

COFFEE FERMENTATION

BACK TO BASICS, THE ROLE OF YEAST IN COFFEE PROCESSING

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Fermentation in coffee is often referred to as some biochemical reaction leading to the removal of the mucilage from the bean. In fact, lots of microorganisms are present at this key step of the coffee processing and can impact the process.

Indeed, indigenous flora can be diverse and some microorganisms can play an important role on the demucilagination but also on the quality of the final product. These microbes occur naturally in the environment and they play different roles, some of which have a positive impact while others may have a negative impact on the coffee.

In its strict sense, fermentation is an anaerobic (without oxygen) cellular process in which organic matter is converted by microorganisms into simpler compounds and chemical energy (ATP) is produced. So, we have production of alcohol, carbon dioxide and secondary metabolites. In general, across different food and beverage applications, fermentation has been used for centuries to preserve, process and affect the sensory attributes of food. Similarly, in coffee we observe benefits of processing or fermenting cherries with selected coffee yeasts. Lallemand has been extensively researching on the impact of selected microbes on coffee processing for more than 6 years now and as a consequence we have commercialized four selected

yeasts for coffee processing. These selected yeasts can be applied for any processing technic, be it whole fruit, wet or honey processing with the exception of coffee whose mucilage removal is done mechanically.

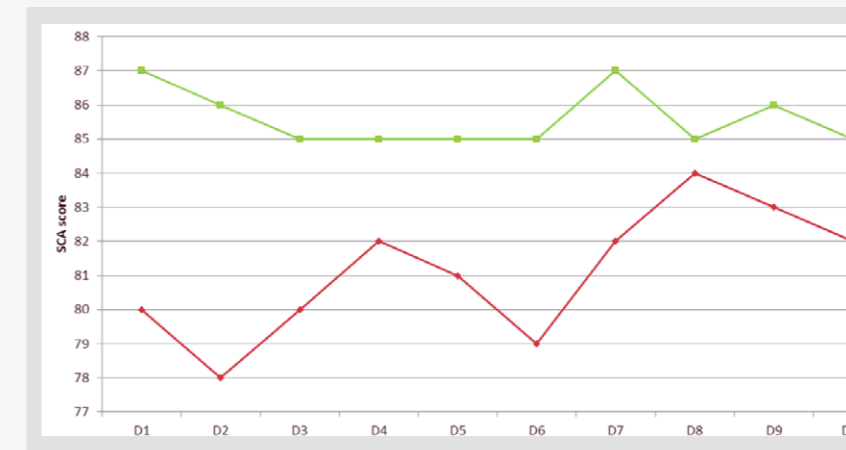
The initial thought that comes to mind for most producers is the fact that they have been fermenting and continue to ferment their coffee without addition of selected microbes. So, what is the difference to what Lallemand in the form of Lalcafé is now offering? The difference is the fact that we are selecting yeasts or microbes that impart positive attributes to our coffee compared to letting the fermentation take place without controlling it. In this case anything that is present (indigenous microbes, good or bad) at the time will do the fermentation. De Malo Pereira (Pereira 2015) evaluated a starter culture fermentation during on-farm wet processing, using one selected strain isolated from green coffee beans (Pereira, 2014). At the end of the fermentation, the selected yeast strain prevailed over indigenous microbiota, and the production of specific aroma compounds increased.

Thanks to this starter culture, the final product was evaluated as a high-quality coffee. During semi-dry processing, Evangelista conducted several starter cultures with different yeasts: *Saccharomyces cerevisiae*, *Candida parapsilosis* and *Pichia guilliermondii*. One of the resulting coffees released caramel flavor, not detected in the control (Evangelista, 2014). In general terms, inoculation with the studied selected yeast avoided the production of undesirable acids such as butyric and propionic acid, therefore enhancing the coffee final quality. In our research and trials in origin countries, we have observed many benefits that a producer stands to gain by controlling fermentation.

Therefore, developing new starter cultures with selected microorganisms could be a way to resolve challenges that are experienced during coffee processing. From our research and observations, starter cultures help the demucilagination process; limit the formation of some undesirable compounds potentially produced by the indigenous flora as bio protectors and benefit from the metabolism of the selected yeast that contributes to the aroma development. When used in wet processing, a reduction of up to 25% in water savings has been observed and over time, there is a consistent quality and profile of the processed coffee as seen in Figure 1 below. On average we observe a 2-point increase in the cup quality of

the coffee on using the Lalcafé yeast.

Figure 1 : Cupping Scores over time



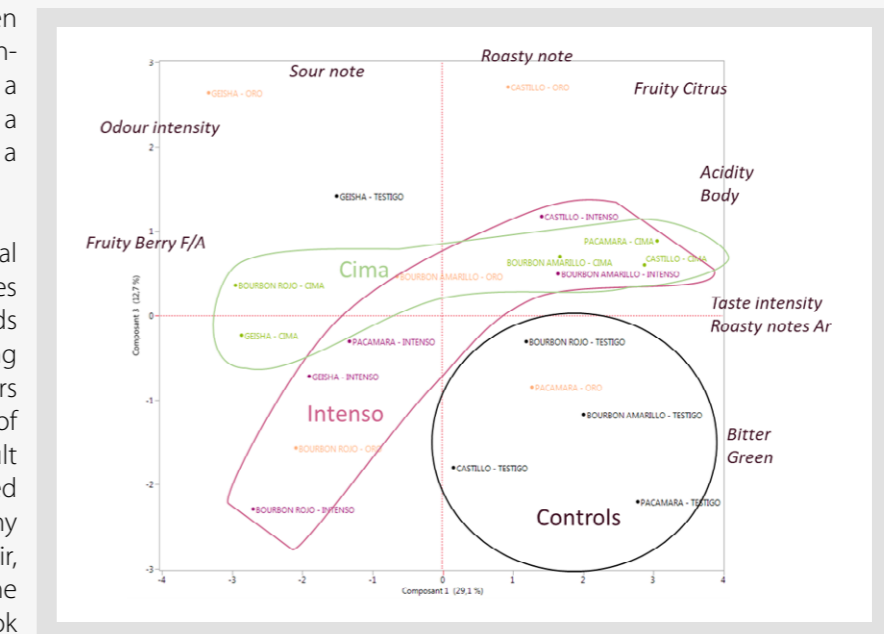
The Green graph shows the small variation in cupping scores which is 2 points between the highest and lowest scores. For non-inoculated fermentations we observed a much higher variation of 6 points. Over a period of 10 days, when yeast was added, a more consistent quality was observed.

Depending on the quality of the raw material (cherries), the yeast has metabolic processes that convert the sugars and organic acids into different flavour compounds enhancing the flavour of the coffee. Some producers have raised concerns with the possibility of making all coffee taste the same as a result of controlling fermentation with selected yeasts. This is not an issue as there are many parameters such as the variety, the terroir, environment, processing technics and the quality of the coffee at harvesting. A look at the impact of yeast on different coffee varieties supports this point as shown in Figure 2. All analyses for Figure 2, were done with JMP 14 with the following tests – ANOVA 2-way @5% and 10%, PCA on 1 to 3 axes, multiple comparison of means with the HSD test @5% and a hierarchical clustering using Ward's method. Even though there is no clear pattern for each strain, we can see that all the controls are amongst the most Bitter and Green samples. On Bourbon Rojo and Geisha, Intenso and Cima show some Fruity Berry notes and low Acidity, Citrus whereas on Bourbon Amarillo and Castillo, Intenso and Cima show some Citrus and Body. For Oro, all cultivars behave differently, giving diverse sensory profile. This PCA highlights the fact that inoculating with a yeast does not

standardize the coffees. Indeed, the cultivar profile still prevails on the sensory map but allows a diversification of it. Each strain will give a twist on any cultivar, most of them are positive but we are starting to shape a pairing after some years of trials and feedback from producers.

Lalcafé yeasts offer a tool with which producers can achieve their goals using the processing technics of their choice given their coffee. We recommend a holistic approach to processing that includes controlling fermentation with selected yeasts. It is better to initially do small trials of all the yeasts to establish

Figure 2: PCA of the impact of Lalcafé Yeast on different coffee varieties



one's preferred strain. We are available to recommend duration and processing technic given the available resources. Figure 3 below, is a guideline that producers can use when selecting the yeast to use. For further enquiries contact Margaret Fundira: mfundira@lallemand.com.

Figure 3: Yeast selection guideline

Coffee cultivar	CIMA	ORO	INTENSO
Geisha	●	●	●
Bourbon	●	●	●
Typica	●	●	●
Catuai	●	●	●
Caturra	●	●	●
Castillo	●	●	●
Catimor	●	●	●
Sarchimor	●	●	●
Pacamara	●	●	●
To be continued			