Robusta Revisited

A New Post-Harvest Process of Upgrading *Coffea canephora* (Robusta) Coffee Beans

Water pollution reduction; Process water and wastewater reduction.

Sensory evaluation

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Post-harvest processes

- Wet washing - requires large volumes of water, produces large volumes of highly polluted effluent.
- Operates only during harvest season. Wastewater - expensive and difficult to clean, involves chemical, physical processes.
- Wastewater, if not treated, affects local waterways (fauna/flora), other industries and human health.

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Other post-harvest processes

- Dry processing - end product generally considered to be of low quality.
- Honey - mostly small scale production
- Aerobic and anaerobic - small scale and individual preferences
- Experimental - adding enzymes; adding micro-organisms - expensive and not readily available to all.

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Coffee tree in full bloom Masaka district, Uganda.

photograph taken July 2024

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Coffee cherries not yet ripe

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Robusta tree with cherries - Uganda

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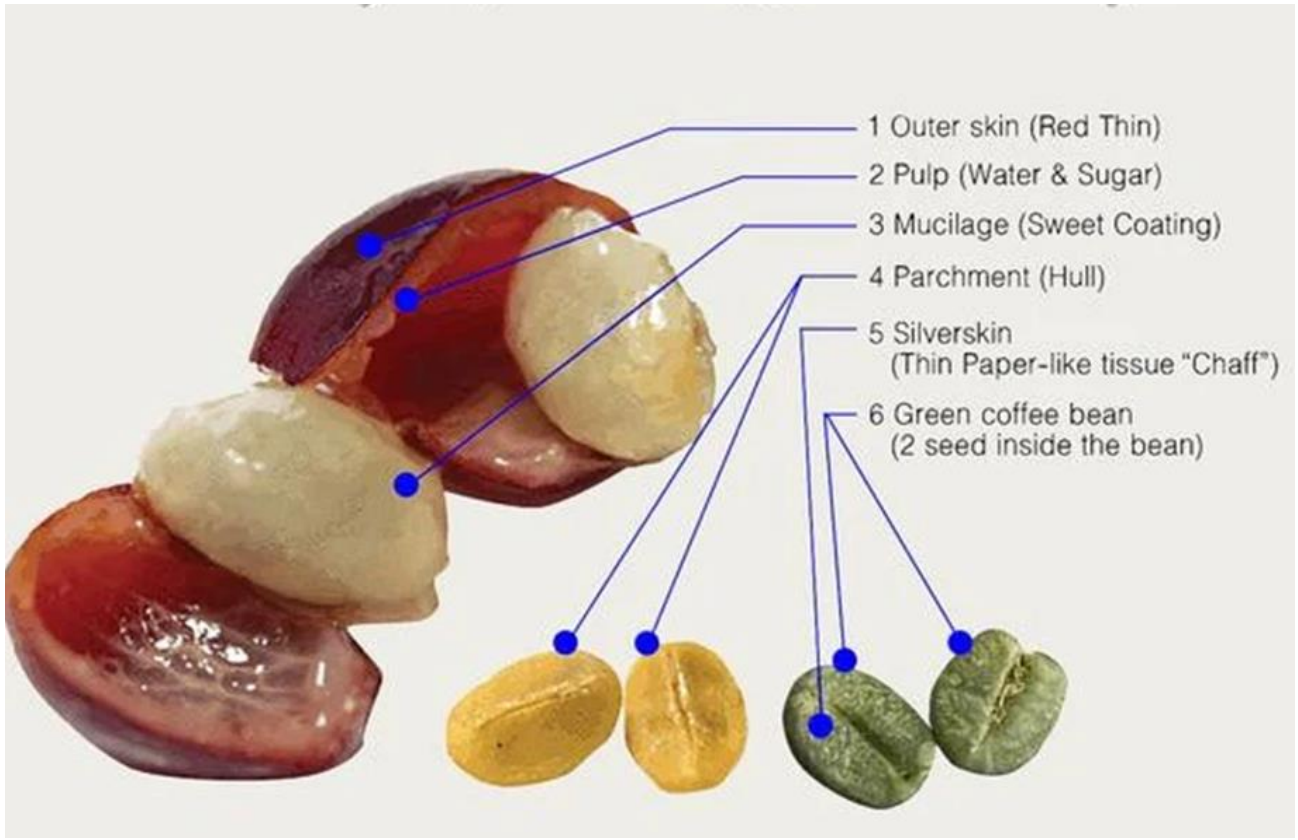
Coffee bean cherry anatomy



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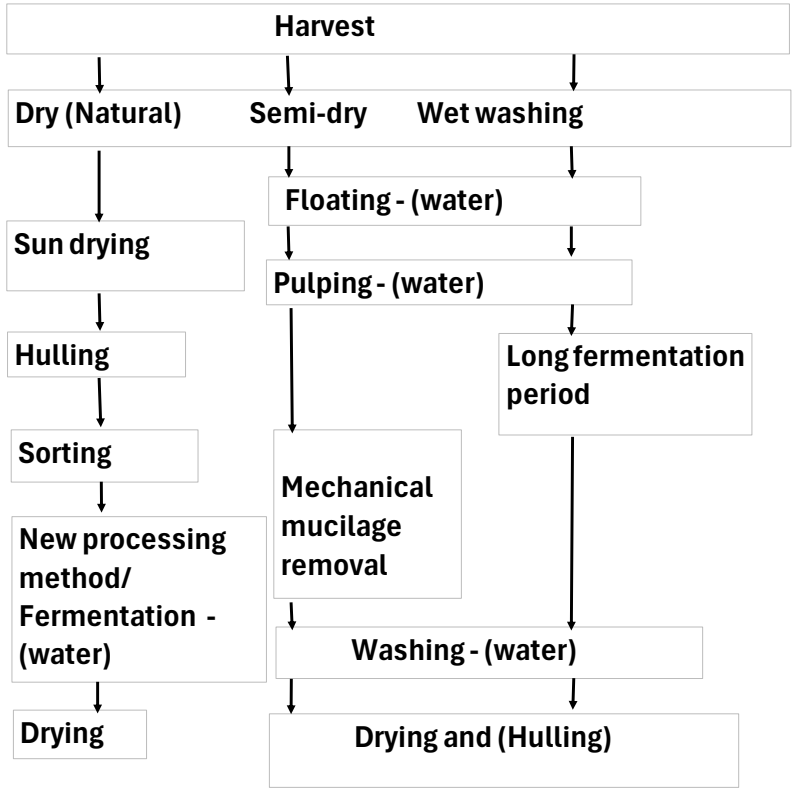
Post-harvest processing



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Climate and environmental fluctuations

- Drought - scarce sources of water - competition for water - rationing.
- Flooding - scarce clean water sources

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The new process operates in batches

- Avoidance of source pollution.
- Process reduction by 70 to 80% compared to wet washing.
- Wastewater reduction by the same factor.
- Energy source: solar power.
- Easy to use - no skills required.

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Analyses of bacteria, fungi and yeast in raw/green coffee beans detected by ISI Food Protection (Aarhus, Denmark) –using – Targeted metagenomics via Next Generation Sequencing (NGS)

- Over 40 different species of bacteria were detected, including Lactobacillus, Citrobacter species.
- Over 30 different fungi were found, including Aspergillus, Saccharomyces species.
- Aspergillus sp. can produce aflatoxins, so we analysed the processed coffee beans for aflatoxin B1, B2, G1 and G2.

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Measurement of aflatoxins; Eurofins/Steins analyses

	Result
Aflatoxin B1	<0.1µ/kg
Aflatoxin B2	<0.1µ/kg
Aflatoxin G1	<0.1µ/kg
Aflatoxin G2	<0.1µ/kg
Sum of measured aflatoxins	<0.4µ/kg

Different stages of processed robusta coffee beans. Left raw/green beans; middle, processed beans; right, roasted beans. (Photograph reproduced with permission from Bioroots ApS. Gilleleje, Denmark)

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Flavour Radar of the Robusta Coffee by Coffee Quality Institute (Zurich, Switzerland).

Fragrance/Aroma	8.08
Flavour	8.00
Balance	8.17
Bitter/Sweet	8.17
Salt/Acid	8.17
Mouthfeel	8.08
Aftertaste	8.08
Uniformity	10.00
Clean cup	10.00
Overall	8.83
Total score	85.58

Sensory Evaluation conducted by Innova Consult (Aarhus, Denmark).

- **Sample A:** Roasted robusta coffee beans at different stages
- Evaluation of freshly ground beans
- Evaluation of the brewed coffee:
- Scent during brewing
- Scent after brewing
- Cupping flavour
- Mouthfeel: long aftertaste, mouthwatering (when you drink water right afterwards, the water tastes sweet)

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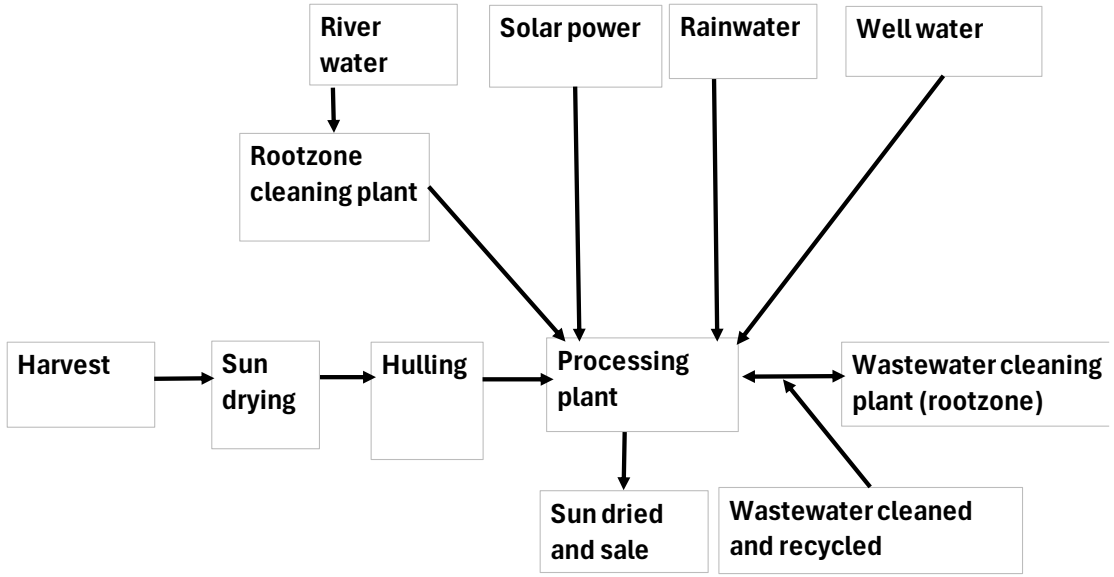
Sensory profile

- There is a current issue, in different scientific cycles, about the detection of the acidity of the coffee!

Pilot plant design



Scheme of the pilot plant designed by Bioroots ApS (Gilleleje, Denmark)

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Discussion and conclusion

- The scale of the process can be adapted to the needs of each group of coffee farmers.
- Comparative cupping between natural upgraded Arabica and washed Arabica.
- Potential impact of the process on smallholder and cooperative incomes.