2026

Target Food Product Profile

Fried Plantain



RTB Breeding

RTB foods

Gates Foundation

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Breeding Root, Tuber, and Banana (RTB) varieties that better serve user and consumer preferences will lead to greater varietal adoption in RTB value chains. This will help to further boost RTB-linked livelihoods and food and nutrition security, and reduce drudgery.

The RTB*foods* project designed and implemented a participatory gendered interdisciplinary methodology with RTB researchers and regional stakeholders. This has contributed to **identifying key traits and characteristics required for RTB food products, in terms of processing and consumption**. **New high-throughput phenotyping tools** for assessing RTB food product quality and preferences have been developed and deployed for use by breeders and food scientists. These validated new traits are already being incorporated into breeding programmes. The project has developed product profiles covering the complete range of RTB food products. Furthermore, the previously unknown and often stereotyped African gastronomy is emerging as an 'African nouvelle cuisine' which will benefit from RTB varietal quality improvements. The RTB*foods* project was supported by the Bill & Melinda Gates Foundation, and ended in 2023, and the work is now embedded within the RTB Breeding Initiative.

This Target Food Product Profile (TFPP) for **Fried Plantain** is being translated into market-driven breeding initiatives to develop new, end-user-focused plantain varieties, which is significantly boosting their adoption.

Product Identity

Fried Plantain is considered as a starchy food and a source of calories made from plantains (*Musa* spp. AAB). Plantain production accounts for 15% of the world's banana fruit production. Africa is the primary supplier of plantain followed by Latin America. Plantains are commonly grown in tropical and subtropical regions of Africa (West and Central Africa), Latin America, and the Caribbean, as well as Southeast Asia. Fried plantains are named differently across locations. It is commonly referred to as 'Dodo' in Cameroon and Nigeria; as 'Alloco' or 'Aloco' in Côte d'Ivoire and Benin; or as 'Red-Red' (longitudinally sliced plantains with salt) and 'Kelewele' (small pieces spiced with pepper, ginger and salt) in Ghana. Fried plantain is a product obtained by frying ripe plantain fruit pulp in vegetable or other oil. In order to prepare fried plantain, the fruit must first be washed, peeled, and cut either lengthwise, horizontally, diagonally, or into small pieces that are around 0.5–2 cm thick. Adding salt is an option. The slices are deep-fried or shallow-fried in hot oil at 150–180°C for about 8–10 minutes. Stirring or carefully turning the pieces from time to time is required until their color reaches an even shade of light or golden-brown. Fried plantain is best prepared with fruit at the fully yellow ripening stage or at the yellow with black spots or patches stage, depending on individual preference and the plantain variety used. Fried plantain is commonly served with various food complements such as omelette, beans, vegetables, roasted fish, chicken or meat kebab, or as a snack, sometimes involving addition of other ingredients. It is commonly prepared in households, restaurants and presented during occasions.



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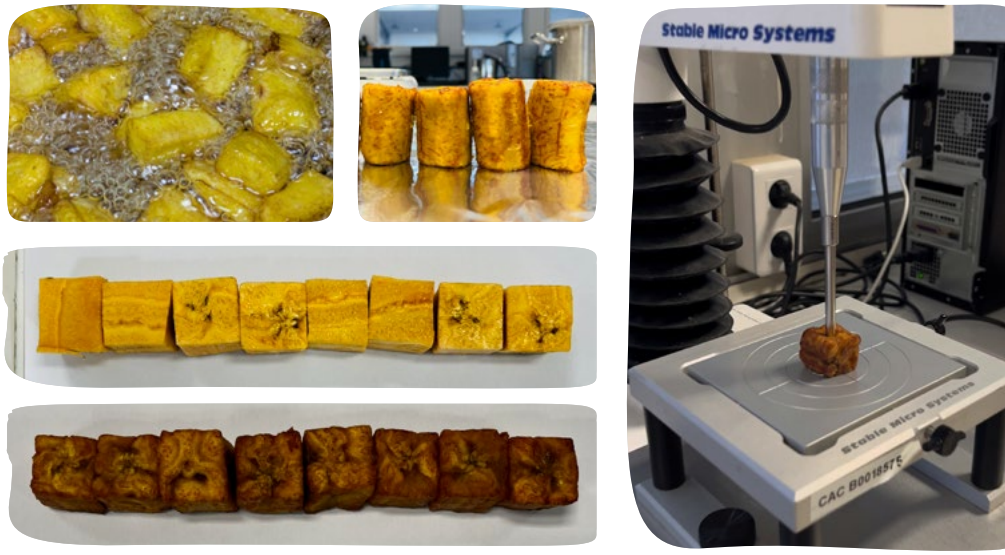
Exploration of good quality traits for Fried Plantain



Ripe plantain market © Dominique Dufour - CIRAD

In order to obtain the best product quality and to rank traits in order of importance, a gendered map of characteristics demanded by food-chain actors was achieved through a multidisciplinary methodology. These actors included plantain farmers, processors/cooks and consumers. Several key end-user preferences for fried plantain quality traits have been identified[1]. **Fruit size, pulp texture (firmness/softness), color, maturity stage, and taste**, have been identified as the most crucial characteristics that affect the quality of processed fried-plantain food products. From the consumer's perspective, a good fried plantain results from properly frying fruits at the **right stage of ripeness, usually yellow or yellow with black patches**. The unique taste and aroma of fried plantains results from the caramelization of sugars in the ripe fruits, hence the brownness. Fried plantain is rendered attractive by its external characteristics including color, appearance, **how well the pieces are separated from one another, a pleasant plantain smell, and sweet taste**. After frying, the pieces should come out **dry (not oily), with a yellow, light brown or golden-brown color** depending on preferences. Fried plantain should appear **firm (not mushy/sticky) but soft enough to chew**. Additionally, to be considered good, it must be consumed when slightly warm. There are minor gender differences between men and women regarding preference for bunch size of fruit. Men focus more on yield (for sale), while women prioritize other characteristics such as taste, related to home consumption.

A trait evaluation toolbox to support breeding superior plantain varieties for enhanced adoption of Fried Plantain



Textural analysis of fried plantain © Dominique Dufour - CIRAD

For the first time, food technologists and social scientists are able to assist breeders with quantifiable thresholds in terms of biophysical, and sensory scores for overall preference for each measured trait. To produce a good fried plantain, **the ripening stage of plantain pulp is prioritized by processors**. Physicochemical and physiological changes occur as plantains mature, including in dry matter content (DMC), fiber, lipid, total soluble solids (TSS), starch content, sugars, and peel color, as key characteristics[2]. During ripening, sugars and lipid content in raw plantain pulp increased, in contrast with the DMC, fiber, and starch content[2]. The biochemical properties of certain plantain varieties at full ripeness (in the yellow stage) are nearly indistinguishable from those observed in overripe varieties (during the yellow stage with black spots). Certain varieties are ideal for frying when they are ripe, while others are more suitable for frying once they are overripe. The biochemical parameters can be used as key indicators for a plantain variety's frying suitability.

A toolbox of standard operating procedures (**SOPs**) for sensory and texture characterization for fried plantain has been developed. Key sensory attributes for fried plantain include appearance (homogeneity of color); smell (frying odor); touch (greasy appearance, sticky between slices); texture in the mouth (firmness, stickiness, chewiness); taste (sweetness, acid taste, saltiness); mouth impression (fattiness, astringency); and plantain aroma. Sensory analysis of fried plantain ranked **firmness and astringency traits as the most important sensory attributes followed by fattiness, chewiness, and color homogeneity**[3]. Preferences for plantain cultivars are influenced by a combination of color, fattiness, tenderness, and sweetness[2]. Fried products made from plantains with high sugar and starch contents have a strong impact on tasters' perceptions of sweetness and tenderness. Consumers prefer sweeter fried plantains. Textural attributes of fresh pulp and fried plantain can be evaluated by a puncture (penetration) test and double compression texture profile analysis (hardness, cohesiveness, springiness, adhesiveness, resilience, gumminess, and chewiness). Both methods can discriminate the textural properties of fried plantain prepared from different plantain genotypes. However, the puncture method is more highly recommended due to its greater accuracy, throughput, discriminability, and repeatability.

A protocol for measurement of fresh RTB color using a chromameter has been developed as a medium-throughput screening tool. This can be adapted to evaluation of peel color, raw pulp and fried plantain. Chemical and biophysical profiling of raw and fried plantain using high throughput measurements is critical to establish measurable traits. Developing molecular markers for identifying genes of interest can be achieved through our approaches based on the preferences of fried plantain users and consumers. Identifying and assessing candidate genes controlling desirable plantain quality traits can accelerate plantain selection and efficiency through genomic-assisted breeding. **Applying combinations of instrumental food-quality analyses, and high-throughput phenotyping tools, together with advanced genomics technologies in plantain selection pipelines will enhance developing and using new elite plantain varieties**. This will comprehensively address stakeholder preferences across the entire plantain value chain. The work will significantly boost adoption rates of new varieties and make them more attractive in the market.

Key Publications

[1] Amah et al., 2021. End-user preferences for plantain food products in Nigeria and implications for genetic improvement. *Int. J. Food Sci. Technol.*, 56(3), 1148–1160. https://doi.org/10.1111/ijfs.14780

[2] Ebah Djedji et al., 2021. Ability to produce alloco (fried plantain) from some plantain (*Musa paradisiaca* L. 1753) hybrids. *Am. J. Innov. Res. Appl. Sci.*, 13(4), 488–495. https://www.american-ajiras.com/Catherine-Ref11ajira210921.pdf

[3] Beugré et al., 2026. Quality attributes associated with the biophysical indicators of good fried plantain (Aloco). *Curr. J. Appl. Sci. Technol.*, 45(8), 59–74. https://doi.org/10.9734/cjast/2026/v45i84732

Díaz-Ávila et al., 2026. Design and evaluation of a semi-continuous vacuum frying system to produce high-quality chips from ripened fruits: Application to plantain. *J. Food Eng.*, 408, 112867. https://doi.org/10.1016/j.jfoodeng.2025.112867

Kouassi et al., 2020. Production mapping and description of the organoleptic qualities of local varieties of plantain (*Musa* spp. AAB) cultivated in Côte d'Ivoire. *J. Agric. Ecol. Res. Int.*, 21(2), 9–21. https://doi.org/10.9734/jaeri/2020/v21i230128



Target Food Product Profile of Fried Plantain

Along with bananas, plantain is a key RTB food security crop in Africa, Asia, and Latin America.

139.5
million tons

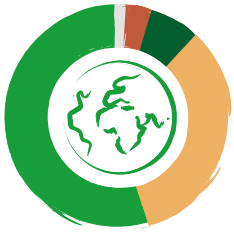


Global annual banana production

Cooking bananas = 42.4 Mt
- Plantain (AAB group)
- Highland banana + ABB group

Dessert banana = 97.1 Mt
- Cavendish
- Gros michel + others

21.0
million tons

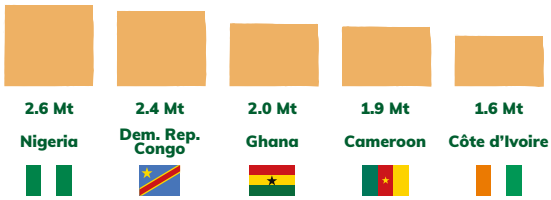


Global annual plantain (AAB group) production

- 55% West and Central Africa
- 33% Latin America
- 7% Asia
- 4% East Africa
- 1% Others

Top 5 plantain (AAB group) producers in Africa





Source: Lescot (2020)

The ripening stage of plantains determines how they are prepared for food



Oil-based cooking

		• Fried plantain with bean stew (red-red) • Spicy fried plantain (kelewele)	• Mashed and fried as pancake (krato, tatale) • Fried plantain with ingredients (dodo Ikire) • Roasted plantain (ebeebe)
• Plantain chips			
• Fried plantain (tapé-tapé)	• Fried plantain (dodo, aloco)		
• Roasted plantain (boli)			

Source: Dadzie & Wainwright, 1995 and Ogazi, 1996

Fried Plantain Preparation

Raw plantain → Peeling → Cutting into slices → Frying in vegetable oil 8–10 min → Fried plantain

Preferences of farmers, producers, processors, and consumers of fried plantain

Raw plantain
- ✓ Finger size
- ✓ Maturity stage (ripeness)
- ✓ Texture (firm and soft)
- ✓ Softness
- ✓ Sweet taste

During processing
- ✓ Full ripeness (yellow to yellow with black specks)
- ✓ Firmness
- ✓ Does not absorb oil

Ready-to-eat fried plantain
- ✓ Yellow, light brown or golden-brown color
- ✓ Dry without oil
- ✓ Firmness (not mushy/sticky)
- ✓ Softness (not too soft)
- ✓ Sweet taste
- ✓ Plantain smell

Key priority traits for development of plantain varieties for fried plantain

- ✓ **Firmness**
- ✓ **Softness**
- ✓ **Fried-product color (yellow, light brown or golden-brown)**
- ✓ **Sweet taste**

As a result of our work, new traits are being integrated into the plantain breeding pipeline. Moving forwards, this will significantly boost adoption rates and performance of new plantain varieties.

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For more information about Fried Plantain, please see https://rtbfoods.cirad.fr/

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