2026

Target Food Product Profile

Boiled Potato



RTB Breeding

RTB foods

Gates Foundation

CIP International Potato Center
A CGIAR Research Center

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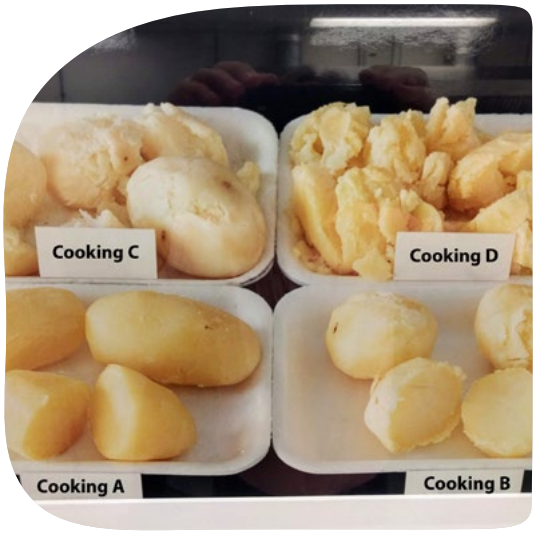
Breeding Root, Tuber, and Banana (RTB) varieties that better serve user and consumer preferences will lead to greater varietal adoption in RTB value chains. This will help to further boost RTB-linked livelihoods and food and nutrition security, and reduce drudgery.

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

Product Identity

Boiled Potato is a significant staple food that is made from potato (*Solanum tuberosum* L.). Potatoes are cultivated worldwide in more than 100 countries. Potato production is mainly concentrated in Asia, and Africa is increasing its production. Historically an Andean and European staple, potatoes are increasingly being adopted by Asian and African consumers. Recently, consumption in Asia and Africa has increased by about 70% (FAOSTAT, 2022). In Africa, it provides an excellent source of income for smallholder farmers and plays a significant role in food security and nutrition. Boiling, mashing, baking, frying, roasting, or steaming the potatoes is possible, and their high starch content makes them an adaptable ingredient in many dishes. In Uganda, boiling potatoes is a typical method of cooking them. Women usually prepare boiled potatoes for household use or commercial purposes. The preparation of plain boiled potato starts with peeling and washing the tubers. They may be lightly fried in oil, and then boiled in a covered pan for 30–45 minutes. A variety of dishes are accompanied by boiled potatoes. They can be served as a single dish or in combination with other vegetables, pulses, legumes, or animal proteins to make a beloved dish called 'katogo'.



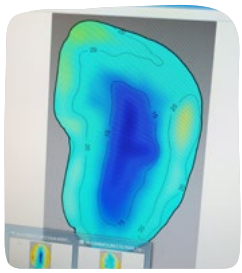
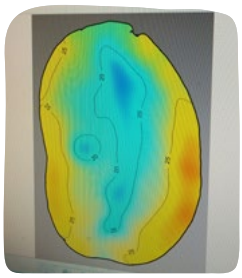
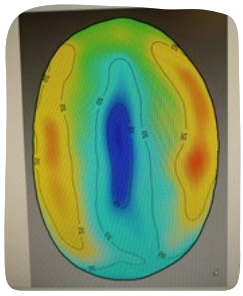
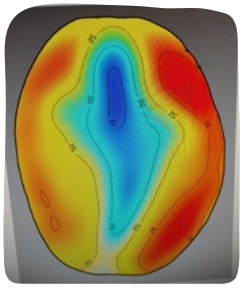
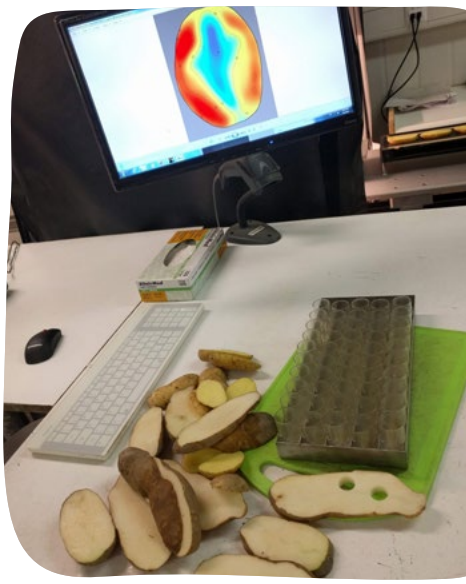
Boiled potatoes of different cooking methods
© Dominique Dufour - CIRAD

Exploration of good quality traits for Boiled Potato


Farmer's house in Nakuru, Kenya
© Michael Major - Crop Trust

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 potato farmers, processors/cooks and consumers of boiled potato. By including boiled potato 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 potato has been developed. Several key end-user preferences for boiled potato quality traits have been identified[1]. From a gender perspective, women were responsible for seed conservation, especially in subsistence production, while men were responsible for commercial seed production due to the capital outlay required. Women also dominate small-scale retailing and processing of potatoes. Red skin and yellow flesh, which were important characteristics for both men and women, have been linked to market preferences. **Women's preference for big size and mealiness** is linked to processing efficiency and eating quality. The high-quality raw materials were characterized by a **red skin color, a moderately large tuber size, yellow flesh color, smooth skin, no damage, firm tuber, and good eyes (few eyes, shallow eye depth)**. During processing, priority was given to potatoes that were **easy to peel and cook fast/ easy to cook**. Final product prioritization consisted of moderately **firm, mealy, good-boiled potato taste (does not taste flat or rotten), good-boiled potato smell, and yellow color**. Gender analysis considered red skin color and no damage characteristics as not a priority. Damages to potatoes due to improper post-harvest handling are considerable harm, as it increases drudgery.

A trait evaluation toolbox to support breeding superior potato varieties for enhanced adoption of Boiled Potato

Hyperspectral images of raw potatoes with highest water concentration in blue zone and lowest water concentration in red zone © 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 textural and sensory analyses for boiled potato has been developed. Sensory attributes of boiled potato can be evaluated by trained panellists including odor, texture in mouth (fracturability, hardness, crunchiness, moisture in the mass, mealiness, smoothness, and uniformity of texture), texture by hand (hardness, moisture release when pressed by fingers, moldability, and stickiness), appearance (flesh color, homogeneity of color, translucency, chalkiness), aroma when chewing, and aftertaste (bitter). Instrumental texture of steamed potato can be determined by penetration (hardness), texture profile analysis—TPA (adhesion, cohesion, springiness, and resilience), and extrusion (degree of deformation yield, and extrusion force). Dry matter content (DMC) has been determined by thermogravimetric methods. Starch and sugar have been measured through acid hydrolysis and sugars content has been accessed by HPLC. For high-throughput assessment of the preferred quality traits—color, mealiness, sweetness, and fibrousness, the near infrared spectroscopy (NIRS) has been calibrated for different types of raw and cooked potato samples. Despite development of hyperspectral imaging analysis of fresh RTB, the approach can be applied for large population screening of potato. Quantitative descriptive analysis (QDA) and consumer acceptance assessments are conducted with sensorial panels. Data analytical methods have been standardized to maximize meaningfulness of comparisons. These tools have enabled describing the main traits quantitatively and qualitatively[2]. At CIP, Kenya, improved potato clones have been evaluated for boiled potato. Certain clones were rated as the highest for chalky appearance and mealiness. Potato genotypes were differentiated by penetration measured by standard texture probe. Instrument-based texture parameters such as penetration peak force (hardness/firmness) and area under the curve (which represents energy needed to penetrate) of boiled potato tubers were significantly associated with sensory attributes such as fracturability and hardness in the mouth. Potato genotypes can be classified into good, intermediate, and poor texture-quality genotypes for boiled potatoes. Good genotypes comprise relatively moderate firmness, requiring moderate work for penetration, and good fracturability in the mouth. Some new genotypes ranked alongside good landrace varieties. NIRS measurement demonstrated high potential in distinguishing yellow color, homogeneity of color, moisture in mass, and uniformity of texture. **Combinations of instrumental food quality analyses, and high-throughput phenotyping tools, together with advanced genomics technologies in potato selection pipelines will enhance discovery of the new elite potato varieties.** This will comprehensively address stakeholder preferences across the entire boiled potato value chain. The work will significantly boost adoption rates of new varieties and make them more attractive in the market.

Key Publications

[1] Mudege et al., 2021. Prioritising quality traits for gender-responsive breeding for boiled potato in Uganda. *Int. J. Food Sci. Technol.*, 56(3), 1362–1375. https://doi.org/10.1111/ijfs.14840

[2] Nantongo et al., 2024. End users' preferences to enhance prospects for varietal acceptance and adoption in potato breeding. *J. Sci. Food Agric.*, 104(8), 4606–4614. https://doi.org/10.1002/jsfa.12882

Ayetigbo et al., 2024. Review of instrumental texture measurements as phenotypic tool to assess textural diversity of root, tuber and banana food products. *J. Sci. Food Agric.*, 104(8), 4527-4539. https://doi.org/10.1002/jsfa.13072

Scott, 2021. A review of root, tuber and banana crops in developing countries: past, present and future. *Int. J. Food Sci. Technol.*, 56(3), 1093-1114. https://doi.org/10.1111/ijfs.14778

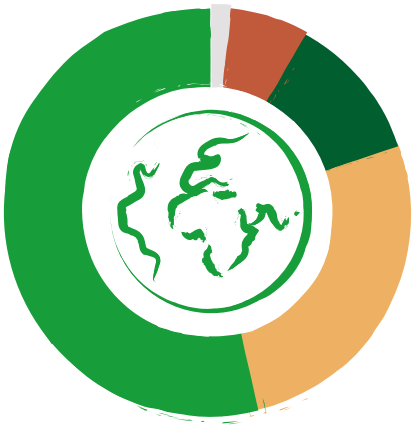
Morris & Taylor, 2019. Improving flavor to increase consumption. *Am. J. Potato. Res.*, 96, 195–200. https://doi.org/10.1007/s12230-018-09702-7

Binner et al., 2000. Cell wall modifications during cooking of potatoes and sweet potatoes. *J. Sci. Food Agric.*, 80, 216-218. https://doi.org/10.1002/(SICI)1097-0010(20000115)80:2%3C216::AID-JSFA507%3E3.0.CO;2-6



Target Food Product Profile of Boiled Potato

Potato is a key RTB food security crop in Africa, Asia, and Latin America.



375
million tons
Global annual potato production

- 54.1% Asia
- 26.1% Europe
- 12.0% Americas
- 7.2% Africa
- 0.5% Others

Source: FAOSTAT, 2022

Top three potato consumers by region (kg/capita/yr)

Africa	Asia	Europe	Latin America
65 Lesotho	105 Kazakhstan	161 Belarus	90 Peru
63 Rwanda	103 Kyrgyzstan	139 Ukraine	65 Bolivia
61 Algeria	97 Uzbekistan	94 Poland	56 Colombia Chile

Boiled Potato preparation

Potato tubers → Peeling → Washing → Boiling 30–45 min → Boiled Potato

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

Raw potato

- Moderately big tuber size
- Yellow flesh color
- Smooth skin
- Firm tuber
- Good eyes (few eyes, shallow eye depth)

During processing

- Easy to peel
- Easy to cook

Ready-to-eat boiled potato

- Yellow color
- Moderately firm
- Mealiness
- Good taste (no flat or rotten taste)
- Good smell

Key priority traits for development of potato varieties for boiled potato

- Moderately big tuber size
- Yellow flesh color
- Easy to cook
- Firmness

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

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

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