Processing modes influence on the sensory profile of various types of coffee

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Abstract. Technological modes of coffee beans processing are constantly developing and improving, which raise the quality of the second most consumed drink in the world after water and meeting an increasingly demand. This paper describes various processing modes and their effect on the organoleptic properties of the coffee drink. The interrelation of climatic features of the raw material growing region, coffee processing and roasting modes, and storage conditions makes it possible to obtain a product with an individual taste profile.

One of the most relevant objects in coffee production is a quality control at all steps of production, both during the post-harvest processing, which affect sensory and physical and chemical indicators. Ensuring the quality of coffee raw materials, considering the marketing and technical requirements imposed on the world market for this product, is now becoming a priority [1].

Nowadays, significant progress has been made in studying the physical and chemical processes that occur during the maturation of coffee beans, because of processing immediately after harvest, as well as during roasting.

Consumer advantages of the drink directly depend not only on factors related to the peculiarities of the technology of coffee production from the ripe fruit of the coffee tree, the degree of roasting, but also on the climatic conditions and the place of its growth. Features of the production of this product are that at the post-harvest stage, different methods of processing coffee cherries are used, adopted in each individual country or even region.

There are two traditional methods of processing the crop after harvesting: dry, which involves drying whole cherries and then clean of coffee peel, and wet, soaking the cherries in water followed by fermentation. Most producers use wet processing, using special techniques depending on the growing conditions.

Fermentation is a microbiological process involving bacteria and yeast. Many centuries, people have used this process to give flavour, aroma, and texture to food and beverages, and to preserve them.
We can increase the curve of special aromas and tastes, getting sensual notes of sweets, citrus and flowers because of controlled fermentation. After coffee roasting, the value and stability of quality increases, but if this process is not controlled, it can lead to quality losses.

Then the grains are dried, peeled from the parchment shell, sorted, packed in bags, and sold to coffee bean roasting companies. The degree of coffee roasting will also affect the organoleptic properties of the drink, as well as the processing method, and is marked on the packaging.

Thus, the creation of an individual taste of the drink is influenced by the growing conditions, harvest, processing method and roasting profile.

The purpose of this research is to study the effect of coffee processing modes on the organoleptic characteristics of the final product – a coffee drink.

Most of the coffee plantations are in the South-Eastern mountainous part of Brazil, namely in the States of Minas Gerais, Espírito Santo and Sao Paulo. These areas are affected by climate change. As we know, Arabica is more sensitive to environmental conditions. Robusta is a stronger and harder variety. This applies not only to the growing season, but also to processing methods. Robusta coffee beans are harvested exclusively by mechanical means. Fermentation, as a processing step, is absent. Sorting is performed only once. Farmers are doing everything to speed up the pre-sale preparation process. All this also affects the quality of the product.

The first key step in traditional Robusta production: cutting trees in the form of palm trees to get maximum sunlight - it speeds up the growing process.

The next step - drying the cherries after harvesting, in mechanical dryers, which increases the processing speed.

The last steps before export is sorting and packaging. One level of sorting with quite high tolerance to defects. Bags without an insert are usually used for packaging. Thus, coffee is poorly protected from various types of impacts during transportation and its physical and chemical parameters change too much. Finally, the raw material gets the taste of burlap, may be contaminated with earth, and have other defects, which leads to a lower price.

In the course of our work, we conducted a comparative analysis of two types of coffee produced on an industrial scale – Arabica and Robusta, and the fundamental differences in their post-harvest processing technologies. A characteristic feature of the approach to processing Arabica is to maintain a consistently high level of quality through fermentation and multi-stage sorting. There are no such steps in Robusta processing [2].

We performed an organoleptic evaluation of Robusta produced using classical technology in the Espirito Santo region. The assessment was made according to a special Protocol of the international Specialty Coffee Association (SCA), consisting of ten indicators: aroma, aftertaste, acidity, sweetness, body, bouquet, integrity, purity of taste, balance, overall impression [3, 4]. Each sample was brewed in the five bowls for monitoring the stability of taste [5].

As shown in figure 1, Robusta's taste qualities received lower ratings and the gap is quite large.
Figure 1. Results of organoleptic evaluation of the quality of Arabica and Robusta coffee samples produced using classical technologies, in points.

However, in the Espírito Santo region of Brazil, there is a successful Federal Institute that studies coffee production and works to improve its quality by changing fermentation modes. Professors of the Federal Institute of Espírito Santo (campus Venda Nova do Imigrante) work with farmers to improve the quality of raw materials and explore different fermentation modes in farm settings [6].

Fazenda Venturim is one of the few farms in Brazil that experiments with Robusta and is the first to export of branded Robusta. All activities of the farm are aimed at producing safe and high-quality coffee.

The processing of coffee matured at the Fazenda enterprises consists of three stages. The first stage is harvesting, and all technical means are adapted to get only ripe cherries. The second and most important stage is fermentation and multi-stage sorting for screening out defective cherries. However, the fermentation process must be controlled to ensure the quality and safety of the product. Since the quality of coffee decreases as the time of spontaneous fermentation increases. The third is mechanical drying for 10 hours in conditions that simulate sunlight and heat. Then the air temperature drops and the grain rests, as at night. Moisture can migrate from the deeper layers of the coffee surface, which ensures more uniform drying [7].

The attention of coffee consumers is focused on Arabica, which accounts for a large share of world production. We compared the physical properties of Arabica and Robusta (table). the study showed a difference in the moisture content of 1-4%.

Table. Basic national standards in the field of knowledge management.

|                     | Arabica   | Robusta  |
|---------------------|-----------|----------|
| Moisture, %         | 10–12     | 13-14    |
| Density, g/l        | 600–750   | 600–750  |
| Water activity      | Less then 0,6 | Less then 0,6 |

High humidity has a great influence on the roasting process. Next important difference: the Robusta grain has an unexpressed crack. The development of taste occurs mainly after the crack. Roast master of the Russian State Agrarian University named K. A. Timiryazev determined the optimal roasting profile for each sample of coffee.

The new approach to coffee processing will lead to the formation of a special market segment, since the taste of the drink from Robusta beans processed in accordance with it changes significantly for the better. This is confirmed by the organoleptic assessment, which was carried out in the Russian State.
Agrarian University according to the method described earlier. As it seen on the taste evaluation of Arabica and Robusta, the indicators are closer (figure 2).

Thus, it becomes necessary to develop new technologies that are accessible and adapted to producers who mostly practice traditional farming methods located in regions where the use of modern technologies is limited.

![Figure 2](image)

**Figure 2.** Results of organoleptic evaluation of Arabica produced by classical and Robusta-by new technology.

Since coffee roasting can be carried out extraterritorially, the main object is to preserve the beans quality during transportation to the customer. As mentioned above, the safety of consumer qualities of coffee is more affected by humidity and temperature, so these parameters are subject to control (see reference). To solve this problem, we suggest using disposable indicators, which are a cardboard card with a sensitive reagent placed on it, the latest generation of which allows you to determine not only the nature of the impact on the product, but also its duration with a pre-selected step from 30 to 480 minutes (figure 3, 4). To prevent contact with coffee beans, the indicators are placed in moisture-permeable bags, which are embedded in the packaging with the product.

![Figure 3](image)

**Figure 3.** Indicators of temperature.

![Figure 4](image)

**Figure 4.** Indicators of humidity.
As a result of the study, the influence of various coffee bean processing modes on organoleptic parameters was determined. The presence of a fermentation stage in the technological process significantly improves the taste characteristics of the drink. A method for tracking the environmental effects on coffee during transportation is proposed.

The object of further research is to study the chemical composition of roasted coffee by means of infrared analysis.

Strictly controlled changes in the post-harvest processing of coffee beans can affect the taste characteristics of roasted coffee. A technology has been developed that brings the organoleptic data of a drink made from less whimsical and cheaper Robusta to the taste of brewed Arabica. A method for ensuring the quality of raw coffee during transportation is proposed.

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