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An innovative approach for the rapid metabolite fingerprinting of cocoa beans fermented with antifungal cultures by Rapid Evaporative Ionization Mass Spectrometry (REIMS)

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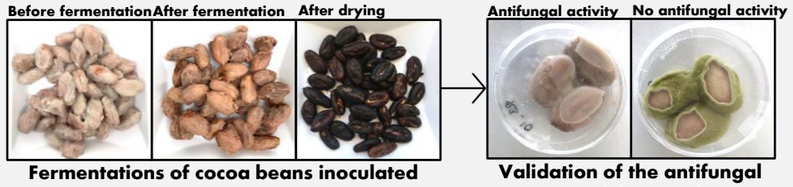
1 Motivation & Method

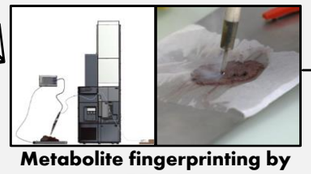
The first transformation step of cocoa beans into chocolate is **fermentation**. Cocoa beans' **contamination by fungi** is one of the leading causes of waste. Current research investigates the development of **functional fermentation co-cultures[1]** to prevent these contaminations.

This study aims to develop a rapid method with no sample preparation for **antifungal microbial strains' selection** and **beans' characterization** based on the cocoa beans' metabolite fingerprints measured by REIMS.

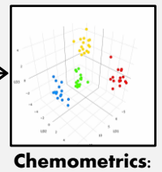


Fermentations of cocoa beans inoculated with co-cultures with/without antifungal activity

Validation of the antifungal activity of the co-cultures



Metabolite fingerprinting by REIMS



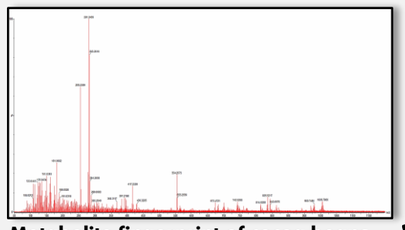
Chemometrics: Multivariate modeling

[1]Fermentation co-culture: selected combination of living microorganisms added at the beginning of the fermentation, leading to food products with desirable characteristics.

2 Results

The metabolite fingerprints of the beans fermented with antifungal co-culture share a **common pattern.** They can be **differentiated from the other beans** thanks to the PCA-LDA model with 94% of correctness.

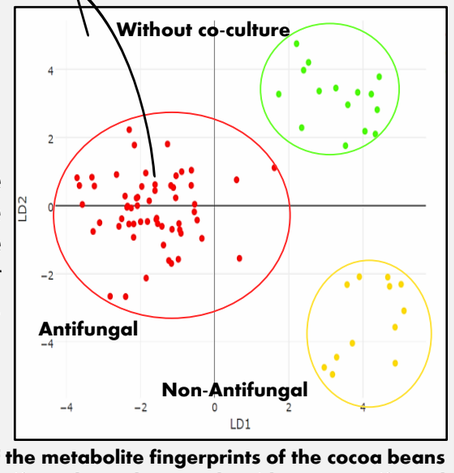
Chemical markers with the highest discrimination were identified.



Metabolite fingerprint of cocoa beans obtained by REIMS

The peaks represent the ionized molecules. The higher the peaks are, the more abundant the molecules are.

The dots represent the metabolite fingerprints. The closer the dots are, the more similar their fingerprints are.



PCA-LDA model of the metabolite fingerprints of the cocoa beans fermented with an antifungal co-culture (red), with a non-antifungal co-culture (yellow), and without co-culture (green)

3 Conclusion

The **rapid fingerprinting method combined with advanced** data analysis shows promising results for cocoa beans' characterization and antifungal strains' selection with **minimum sample preparation.**

On-farm applications of the co-cultures and further identification of the **quality markers** will be conducted.

4 Contribution to Sustainable Food Systems

The antifungal co-culture will improve food bio-preservation, benefiting farmers and retailers by **reducing food waste** from microbial spoilage.

Safer products will be provided to consumers, **reducing mycotoxin contamination risks** and **avoiding** the use of **chemical** preservatives.

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World Food System Center