Combined effect of drying conditions and starch composition on breadmaking ability of sour cassava starch

P. Maldonado-Alvarado1,2, L. Grosmaire1,2 T. Tran3, J.L. Delarbre1,2, D. Dufour1,4
1 Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement (CIRAD) - UMR Qua lisud - Montpellier, France
2 Fac Sci Pharmaceut & Bio - UMR Qua lisud - Universite Montpellier 1 – Montpellier, France
3 Cassava and Starch Technology Research Unit (CSTRU), Kasetsart University - Bangkok, Thailand
4 Centre International de Agriculture Tropical (CIAT), Cali, Colombia

INTRODUCTION

• Cassava starch modified by fermentation and UV irradiation acquires bread making ability.
• Exhaustive works have been performed to try to better understand sour starch breadmaking ability but to date are still not fully elucidated.
• The aim of this work is to contribute to a better understanding of sour cassava properties, and to highlight the effects of varietal, altitude and process parameters on the breadmaking ability.

Manufacturing process of sour starch:

Cassava fucula extraction

Sour cassava starch

Sun drying or UV

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Interest:

- Empirical processing
- Irregular product quality
- Dependence of climatic conditions
- Good breadmaking ability
- Gluten free

Materials:

13 cassava starchyes (CIAT - Colombie) x 4 treatments

3 lowlands (1000 m) 10 highlands (1700 m)

Methods:

\[ \text{1) Non fermented oven-dried (NFO)} \]
\[ \text{2) Non fermented sun-dried (NFS)} \]
\[ \text{3) Fermented oven-dried (FO)} \]
\[ \text{4) Fermented sun-dried 'Rallanderia' (FSR)} \]

Results:

Good breadmaking ability after fermentation + sun-drying (FSR) and notably in highland varieties

Highland varieties seem to be different to lowland:
- More marked sensitivity to sun-drying
- Different molecular structure, probably
Hypothesis established from pasting properties, intrinsic viscosity and granule size.

Mechanism of starch damage:

1. At supramolecular level occurring main during fermentation. The site of preferential damage depends on cultivar altitude (differences in particle size, RVA and intrinsic viscosity analyses)
   a) High variety granules were damaged throughout their structure
   b) In lowland varieties granules were attached only on their surface
   - only off the outer layers of the granules was shaved, leading to smaller granules with mostly intact cores.

2. At molecular level, fermentation and sun-drying treatments may also damage starch structure, i.e. by molecular weight reduction or depolymerization mechanisms.

Conclusion:

- Post-harvest treatments were prevailing factors in improving breadmaking ability, while the varietal factor had some influence.
- Fermentation had a more pronounced effect than sun-drying, but the combination of both treatments improved dough expansion.
- Amylose content influenced negatively dough expansion, possibly amylose-lipid complex formation.
- The mechanism of starch degradation was located at supramolecular and molecular level:
  - At supramolecular level it occurs mainly during fermentation. It depends on cultivation altitude: lowland varieties were attacked on their surface whereas highlands throughout their center. In highlands, breadmaking ability was better than lowlands, perhaps due to more extensive granule collapse during gelatinization, consequently better film formation around the bubbles of steam-driven dough expansion.

What produces breadmaking ability?

A mechanism of starch degradation not fully elucidated

Objectif

Comprehension of determinant factors to predict breadmaking ability of sour cassava starch

Specific objective

Importance of treatment effect Vs varietal effect

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Legend

Treatment effect better than varietal effect

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Literature cited:


Fig. 1: Breadmaking ability of both fermented and sun-dried cassava starches (FSR).

Fig. 2: Negative correlation between amylose content and breadmaking ability.

Fig. 3: FSR and FSR.

Fig. 4: Altitude effect linked to different location of granule starch damage occurring during fermentation.