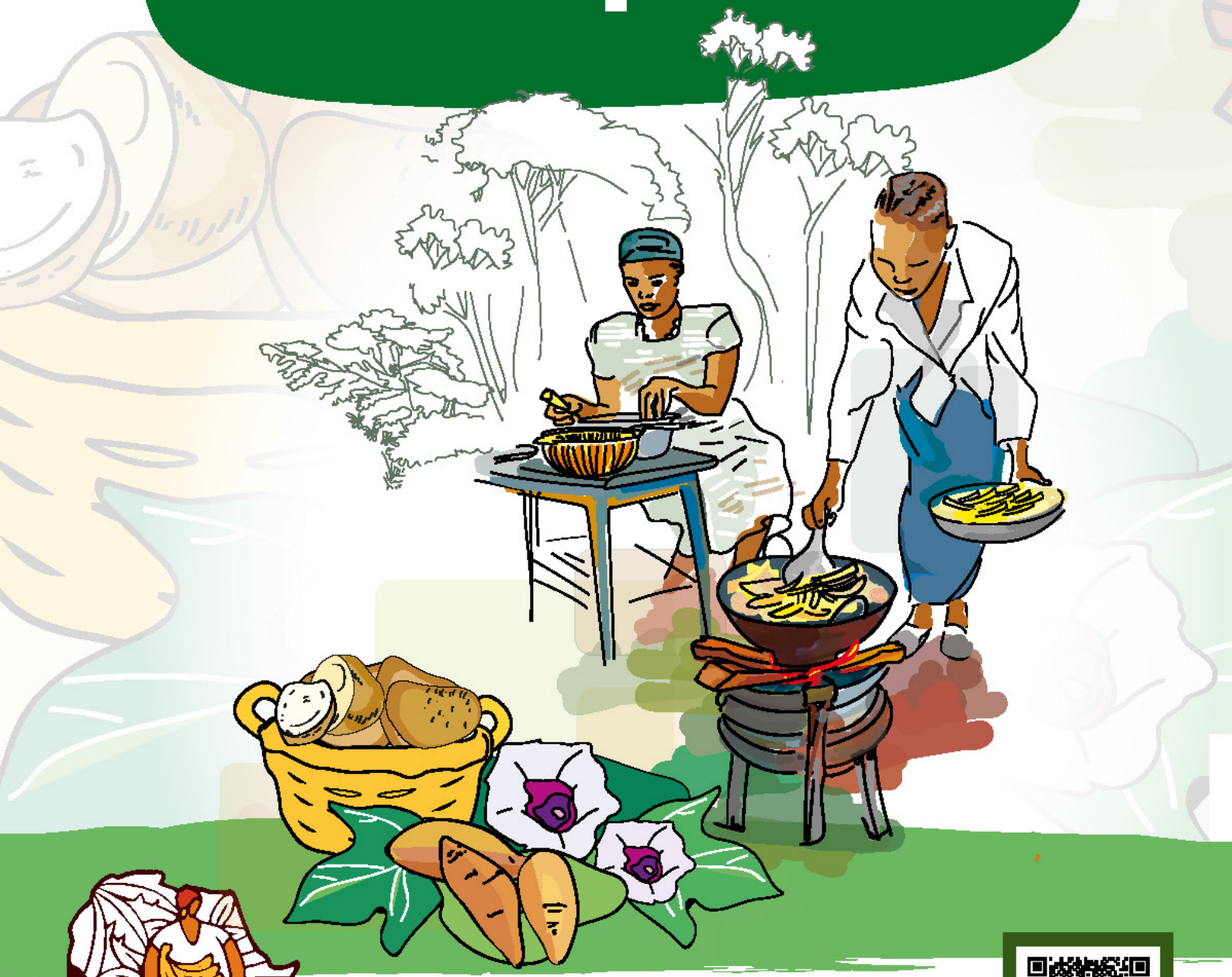
2026

Target Food Product Profile

Fried Sweetpotato



RTB Breeding

RTB foods

Gates Foundation

CNRA Centre National de Recherche Agronomique

National Root Crops Research Institute Umudike

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CIP International Potato Center A CGIAR Research Center

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 Sweetpotato** is being translated into market-driven breeding initiatives to develop new, end-user-focused sweetpotato varieties, which is significantly boosting their adoption.

Product Identity

Fried sweetpotato is a staple food made from sweetpotato (*Ipomoea batatas* (L.) Lam), which is of increasing importance for food and nutrition security in sub-Saharan Africa. Deep-fried sweetpotato is widely consumed in different forms: 'French Fries', thinly sliced chips (usually called crisps in the UK and its former colonies), or larger wedges, known as 'Chunk Fries'. In West Africa, chunky fries are the most commonly eaten form, mostly produced by small-scale, female street vendors. An estimated 30% to 80% of sweetpotato grown (mostly white or yellow-fleshed types) is fried in informal markets and by the roadside in Nigeria, Ghana, Burkina Faso and Côte d'Ivoire. Investigation of chunk fry processing in Ghana and Nigeria revealed slight variations in the process of peeling, slicing (wedge size varies), washing, salting, drip drying and deep frying[1]. There are two distinct salting practices: washing in a salt solution prepared to taste or sprinkling salt on raw slices after washing while drip drying. Deep frying involves pre-heating vegetable oil (temperatures varied from 120–185°C), occasionally turning the slices until a bright golden-brown color is achieved, and the oil stops bubbling after around five minutes. In West Africa, chunk fries produced by artisan fryers are the most popular. French fries and chips are relatively minor but increasingly important products in urban areas elsewhere in sub-Saharan Africa. Globally, frozen sweetpotato French fries, usually made from orange-fleshed sweetpotato, have increased greatly in importance in recent years, as have chips produced from sweetpotato with different flesh colors.



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Exploration of good quality traits for Fried Sweetpotato



Dr. Rachel Odomamiro interviewing expert chunk fry processors in Agbamu, Kwara State in Nigeria[2]

In order to obtain the best product quality and 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 sweetpotato farmers, processors/cooks and consumers of fried sweetpotato. By including fried-sweetpotato processors in a participatory diagnosis of processing, and consumers in rural and urban areas in consumer testing, a more appropriate gendered food-product profile for fried sweetpotato has been developed. Several key end-user preferences for fried sweetpotato quality traits have been identified[2]. Farmers give priority to high yielding and early maturing, meet their taste preferences regarding sugariness, are easily marketable and store well. Processors prefer the raw sweetpotato roots for frying that are hard when pressed with the finger, have a regular shape, smooth skin, with a medium to large root size (200–450g) and no holes (indicative of weevil damage), as well as being easy to peel. During peeling and slicing, raw roots should be hard to slice, whilst after slicing, the surface should be almost dry and not sticky. Hard-to-slice roots connote both high dry matter and mealiness. Stickiness and a moist surface indicate high moisture content, associated with excessive oil absorption during frying. Processors prefer raw roots with little or no exudates (latex) after peeling or slicing. Peeled roots should be hard to slice and not sticky. Cooks prefer a short frying time of approximately 3–5 minutes. The preferred fried product is uniform yellow or orange chunk fries with a brown tint, with the fried chunks/slices having a crispy exterior and not being soggy or oily. **Fried products should be crisp, slightly to moderately sugary, and mealy.** Fried slices or chunks that are filling or satisfying upon eating are the preferred choice.

A trait evaluation toolbox to support breeding superior sweetpotato varieties for enhanced adoption of Fried Sweetpotato



Color range of tasty fried products made from different sweetpotato varieties. © Dominique Dufour - CIRAD

For the first time, food technologists and social scientists can now assist breeders with quantifiable thresholds in terms of biophysical and sensory scores for overall preference for each measured trait. A toolbox of standard operating procedures (SOPs) for texture and sensory characterization has been developed. Measurement of dry matter content (DMC), starch, and sugars have been adapted to sweetpotato. The color of fresh raw sweetpotato can be rapidly measured using a chromameter. A combination of consumer-acceptance testing and descriptive sensory analysis in Ghana and Nigeria has identified the preferred sensory attributes of fried sweetpotato[3]. Market and community surveys identified three consumer segments with contrasting preferences. One group preferred sweet-tasting sweetpotatoes with a crispy, crunchy and mealy texture, while another group preferred a dry texture and a 'yam flavor'. The third group was predominantly influenced by an attractive color and flavor, and softer textures. **Sweetpotato cultivars of any color, with dry, crispy, mealy texture and moderately sweet taste are the most attractive** for many consumers. However, most currently available orange-fleshed cultivars are generally perceived as poor candidates for fried products by processors due to high oil absorption during frying. Consumer testing in Côte d'Ivoire determined white- and yellow-fleshed varieties as having a good appearance, sweet taste, and attractive texture, while orange-fleshed cultivars as having a more attractive texture and sweeter taste[4]. Consumers choose fried sweetpotatoes that have a good texture (dry, crispy, friable) and slightly sugary taste (yam-like taste). Fried sweetpotatoes that are crispy and feel good in the mouth have a high dry matter content. Sensorial texture (hardness, smoothness, oiliness, and roughness) of the fried sweetpotatoes can be predicted based on the interaction of the sample's starch thermal property (gelatinization) and amylase activity[5]. Consumer segmentation of fried sweetpotato in West Africa can provide valuable information to sweetpotato breeders, growers and retailers to prioritize attributes in their breeding, growing or product sourcing decisions.

An acceptable sweetness level is a priority for end-users of sweetpotatoes. NIRS calibration curves have been developed for evaluating levels of fructose, glucose, sucrose and maltose in sweetpotato roots[5]. This method is capable of screening for sweetness with large sweetpotato populations. Developing molecular markers for identifying genes of interest can be achieved through our approaches based on the preferences of fried sweetpotato users and consumers. Identifying and assessing candidate genes controlling desirable sweetpotato quality traits can enhance sweetpotato selection and efficiency through genomic-assisted breeding. **Breeding efforts should prioritize physico-chemical properties of raw and fried sweetpotato cultivars for their sensory properties and consumer acceptance. Screening should combine high-throughput phenotyping tools, and help incorporate quality traits into selection, assembling** elite germplasm varieties with attributes fit for frying. This will comprehensively address stakeholder preferences across the entire fried sweetpotato value chain. The work will significantly boost adoption rates of new varieties and make them more attractive in the market.

Key Publications

[1] Carey et al., 2021. Review of knowledge to guide product development and breeding for sweetpotato frying quality in West Africa. *Int. J. Food Sci. Technol.*, 56(3), 1410–1418. https://doi.org/10.1111/ijfs.14934

[2] Ssali et al., 2021. Fried sweetpotato user preferences identified in Nigeria and Ghana and implications for trait evaluation. *Int. J. Food Sci. Technol.*, 56(3), 1399–1409. https://doi.org/10.1111/ijfs.14764

[3] Dery et al., 2021. Sensory characteristics and consumer segmentation of fried sweetpotato for expanded markets in Africa. *Int. J. Food Sci. Technol.*, 56(3), 1419–1431. https://doi.org/10.1111/ijfs.14847

[4] Kouassi et al., 2021. Consumer preferences for boiled and fried sweetpotato in Central and Northern Côte d'Ivoire, West Africa. *J. Adv. Biol. Biotechnol.*, 24(8), 33–46. https://doi.org/10.9734/JABB/2021/v24i830231

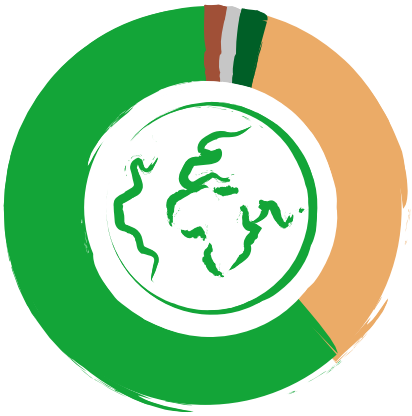
[5] Allan et al., 2023. Impact of sweetpotato starch structures, thermal properties, and granules sizes on sweetpotato fry textures. *Food Hydrocoll.*, 137, 108377. https://doi.org/10.1016/j.foodhyd.2022.108377 & *Corrigendum Food Hydrocoll.*, 139, 2023, 108559. https://doi.org/10.1016/j.foodhyd.2023.108559

[6] Amankwaah et al., 2024. Development of NIRS calibration curves for sugars in baked sweetpotato. *J. Sci. Food Agric.*, 104(8), 4801–4807. https://doi.org/10.1002/jsfa.12800



Target Food Product Profile of Fried Sweetpotato

Sweetpotato is a key RTB food security crop in Africa and other developing countries.



85.8
million tons

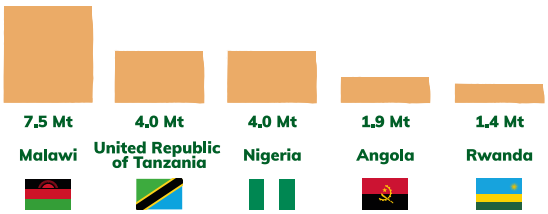
World sweetpotato annual production

- **61.4% Asia**
- 33.7% Africa
- 2.45% Latin America
- 1.05% Oceania
- 1.4% Other

Source: FAOSTAT, 2022

Top 5 sweetpotato producers in Africa





Source: FAOSTAT, 2022

Sweetpotato food products consumed in West Africa





Source: Kouassi et al., 2024 and Peters, 2015

Fried sweetpotato preparation



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

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

Raw sweetpotato

- Smooth skin
- Regular shape
- No holes
- No off odors
- Firmness (hard roots)

During processing

- Firm for slicing
- Not sticky in hand and not slippery
- Uniform color
- Little or no surface moisture
- No unpleasant odors
- Little or no exudates after peeling
- Short frying time (3-5 minutes)

Ready-to-eat fried sweetpotato

- Uniform color (light brown or yellow/orange with brown tint)
- Not soggy or oily (crispness and dryness)
- Good mouthfeel (mealiness and high dry matter)
- Sweetness (slightly to moderately sugary)

Key priority traits for development of sweetpotato varieties for fried sweetpotato

- **Firm flesh for slicing**
- **Short frying time**
- **Uniform color of final product(s)**
- **Dryness/High dry matter**
- **Crispness**
- **Mealiness (mealy/floury in mouth)**
- **Sweetness (slightly to moderately sugary)**

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

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