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Physicochemical Evaluation of Unripe Yellow Bourbon Coffee Treated with Nucoffee Versatians

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Introduction

Brazilian coffee production includes unripe beans, traditionally considered undesirable. However, these beans present a chemical profile distinct from that of ripe beans (Cardoso et al., 2025). This study evaluated the impact of a controlled immersion process using Nucoffee Versatians, a methodology patented by Syngenta, on 100% unripe fruits of the Yellow Bourbon coffee cultivar, harvested exclusively from the São João DB farm plot in Varjão de Minas, Brazil (-18.4265143, -46.0701618). The objective was to analyze the physicochemical properties (pH, Brix, density, and temperature) of fruits subjected to different treatments, including the application of a new product (NOVO) and the reuse of this product in subsequent batches (REAP), in order to assess the effect of product reuse on fruit quality.

Figure 1: Yellow Bourbon coffee plantation (left) and unripe cherries harvested for the study (right).

Figure 2: pH (left) and density (right) of unripe Yellow Bourbon coffee

Materials/Methods

Nine distinct treatments were carried out, including a control (CTRL), application of the new product (NOVOA, NOVOC, NOVOE, NOVOG), and product reuse in subsequent batches (REAPB, REAPD, REAPF, REAPH). All treatments followed standardized immersion conditions to ensure comparability. After treatment, samples were immediately measured for pH, soluble solids (Brix), density, and temperature using calibrated equipment under controlled laboratory conditions. Statistical analyses comprised normality testing to verify data distribution, analysis of variance (ANOVA) to detect significant differences among treatments, and multiple comparisons using Dunnett's test, with the control serving as the reference group. All analyses were performed at a 5% significance level ($p < 0.05$). Replicates were conducted to increase reliability, and results were expressed as mean ± standard deviation.

Figure 3: Yellow Bourbon coffee in drying phase

Results/Discussion

Significant differences were observed for pH, Brix, and density among treatments ($p < 0.05$). For pH, all treatments with the product (NOVO and REAP) differed significantly from the control, exhibiting lower mean values. Brix values were significantly higher in treated samples compared to the control, with no notable differences between new and reused product treatments. Density showed significant variation, particularly in the REAPD, REAPF, and NOVOE treatments, suggesting an influence of both treatment type and product reuse. No significant differences were detected for temperature. Overall, these findings indicate that product reuse (REAP) produces effects comparable to those of the new product (NOVO) for most variables analyzed, highlighting potential economic and environmental advantages.

Conclusion/Perspectives

Controlled application of Nucoffee Versatians significantly altered the physicochemical properties of unripe Yellow Bourbon coffee fruits, with product reuse proving to be an effective alternative without significant quality loss. These results support the feasibility of scaling up the process to an industrial level, with positive implications for sustainability and cost reduction. Future studies should investigate the long-term effects of reuse on sensory attributes and final coffee quality.

References: *Cardoso, L.M.A.B., Rocha, R.A.R., Cruz, M.A.D. et al. Transforming Challenges into Quality: The Power of Controlled Fermentation in Immature Arara Coffee Beans. Food Bioprocess Technol (2025). https://doi.org/10.1007/s11947-025-03880-z.*

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