2026

Target Food Product Profile

Boiled Yam



RTB Breeding

RTB foods

Gates Foundation · cirad · CNRA · IITA · INRAE

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

Product Identity

Boiled Yam is a versatile dish in African cuisine. It can be made from either white yam or yellow yam (*Dioscorea cayenensis* subsp. *rotundata complex*), or water yam or greater yam (*Dioscorea alata*). It is most commonly consumed as a staple food by millions in West Africa's yam belt: Benin, Côte d'Ivoire, Ghana, Nigeria, and Togo. The dish is presented in various ways during cultural and social celebrations, and is often shared with friends and family. Boiled yam can be simply prepared in a saucepan. Fresh yam tubers are peeled, sliced and placed immediately in water to reduce any brown discoloration, then boiled or steamed until sufficiently tender. Normally, boiling yam takes 15–20 minutes whereas steaming takes 30–40 minutes, and is ready to serve when easily broken with a fork. Boiled yam is relatively dry. It is usually served as a main meal accompanied by sauces, stews, or soups, or eaten as a side dish. It is mostly eaten with vegetables and sauce with fish or meat. However, the simplest way to eat is to drizzle with groundnut oil or palm oil. **All yam varieties can be boiled, but not all of them exhibit the qualities as expected by the consumer.** Processors prefer boiling small quantities of yam pieces for domestic consumption, and steaming when they prepare in large quantities for sale, mainly because steaming better sustains day-long yam tuber integrity during selling.



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Exploration of good quality traits for Boiled Yam



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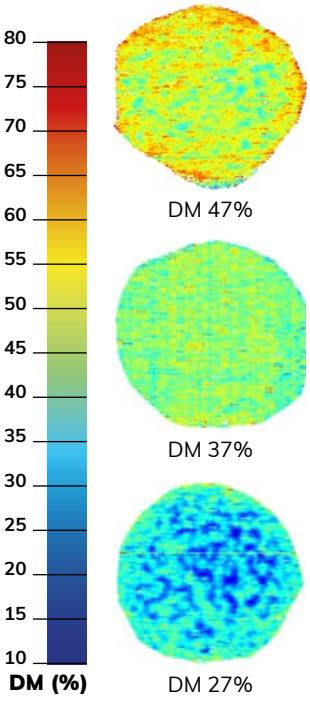
In order to obtain the best product quality and rank traits in order of importance, a gendered map of characteristics demanded by food-chain actors was achieved through a multidisciplinary methodology. These actors included yam farmers, processors/cooks, and consumers. By including boiled-yam processors in a participatory processing diagnosis, and consumers in rural and urban areas in consumer testing, more appropriate gendered food-product profiles for boiled yam in Benin and Nigeria have been developed. Several key end-user preferences for boiled yam quality traits have been identified, but these have not been previously included in breeding pipelines[1]. These relate to the main groups of sensory dimensions: appearance, texture, odour, and taste. **For boiled yam, appearance and texture appear to be more important than odour and taste**. Raw yams for boiling should be regular in size, weight, and shape, as irregularities reduce the ease of peeling, increase transport costs, and discourage adoption. During processing, ease of peeling is considered the most important, followed by lack of discoloration, a short cooking time, low cooking water viscosity, and a lack of black spots or blemishes. Ready-to-eat boiled yam should be white/yellowish, crumbly/mealy, not sticky in hand and in mouth, sweet taste, and yam flavored. It should not darken during cooking, demonstrate good post-cooking stability, and smell good. **The market value of yams for boiling is defined by their raw traits, which are generally more important for men, while ease of peeling, extent of discoloration, sweetness, and crumbliness are priority traits for women.**

A trait evaluation toolbox to support breeding superior yam varieties for enhanced adoption of Boiled Yam





↑ Karima Meghar, a chemometrician (CIRAD, France) with a hyperspectral imaging camera © Dominique Dufour - CIRAD

← Hyperspectral images of cross-section of raw yam samples at 27, 37, and 47% dry matter (DM) © Michael Adesokan - IITA

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. Three prioritized food quality attributes for boiled yam included ease of breaking, crumbliness, and sweetness of taste[2]. A toolbox of standard operating procedures (SOPs) for yam sampling, and texture and sensory analyses for boiled yam has been developed. Boiled yam texture analysis assesses crumbliness, and ease of breaking has been measured using a texturometer with penetration and compression tests, and by an extrusion method. Direct assessment of boiled yam mealiness can be achieved by using a penetrometric method. Sugar intensity has been assessed using high-performance liquid chromatography (HPLC). Dry matter content (DMC) has been determined to reflect the amount of total solids in fresh and boiled yam.

Quantitative descriptive analysis (QDA) and consumer acceptance assessments have been conducted with sensory panels. Data analytical methods have been standardized to maximize meaningfulness of comparisons. These tools have enabled quantitative and qualitative descriptions of the main traits[2]. Crumbliness in texture and ease of breaking were well-predicted by penetration force and DMC, while sweetness was well-predicted by DMC and sugar intensity. Certain improved water yam genotypes displayed satisfactory sensory and texture acceptance thresholds and related biophysical parameters. The improved yam clones were effectively evaluated using sensory and instrumental texture-based approaches in Benin, Côte d'Ivoire, Ghana, and Nigeria. This allows normalization of the yam breeding participating in the project, and also with other breeders around the world. It also enables identifying the best parents for developing new varieties with the desired quality traits. Additionally, high-throughput phenotyping tools such as near infrared spectrometry (NIRS) and hyperspectral imaging, have been developed for screening raw tubers or flour for rapidly, and non-destructively evaluating large populations of yam clones[3,4].

Based on boiled yam user and consumer preferences, our approaches have helped develop molecular markers that can identify genes of interest[5]. The research has mapped yam quality attributes to several genes. Traits include both raw yam tuber quality traits (i.e. color, texture, DMC, and starch accumulation), and culinary quality attributes (i.e. cooking time, DMC, hardness, and moldability). In addition, the candidate genes controlling yam tuber quality have been assessed[5]. Breeders will now be able to boost yam selection speed and efficiency through genomics-assisted breeding, using validated markers for genes that control desirable quality traits. **Combinations of instrumental food quality analyses, and high-throughput phenotyping tools, together with advanced genomics technologies in yam selection pipelines will enhance discovery of the new elite yam varieties.** This will comprehensively address stakeholder preferences across the entire boiled yam value chain. The work will significantly boost adoption rates of new varieties and make them more attractive in the market.

Key Publications

[1] Honfozo et al., 2021. Boiled yam end-user preferences and implications for trait evaluation. *Int. J. Food Sci. Technol.*, 56(3), 1447–1457. https://doi.org/10.1111/ijfs.14707

[2] Adinsi et al., 2024. Characterizing quality traits of boiled yam: texture and taste for enhanced breeding efficiency and impact. *J. Sci. Food Agric.*, 104(8), 4626–4634. https://doi.org/10.1002/jsfa.12589

[3] Adesokan et al., 2024. Evaluating the dry matter content of raw yams using hyperspectral imaging spectroscopy and machine learning. *J. Food Compos. Anal.*, 135, 106692. https://doi.org/10.1016/j.jfca.2024.106692

[4] Alamu et al., 2021. Near-infrared spectroscopy applications for high-throughput phenotyping for cassava and yam: A review. *Int. J. Food Sci. Technol.*, 56(3), 1491–1501. https://doi.org/10.1111/ijfs.14773

[5] Mota et al., 2024. Whole-genome sequencing and comparative genomics reveal candidate genes associated with quality traits in *Dioscorea alata*. *BMC Genomics*, 25, 248. https://doi.org/10.1186/s12864-024-10135-2

Bakayoko et al., 2026. Participatory selection of white guinea Yam (*Dioscorea rotundata* P.) elite cultivars using organoleptic and sensory quality-related traits of boiled and pounded tubers. *Adv. Agric.*, 2026(1), 6686087. https://doi.org/10.1155/aia/6686087



Target Food Product Profile of Boiled Yam

Yam is a key RTB food security crop in African and other developing countries.



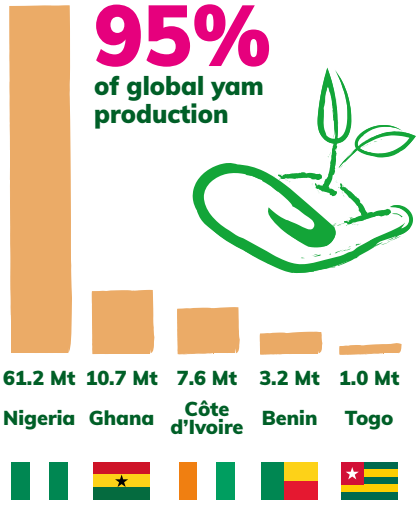
88.3
million tons

World yam annual production

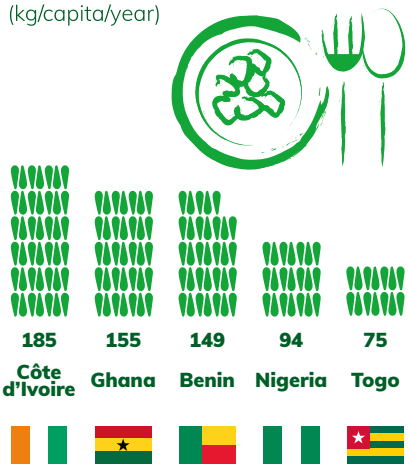
- **98.1% Africa**
- 1.2% Latin America
- 0.2% Asia
- 0.5% Others

Source: FAOSTAT, 2022

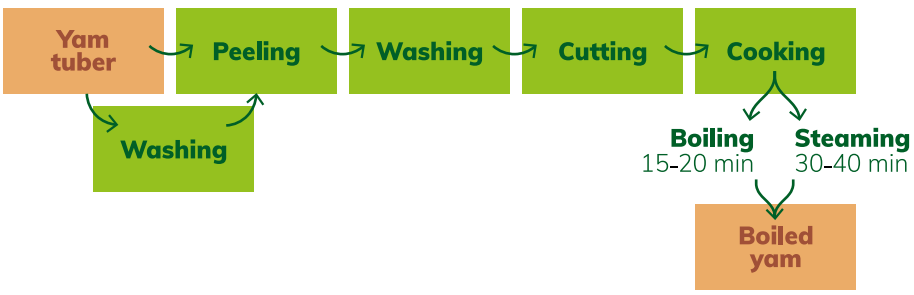
Five countries in West Africa account for 95% of global yam production



Top five yam consumers
(kg/capita/year)



Boiled yam preparation



Preferences of farmers, producers, processors, and consumers of boiled yam

Raw yams

- Heavy well-rounded tuber
- White colored flesh
- Smooth skin when touching
- No black spots

During processing

- Easy to peel
- White or yellowish color
- Pleasant aroma
- Easy to cut and cook
- Lack of discoloration during peeling

Ready-to-eat boiled yam

- White or yellowish color
- Not sticky in hand and in mouth
- Non-fibrous
- Crumbly/friable
- Sweet taste
- Pleasant aroma

Key priority traits for development of yam varieties for boiled yam

- **Ease of peeling**
- **Extent of discoloration**
- **Sweetness**
- **Crumbliness**

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

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For more information about Boiled Yam, please see https://rtbfoods.cirad.fr/

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This article is available at: https://doi.org/10.18167/agritrop/00896