statistical analysis (Analysis of Variance, ANOVA with Fisher tests and Multiple Correspondence Analysis, MCA) crossing the soil data, the climate data and cup testing data enable to highlight the parameters for the production of a "gourmet" coffee and to outline the map of the terroir fit for this cultivation on the Reunion Island.

Table 2. Elements used to carry out the statistical analyses done on the 2006, 2007 and 2008 harvests to define the favourable terroir.

	Harvest 2006	Harvest 2007	Harvest 2008
Number of cities and villages	11	9	6
Number of coffee plots	48	43	29
Altitude (from X to Y)	270 m to 1209 m	453 m to 1209 m	315 m to 1209 m
Number of coffee lots (used for the cup testing)	399	612	579
Number of different soils	6 (2,3,4,5,8,11)	5 (2,3,4,5,8)	4 (3,4,5,8)

RESULTS AND DISCUSSION

The results of the statistical analyses show the impact of altitude on sensory quality of coffee. The statistical analyses (ANOVA, not related here, and MCA: Figures 1 and 2) enable to define the fitted altitudes and soils. All the results enable to define the parts of the Reunion Island adapted to produce “gourmet” Bourbon pointu coffee.

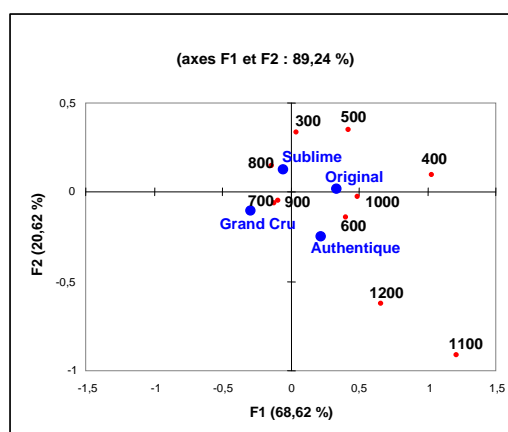


Figure 1. MCA altitude /marketing classes.

Altitude

The study of the impact of altitude on the sensory quality shows that all the marketing classes are located between 700 m and 1000 m. “Grand Cru” is the only class to be located between 800 m and 900 m.

Altitude is linked with climate conditions (Table 3).

The temperature fluctuations and the sun radiance have an impact on sensory quality. Statistical analyses (ANOVA) crossing sensory data and climate data enable to specify the ranges for the Bourbon pointu coffee cultivation on the Reunion Island:

Table 3. Correlations between altitude and the climate variables.

Variables	T° minimum	T° mean	T° maximum	Wind speed	Rainfall	Sun radiance
Altitude	-0.733	-0.863	-0.798	-0.178	-0.019	-0.530

Temperature

- Minimal temperature: between 12 °C and 16 °C
- Mean temperature: between 15 °C and 19 °C
- Maximal temperature: between 22 °C and 24 °C

Sun radiance

- For one month: mean sun radiance between 1100 and 1900 MJ
- For one year: sun radiance between 15500 and 21000 MJ

Rainfall

Rainfall: between 750 mm and 1750 mm, with a maximum of three dry months (with rain fall < 25 mm) along the year.

Soil

The ANOVA shows that the soils of types 4, 8 and 3 give better results for the Preference score than the others soils.

The analysis (MCA) (Figure 2) crossing the soils and the marketing classes shows that the soil of type 4 (Silandic Andosols on ashes) and of type 8 (Leptic Cambisols on ashes) give coffees of better sensory quality (Grand Cru and Sublime are close to these soils).

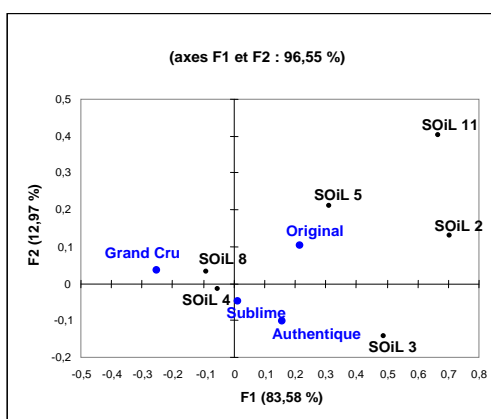


Figure 2. MCA types of soils /marketing classes.

Figure 3 shows that the type of soil has an important impact on the sensory quality of coffee (Soil 4: propitious soil; soil 2: medium soil; soil 9: non propitious soil).

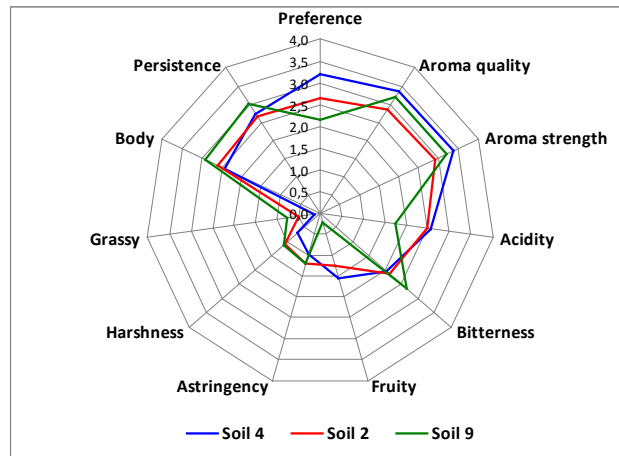


Figure 3. Sensory profile of Bourbon pointu coffee according to the type of soil.

CONCLUSION

Statistical analyses done on three harvest periods enable to highlight the main factors to produce a « gourmet » Bourbon pointu coffee on the Reunion Island (Grand Cru marketing class):

- Altitude : between 800 m and 900 m
- Climatic data
- Soil type 4 (Silandic Andosols on ashes) and type 8 (Leptic Cambisols on ashes/ Brown Andic soil).

Table 4. Adequate climatic data for the highest sores for Grand Cru marketing class.

Variables	T° minimum	T° mean	T° maximum	Wind speed	Rainfall	Sun radiance
Grand Cru	14 °C ± 2	17 °C ± 2	23 °C ± 2	70 km/h ± 20	1450 mm ± 300	17000 MJ ± 300

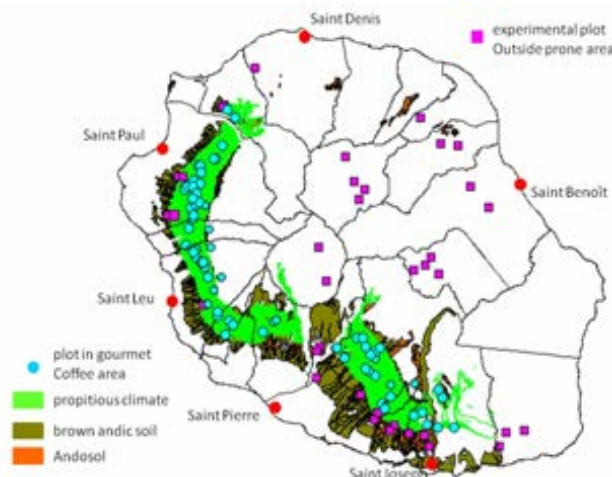


Figure 4. Map of the adequate terroir to produce a Bourbon pointu « gourmet » coffee.

Out of the pedoclimatic conditions and altitude, some other factors are essential to produce a Bourbon pointu «gourmet» coffee:

- Plant material selected for the sensory performances,
- Berry maturity stage when harvesting,
- Post-harvest process...