

Study of the impact of yeast starter use on microbial population dynamics during the fermentation of cocoa beans, and of its ultimate impact on cocoa composition and flavor

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Cocoa quality derives strongly from its flavor. Cocoa flavor may be seen as the result of the biochemical reactions that take place during the cultivation, harvest and post-harvest processing of the cocoa beans. Both, volatile and non-volatile compounds contribute to the final flavor perception of cocoa. Fermentation has arguably the most significant impact on the formation of volatiles (mainly alcohols, esters, and carboxylic acids), and their precursors. Some of these precursors and intermediates will then be further transformed during roasting by means of Maillard reactions and Strecker degradation. Fermentation of cocoa beans involves an initial anaerobic phase (driven by yeasts and lactic acid bacteria), followed by an aerobic phase (where acetic acid bacteria are predominant). This work focused on the study of the impact of fermentation time and of the use of a commercial yeast starter culture on the compositional differences in the taxonomy of fungal and bacterial microbiota present in the cocoa bean and pulp mass throughout fermentation, as well as on the final volatile composition of the dry beans obtained therefrom. This microbial composition would thus influence greatly the final volatile composition of the beans, which translates into differences in the perceived flavor profiles of the products obtained thereof. Large-scale fermentation trials of CCN-51 cocoa beans were carried out in wooden boxes (550kg) in Ecuador in February 2022. Two different fermentation techniques were carried out: one spontaneous and another one inoculated with a commercially available strain of *Saccharomyces cerevisiae*. Beans with pulp were collected every 24h throughout the entire fermentation process for the fungal and bacterial DNA to be later extracted, amplified and sequenced following a metabarcoding approach, using the pertinent ITS and ADNr 16S taxonomy assignment databases. Likewise, beans were collected and dried after 4, 5, 6, and 7 days. A SPME-HS extraction (using a DVB/CAR/PDMS fiber) and GC/MS analysis of volatiles compounds was performed on dried raw beans. This allowed to showcase the impact of time and of the addition of yeasts during fermentation on the composition of microbial communities and on the flavor potential of the fermented cocoa.