2026

Target Food Product Profile

Boiled and Steamed Sweetpotato



RTB Breeding

RTB foods

Gates Foundation

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CIP International Potato Center

A CGIAR Research Center

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

Product Identity

Boiled and Steamed Sweetpotatoes constitute an important food made from sweetpotato (*Ipomoea batatas* (L.) Lam) which is the second most important root crop in sub-Saharan Africa, as indicated by its high production and role in food security. Angola, Burundi, Nigeria, Rwanda, Tanzania, and Uganda are the major producers and consumers. Sweetpotato is a nutritious food containing beta-carotene (provitamin A carotenoid [pVAC]), and vitamin C, especially the carotenoid-rich orange-fleshed sweetpotato cultivars. Boiled or steamed sweetpotato is simply prepared with peeled or unpeeled roots. For boiling sweetpotatoes, the peeled roots are immersed directly in cold water and boiled in a saucepan covered with either banana leaves or a saucepan lid. Sweetpotatoes are deemed ready when almost all boiling water has evaporated. It takes about 40–50 minutes. Use the correct volume of water to prevent undercooking, burning or overcooking which otherwise results in watery, tasteless or burnt roots. Normally, about 650 ml of water is required for boiling 2 kg of roots. For steaming, peeled sweetpotatoes are wrapped in banana leaves, placed in a saucepan with water, banana stalks and leaf midribs at the base of the saucepan and thereafter steamed. Steaming time is about 60–70 minutes. More water is used for steaming than for boiling, about 1.5 liters for 2 kg of roots. An additional indicator for readiness is change in color and softness of the banana leaves used for wrapping. Well-cooked sweetpotato is served hot, either being cut into cubes or mashed. It is served as a side dish with salt and pepper or as a main meal with salads, soups, and stews.



Steamed yellow sweetpotato cooked in banana leaves. © Alexandre Bouniol - CIRAD

Exploration of good quality traits for Boiled and Steamed Sweetpotato

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. By including boiled-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 boiled and steamed sweetpotato has been developed. Several key end-user preferences for boiled and steamed sweetpotato quality traits have been identified[1]. Women play a significant role in selecting varieties, cooking, and marketing. **Men prioritize early maturity and large raw sweetpotato roots, while women like its sweet taste. Traders highlight large roots, hard, smooth skin (not damaged) and moderately sweet tasting** as important characteristics for a desirable boiled sweetpotato. During food preparation, firm, large roots with white-, yellow- or orange-colored flesh that are easy to peel indicate high quality sweetpotato roots. **Most women highlight the ease of peeling and the sappiness of raw roots.** Roots that contain a lot of sap (latex) are unattractive, as they are difficult to wash and some residual sap can be detected in the boiled roots. For boiling, preferred quality characteristics include sweet smell of boiling sweetpotato, soft to touch (surface) and development of whitish/floury spots and sometimes cracks on the surface when ready. The preferred characteristics of boiled or steamed sweetpotato include i) attractive flesh color (which may be white, yellow or orange), ii) sweetness, iii) mealy texture that is crumbly, floury, friable, moderately firm yet soft, and not fibrous and iv) having a characteristic sweetpotato aroma. When asked, women specifically mentioned "not watery" and "split surface" as preferred characteristics while non-fibrousness was unique to the men. **Mealiness, sweet taste and good sweetpotato smell are important attributes for boiled and steamed sweetpotatoes across genders and geographical regions.** Gender norms and roles influenced men's and women's preferred characteristics, thus highlighting the need for increased gender awareness in participatory breeding initiatives.



Cut of white and yellow mealy steamed sweetpotatoes © Dominique Dufour - CIRAD

A trait evaluation toolbox to support breeding superior sweetpotato varieties to enhance their adoption for Boiled and Steamed Sweetpotato



Edwin Serunkuma (CIP, Uganda) determining the firmness of boiled sweetpotato samples using a texture analyzer with a plate probe © 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 sample preparation, texture and sensory characterization for boiled and steamed sweetpotato has been developed. SOPs for measuring dry matter content (DMC), starch and sugar through acid hydrolysis, and sugars by HPLC can be applied with sweetpotato roots. Evaluation of water absorption and cooking time of boiled sweetpotato have been adapted from the SOPs for boiled cassava. Texture characteristics of boiled sweetpotato such as firmness and mealiness can be analyzed with texture profile analyzer (TPA) using a plate probe and a cylindrical probe (penetration). Cell wall saccharide composition, pectin methylesterase (PME) activity, and galacturonic content of sweetpotato have been determined to allow eventual correlation between different textural properties. Quantitative descriptive analysis (QDA) and consumer acceptance assessments conducted with sensory panels enable describing the main traits quantitatively and qualitatively. These tools have been developed for a sweetpotato breeding program at CIP in Uganda[2,3]. **Threshold values of sweetpotato sensory attributes** that influenced consumer acceptability have been identified. These include **cooked-root sweet taste; aroma and flavor[4]; firmness, and mealiness**. Consumers liked the color of all sweetpotato varieties ranging from white, through yellow to orange. Some released varieties have performed well, with excellent eating characteristics. Starch and sugar content, starch granule ratio, and amylase activities contributed to predicting mouthfeel textures[4]. Sweet-tasting cooked sweetpotato has a high maltose content. Preferences for some released sweetpotato varieties over landrace varieties highlight the potential for increased adoption of nutritionally improved varieties that match local consumers' sensory preferences. Newly released sweetpotato varieties have been assessed at CNRA, Côte d'Ivoire. Among the clones assessed, those that received the highest ratings were praised for their appealing texture and yam-like taste when boiled.

High-throughput measurements using near infrared spectroscopy (NIRS) have been calibrated on raw-intact, raw-mashed, cooked-mashed, raw freeze-dried, and cooked freeze-dried sweetpotatoes for color, mealiness, sweetness, and fibrousness. Storage root dry matter, starch, glucose, fructose, sucrose and β-carotene content have been predicted using NIRS. and correlated with α- and β-amylase activity[5,6]. Additionally imaging technology (DigiEye) can instantaneously predict color and mealiness. Developing molecular markers for identifying genes of interest can be achieved through our approaches based on the preferences of boiled and steamed sweetpotato users and consumers. Identifying and assessing candidate genes controlling desirable sweetpotato quality traits can accelerate sweetpotato selection and efficiency through genomics-assisted breeding. **Combinations of instrumental food quality analyses, and high-throughput phenotyping tools, together with advanced genomics technologies in sweetpotato selection pipelines will enhance developing and using new elite sweetpotato varieties.** This will comprehensively address stakeholder preferences across the entire boiled and steamed sweetpotato value chain. The work will significantly boost adoption rates of new varieties and make them more attractive in the market.

Key Publications

[1] Mwanga et al., 2021. Development of a food product profile for boiled and steamed sweetpotato in Uganda for effective breeding. *Int. J. Food Sci. Technol.*, 56(3), 1385–1398. https://doi.org/10.1111/ijfs.14792

[2] Nakitto et al., 2022. Sensory guided selection criteria for breeding consumer-preferred sweetpotatoes in Uganda. *Food Qual. Prefer.*, 101, 104628. https://doi.org/10.1016/j.foodqual.2022.104628

[3] Nakitto et al., 2024. Decision tree scoring system to guide selection for consumer preference in sweetpotato breeding trials. *J. Sci. Food Agric.*, 104(8), 4615–4625. https://doi.org/10.1002/jsfa.12883

[4] Abugu, et al., 2025. Comprehensive review of sweetpotato flavor compounds: opportunities for developing consumer-preferred varieties. *Compr. Rev. Food Sci. Food Saf.*, 24, 7017 https://doi.org/10.1111/1541-4337.70172

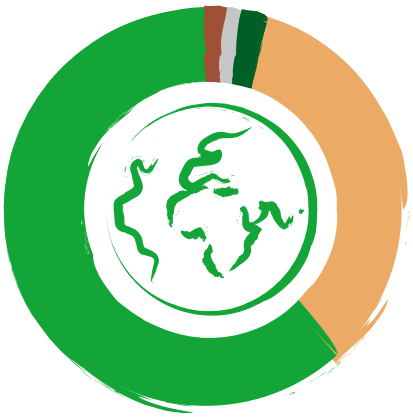
[5] Amankwaah et al., 2024. Development of NIRS calibration curves for sugars in baked sweetpotato. *J. Sci. Food Agric.*, 104(8), 4801–4807. https://doi.org/10.1002/jsfa.12800

[6] Amankwaah et al., 2024. Interrelations of α- and β-amylase activity with starch, sugars, and culinary and nutritional quality attributes in sweetpotato storage roots. *J. Sci. Food Agric.*, 104(8), 4662–4670. https://doi.org/10.1002/jsfa.12832



Target Food Product Profile of Boiled and Steamed Sweetpotato

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



85.8
million tons

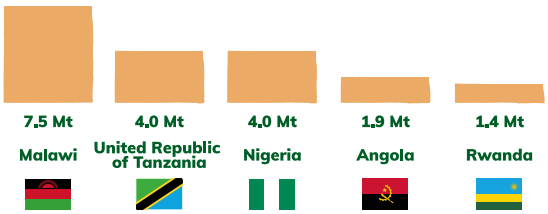
World sweetpotato annual production

- **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

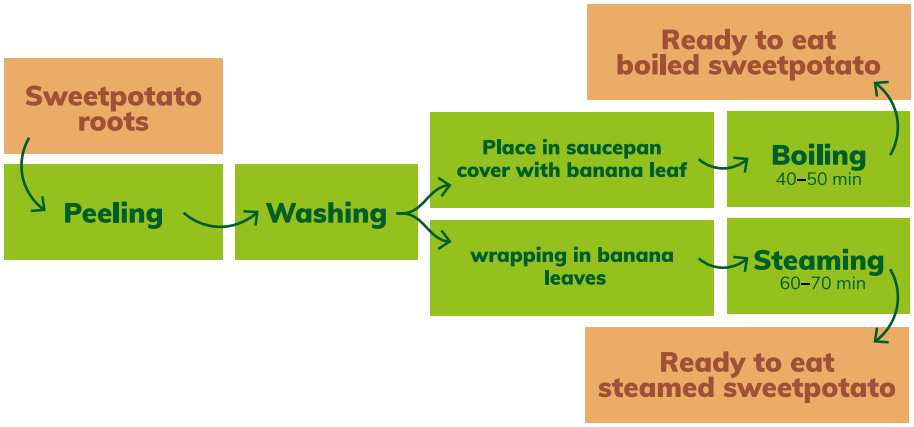
Sweetpotato food products consumed in West Africa





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

Boiled and Steamed Sweetpotato preparation



Preferences of farmers, producers, processors, and consumers of boiled and steamed sweetpotatoes

Raw sweetpotato

- Large roots
- Hard roots
- Sweet taste
- Smooth skin

During processing

- Easy to peel
- Firm flesh
- Large roots
- White-, yellow- or orange-colored flesh
- Moderate sap-levels

Ready-to-eat boiled and steamed sweetpotato

- Mealiness (crumbly, floury, and friable)
- Sweet taste
- Good sweetpotato aroma
- Firm flesh (moderately firm yet soft)
- Not fibrous

Key priority traits for development of sweetpotato varieties for boiled and steamed sweetpotato

- **Attractive flesh colors (white/yellow/orange)**
- **Mealiness (crumbly, floury, and friable)**
- **Sweetness**
- **Sweetpotato aroma & flavor**
- **Firmness (moderately firm yet soft)**
- **Not fibrous**

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.

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For more information about Boiled and Steamed Sweetpotato, please see https://rtbfoods.cirad.fr/

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