Scientific Progress Report

Understanding the Drivers of Trait Preferences and the Development of Multi-user RTB Product Profiles - RTBfoods Scientific Progress Report for Period 3 (Jan-Dec 2020)

Montpellier, France, 22 February 2021

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Ethics: The activities, which led to the production of this document, were assessed and approved by the CIRAD Ethics Committee (H2020 ethics self-assessment procedure). When relevant, samples were prepared according to good hygiene and manufacturing practices. When external participants were involved in an activity, they were priorly informed about the objective of the activity and explained that their participation was entirely voluntary, that they could stop the interview at any point and that their responses would be anonymous and securely stored by the research team for research purposes. Written consent (signature) was systematically sought from sensory panellists and from consumers participating in activities.

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ABSTRACT

This paper presents the Work Package 1 Scientific Progress Report for Period 3 of the RTBfoods project. This includes: a summary of achievements; a description of the completion of WP1 outputs and deliverables; the impact of COVID-19 on WP1 activities; issues in WP1 coordination, and collaboration and partnerships. Finally, it includes the next steps for Period 4. The draft report was submitted to PMU on 18 December 2020 and the final report on 23 February 2021.The report is authored by L. Forsythe, G. Fliedel, A. Bouniol, and T. Madu.

1 PRODUCT PROFILES & WP1 TEAMS ACROSS COUNTRIES

Please review table below with information provided by Partner Focal Points:

Crop	Product Profile	Product Champion	Partner Institutes responsible for WP1 activities	Institute Focal Point	WP1 Team Composition	
					Product Profile WP1 Correspondent	Names of Operational Staff for WP1 Field Work& Data Management
Cassava	**PP1- Boiled Cassava**	Robert Kawuki (NaCRRi-Uganda)	NaCRRI-Uganda	Robert Kawuki	Ann-Ritah Nanyonjo	Sophia Hamba, Paula Iragaba
			IITA-Benin	Busie Maziya-Dixon	Sounkoura Adetonah	Jules Bakpe
			UAC-FSA Benin	Noel Akissoe	Laurent Adinsi	Laurenda Honfozo Alexandre Bouniol (Cirad)
	PP2- Gari, Eba, Attiéké	Busie Maziya-Dixon (IITA-Nigeria)	IITA-Nigeria [Gari/Eba]	Busie Maziya-Dixon	Bela Teeken	Bello Abolore Deborah Olamide Olaosebikan
			NRCRI-Nigeria [Gari/Eba]	Ugo Chijioke	Tessy Madu	Benjamin Okoye
			IITA & ENSAI-Cameroon [Gari]	Busie Maziya-Dixon Robert Ndjouenkeu	Bela Teeken (IITA-Nigeria)	Huber Noel Takam (IITA-Cameroon) Franklin Ngoualem Kégah (ENSAI-Cameroon) Robert Ndjouenkeu (ENSAI-Cameroon)
			CNRA-Côte d'Ivoire [Attiéké]	Amani Kouakou	Catherine Ebah	Landry Kanon Ernest Depieu
	PP3- Fufu	Ugo Chijioke (NRCRI-Nigeria)	NRCRI-Nigeria	Ugo Chijioke	Tessy Madu	Benjamin Okoye

Crop	Product Profile	Product Champion	Partner Institutes responsible for WP1 activities	Institute Focal Point	WP1 Team Composition	
					Product Profile WP1 Correspondent	Names of Operational Staff for WP1 Field Work& Data Management
Cooking Banana	**PP4- Boiled Plantain**	Gérard Ngoh (CARBAP-Cameroon)	CARBAP-Cameroon	Gérard Ngoh	Gérard Ngoh	Cédric Kendine
	PP5- Matooke	Kephas Nowakunda (NARL-Uganda)	NARL & Bioversity-Uganda	Kephas Nowakunda (NARL) Pricilla Marimo (Bioversity)	Pricilla Marimo (Bioversity)	Kenneth Akankwasa (NARL)
	PP6- Fried Plantain	Delphine Amah (IITA-Nigeria)	IITA-Nigeria	Busie Maziya-Dixon	Delphine Amah	Esme Stuart
Sweetpotato	**PP7- Boiled Sweetpotato**	Robert Mwanga (CIP-Uganda)	CIP-Uganda	Jolien Swanckaert	Sarah Mayanja	Samuel Edgar Tinyiro
	PP8- Fried Sweetpotato	Jan Low (CIP-Kenya)	CIP-Nigeria	Jolien Swanckaert	Edward Carey	Simon Imoro Reuben Ssali
Yam	**PP9- Boiled Yam**	Noel Akissoe (UAC-FSA-Benin)	UAC-FSA Benin	Noel Akissoe	Laurent Adinsi	Laurenda Honfozo Alexandre Bouniol (Cirad)
			IITA-Nigeria	Busie Maziya-Dixon	Bela Teeken	Bello Abolore Deborah Olamide Olaosebikan
			NRCRI-Nigeria	Ugo Chijioke	Tessy Madu	Benjamin Okoye Nnaemeka Onyemuwa
	PP10- Pounded Yam	Bolanle Otegbayo (Bowen University-Nigeria)	Bowen University-Nigeria	Bolanle Otegbayo	Bolanle Otegbayo	OlayinkaTinuke O. Awoniyi
			IITA-Nigeria	Busie Maziya-Dixon	Bela Teeken	Bello Abolore Deborah Olamide
			NRCRI-Nigeria	Ugo Chijioke	Tessy Madu	Benjamin Okoye Nnaemeka Onyemuwa
Potato	**PP11- Boiled Potato**	Thiago Mendes (CIP-Kenya)	CIP-Uganda	Jolien Swanckaert	Sarah Mayanja	Samuel Edgar Tinyiro

2 WP1 SUMMARY NARRATIVE

RTBfoods Work package 1 has had another exciting and productive year. While COVID-19 has restricted some activities, remarkable progress has been made and for that we are grateful to our partners. We have also welcomed Dr Tessy Madu to the Coordination team. This report presents our achievements in developing RTB product profiles, gender research, publications, presentations and partnerships in Period 3 (P3).

Significant achievements have been made regarding output 1.1.1, *gendered knowledge produced on quality characteristics, demands and consumption patterns for 11 RTB products in 5 African countries*. This large output is the accumulation of a five-step methodology to identify user preferences for RTB products, and in understand the socio-economic dynamics and drivers of which they are situated, which has been implemented across the project countries (Forsythe, et al., 2020). Step 1 outputs (state of knowledge report) were finalised in previous years; however, P3 has seen the completion of Steps 2, 3 and 4, of which the outputs will be available online shortly. It is expected that the results from profiling the roles of food chain actors with their gender-differentiated product quality characteristics and varietal preferences will support breeding programmes to improve adoption of new varieties and impact on food and income security in SSA.

Regarding Step 2, gendered food mapping, all work has been completed for 13 food products. These reports show a number new and interesting findings. For example, all products under study were ranked highly in their importance for food, and often, for income – which provides an extensive evidence based on the importance of these products in people's lives. Agronomic and processing practices differed substantially among all profiles, even for similar products in the same country, by factors such as gender, ethnicity, migration status and wealth. Socio-demographic factors also played a significant role in determining who participated and benefited from certain activities in the food chain, and under what conditions. The versatility of the RTB crops, particularly for cassava and yam products in Nigeria, Benin and Ivory Coast, means that breeders will need to address the traits associated with a range of products as a priority. This will help producers and processors to flexibly meet the demand of different products, and therefore, increase their resilience.

Poorer people, predominately women and female headed households, had smaller and poorer quality land in all contexts, which means that agronomic characteristics such as quick maturity, minimal labour requirements, in ground storability and the ability of the crop to thrive in intercropping conditions, without fertiliser, are vital. Processing conditions in West Africa were in many contexts unhealthy and drudgerous; therefore, small-scale mechanisation would have a significant impact on improving the quality of life of processors across the region.

Another finding across countries and products was the preference for local varieties over released varieties in most circumstances. While saving and exchanging seeds/stems within communities were the most predominate way of accessing new material, particularly among women, there was also a significant amount of purchasing. Interestingly, the study on matooke found that a higher proportion of women purchased banana varieties compared to men.

There were similar agronomic preferences for crops among the countries. However, the IITA team in Nigeria found several important breeding traits for cassava that have traditionally not received much attention, including 'stem longevity' and stem quality (related to good sprouting). Good canopy cover was also felt to reduce weeding labour (and would specifically reduce women's labour). This trait sets apart the preference for smaller canopies desired by large scale mechanized farming, which highlights the type of 'trade-offs' breeders will need to make with the development of new varieties.

In some contexts, quality characteristic prioritised by food chain actors were similar for products in different contexts, and for other products, it was the opposite. However, major drivers were agronomic, post-harvest and quality related, as expected. Regarding boiled cassava, quality characteristics in Nigeria related to softness and sweetness, but in Benin a white flesh and crumbly

texture was highlighted. In Uganda, a pink or white outer skin was preferred, and non-fibrous roots were mentioned. This may not necessarily indicate differences in the desired characteristics, but in the importance of those characteristics with the varieties available in that context.

In some cases, differences in quality characteristic prioritised by food chain actors were related to socio-demographic factors, particularly ethnicity or migration status. Regarding gari in Nigeria, preferences regarding colour, and the level of drawability, softness and sourness differed across gender, regions/states for gari/eba. Gender differences for quality characteristic preferences mainly related to differences in prioritisations, and that women noted a greater number of quality characteristics compared to men.

Regarding Step 3, participatory processing demonstration, all activities have been completed for 10 RTB food products. The field diagnostic activities carried out by partners, with support of the WP1 Coordination team, resulted in a set of unique datasets for each product profile, documented local processing know-how, established the main quality characteristics expected by processors, and identified the critical processing stages required for high quality, profitable, products. Step 3 used elements of experimental design and mixed methods, and drew on results from Step 2, to provide new information of importance for Step 4, in addition to WP2 and breeders more generally.

Among the many and detailed results obtained for each product profile, this work has identified major quality and profitability criteria directly from local processors. Regarding raw materials of cassava, yam and sweet potato, processors pay attention to density (high dry matter content; profitability); shape (processing difficulty and profitability), and the appearance of the root/tuber rather than their mere size. The external appearance of a variety does not guarantee its suitability for processing or a high-quality final product with a desired sensory profile; however, processors evaluate the exterior appearance of RTB crops (colour and/or roughness of the skin) to recognize the local varieties they process. It is thus preferable that the raw materials have a high dry matter content, this guaranteeing suitability for processing, good yield and textural properties. Processors also pay attention to the textural behaviour of products during cooking. Indeed, the cooking-ability of a product is perceived by the evolution of its texture, which must reach that sought by consumers, and which corresponds to a certain degree of destructuring and hydration of the matrix that varies according to the product profile and local habits.

Another important characteristic concerns the appearance of the final products in terms of colour, shininess and roughness. It is generally preferable that these meet specific criteria expected by consumers, this guaranteeing good sales for the processors. Finally, although more difficult to perceive in Step 3, the sensory characteristics of the products are important in the choice of varieties. Indeed, even if a variety meets a set of expected criteria in terms of suitability for processing, the perception of a bad taste / odour of the product during its consumption would lead to rejection of the variety.

The majority of studies show that local varieties combine both excellent processing-ability and sensory profiles, which are the result of selection over time giving them very specific characteristics. In this sense, we can cite the example of the fibre content of cassava and its position within the root. A central fibre in the cassava root facilitates the defibration work performed by processors during fufu processing. This can be an inconvenient for the consumer when cassava root is boiled.

This activity also makes it possible to promote the expertise of processors and their extensive knowledge of the products and consumer preferences. Thus, their participatory diagnosis aimed at evaluating the final products from contrasting varieties in terms of sensory characteristics. During this activity, many and precise sensory characteristics were collected and were used for the development of some specific tools (CATA and JAR terms) for the implementation of the Step 4 of the WP1's methodology.

Regarding Step 4, the consumer testing, partner fieldwork and reports have been completed for 10 products. This step draws and expands on data collected from Step 2 and 3, and completes fieldwork

activities to start food Product Profile consolidation. For this step, each team selects 20-25 relevant sensory characteristics among those identified in the previous steps, with a good balance between the most liked and least liked characteristics related to the appearance, odour, texture and taste of the final product to well describe each product during testing. Secondly, select varieties very different in quality characteristics to made products perceived differently by the consumers and got a large range of mean overall liking. Thirdly, invite a large number of consumers (250 to 300 consumers) in rural and urban areas of two different regions to test the 4-5 products and describe them by using all the sensory terms, which was not so easy because of the different languages and the distance between locations. Fourthly, propose products constant in sensory properties (temperature, texture, appearance etc.) for all the consumers to give their opinion. Guidance on Step 4 consumer data analysis and reporting was also developed, that focuses on the reporting of consumer data analysis and interpretation with different chapters on the objectives, methodology and five types of results expected. This includes four tutorials and accompanied by an Excel file with examples.

Most of the teams were able to successfully complete these activities. Using sensory descriptors collected in Steps 2 and 3, the consumers -just by describing each product tested and giving an overall liking score of them- made it possible to establish a sensory mapping of the most liked characteristics linked to high overall liking and least liked characteristics linked to low overall liking. All the sensory mapping obtained with the consumers for the different products by the teams were reported in the Step 4 paragraph on narrative key scientific findings. For most of the teams, this map will be able to be correlated with that obtained by the WP2 panellists who generated descriptors and scored each of them. This will be the result of WP1 Product Profile and the link with WP2 & WP4 teams. Output 1.2.1, or the WP1 Product Profile, requires the completion of steps and therefore it will be produced in Year 4 and transfer to WP2 by most of the teams. The five Product Profiles expected in priority by partner breeding programs will be delivered in priority (boiled yam, boiled cassava, matooke, sweetpotato and Eba).

Results from Steps 1-4, in Output 1.1.1, have led to 15 peer-reviewed papers in a special issue called “Consumers have their say: Assessing preferred quality traits of roots, tubers and cooking bananas, and implications for breeding” in the International Journal of Food Science and Technology (IJFST). This includes the 5-step methodology written by the WP1 coordination team and focal points - a collaborative effort among food scientists, social scientists and a breeder to develop a methodology to identify the demand for quality characteristics among diverse user groups along RTB food chains. This initiative presents a new basis to understand the priorities of food chain actors and quality characteristics associated for RTB crops in specific contexts, for the scientific community and development practitioners. This methodology was applied, adapted and – importantly - improved by 12 interdisciplinary teams in WP1, which were synthesised and published in the 13 publications in the same special issue. WP1 coordinators, focal points and partners are extremely proud of how our work has made an extensive contribution to knowledge.

In terms of our gender research (output 1.1.2), we have made significant strides this year, that we are very proud of. Firstly, a report of the results of a gender analysis of data from Step 2 was designed and co-developed by the newly established, Gender Working Group (GWG). The report covers nine RTB products and eight research teams and includes analysis of gender roles along the food chain, and a gender analysis of varietal use and preferences, in addition to an analysis of preferences for quality characteristics of RTB crops from planting to consumption. Our findings were presented at the GREAT gender-responsive crop breeding conference and ANR conference on gender research methods and were summarised in a blog on for the RTBfoods and NRI’s websites. The GWG consists of eight partner research teams and two WP1 Coordinators, Lora Forsythe and Tessy Madu, and provides an equitable approach to developing research outputs and publications involving cross-partner research.

There were also several new scientific collaborations between partners that are worthy of note. In addition to the establishment of the GWG which has established collaboration of 16 social scientists from 9 institutes, there was also continuing partnership between NRCRI and Bowen in Nigeria on Boiled & Pounded Yam, and NRCRI & IITA in Nigeria on Gari-Eba, and ENSAI & IITA in Cameroon on Gari. The five-step methodology developed in WP1 has been used in the NextGen Cassava

project in Tanzania and will be applied in the Sweet Gains project in Mozambique. Part of the results from the studies were published in the Special Issues of IJFST. The WP1 Leader and other RTBfoods project members were invited to a number of events on integrating gender into breeding programmes, including those hosted by the Gender and Breeding Initiative and Excellence in Breeding. The WP1 Leader also represented the GWG at the GREAT Gender and Breeding Conference to present interim findings, and the findings were also used in a presentation by PMU to the ANR for a gender and research methods conference. The WP1 Coordinators and focal points have also been engaged with WP5 to start the process of amalgamation in Period 4.

We have many exciting plans for Period 4, including the finalisation of the Product Profiles (Step 5); WP1 lesson learned activities and improvements to the methodology, further in-depth gender analysis of WP1 data. We look forward to another RTBfoods year!

3 WP1 ACHIEVEMENTS & CONTRIBUTION TO OUTPUT 1.1.1, OUTPUT 1.1.2, OUTPUT 1.2.1 & OUTPUT 1.5.1

Fill-in the table below to provide an update on progress made toward the achievement of project outputs in Period 3 – ***NB: Information provided in this table will be used to update the RTBfoods Results-Tracker.***

Output	Period 3 Targets/ Milestones	Achieved in Period 3	Variance & Brief Explanation
1.1.1	**15 studies on quality characteristics, demands and consumption patterns for 11 RTB food products** (Step 2, Step 3, Step 4) **Note:** Underlined products indicate primary country & responsible institute.		
	Step 2	In P3, 13 product reports for Step 2, Gendered Food Mapping have been completed.	Information: Focal point had time constraints in completing the review of reports following a return from maternity leave, in addition care responsibilities with COVID restrictions. For partners, there has been some delay due to the focus of partners on the special issue. The remaining two reports are expected in period 4 and have been delayed due to competing responsibilities of partners.

Output	Period 3 Targets/Milestones	Achieved in Period 3	Variance & Brief Explanation
1.1.1	**Step 3**	In P3, 14 reports for Step 3, participatory diagnosis on quality characteristics have been submitted.	Information: Some delay due to the focus of partners on the special issue of the IJFST and fieldwork delays related to COVID.
	Step 4	In P3, 11 reports for Step 4, consumer testing have been finalised.	Information: Some delay due to the focus of partners on the special issue of the IJFST and fieldwork delays related to COVID.
1.1.2	**0.3 gender analysis report**	On-going working paper submitted with the annual report attached with 4 conference presentations on gender in RTBfoods framework and main findings on gender from surveys on RTB preferences.	NA.
1.2.1	**11 food product profiles (first iterations)** accessible to RTBfoods partners on RTBfoods secured repository	In total 11 scientific peer-reviewed papers corresponding to the 11 RTB food Product Profiles have been published.	In Period 3, the PMU encouraged partner teams to promote new knowledge generated on RTB food product profiles through peer-reviewed papers. These papers present a new basis to understand the priorities of food chain actors and quality characteristics associated for RTB crops in specific contexts, for the scientific community and development practitioners. In Period 4 & 5, efforts will be made to transfer this knowledge under appropriate format to enable other WPs develop laboratory analysis methods.

Output	Period 3 Targets/Milestones	Achieved in Period 3	Variance & Brief Explanation
1.5.1	Processed Data from surveys secured on RTBfoods platform for 6 teams (covering 5 food/processed products surveyed in Period 2)	All Step 2 datasets and consent forms are available on the platform for 11 products: • boiled and pounded yam (Bowen), • boiled and bounded yam (NRCRI), • Gari/Eba (IITA) • Gari/Eba (NRCRI) • Fufu (NRCRI) • Matooke (NARL/Bioversity) • Boiled sweetpotato (CIP) • Boiled yam (UAC/FSA) • Boiled plantain (CARBAP) • Gari (ENSAI) • Fried plantain (IITA)	In total 80% of datasets (raw data + processed data files + consent forms) generated during surveys by 9 partner teams have been securely uploaded on the RTBfoods platform with restricted access to non-anonymized data. Few remaining datasets (raw & processed data files) from Step 4 surveys performed in Period 3 are still to be cleaned and uploaded on RTBfoods platform.
		Datasets, questionnaires and consent forms corresponding to Step 3 have been uploaded for: • Boiled Plantain (CARBAP) • Gari/Eba (IITA) • Boiled Sweetpotato (CIP) • Matooke (NARL/Bioversity) • Fufu (NRCRI) • Boiled Potato (CIP) Datasets/questionnaires by: • Boiled yam (UAC/FSA) • Gari/Eba (NRCRI) • Boiled yam (NRCRI) • Pounded yam (NRCRI) • Pounded yam (Bowen Uni.) • Boiled cassava (UAC-FSA)	
		Raw data from Consumer testing (Step 4) have been uploaded on RTBfoods platform by: • FSA Benin, boiled yam • FSA Benin, boiled cassava • NaCRRI Uganda, boiled cassava • NARL/Bioversity Uganda, Matooke • CARBAP Cameroon, boiled plantain • NRCRI Nigeria, Gari/Eba • NRCRI Nigeria, Fufu • NRCRI – Nigeria, boiled and pounded yam • IITA Nigeria, Gari/Eba • CIP Uganda, sweetpotato	

Please complete the List of Deliverables submitted in Period 3 & Responsible Persons below. The draft list hereunder has been consolidated by Eglantine based work plans for Period 3: Deliverable Titles as well as Responsible Persons may be changed.

Activities performed under 1.1.1, 1.1.2, 1.2.1 & 1.5.1	**Deliverables Expected for Submission in Period 3 (Responsible Person or Data Managers)**
Capacity Strengthening	A.2- Capacity Strengthening Kit (in complement to or new versions of material produced & delivered in Period 1 & 2): • Guidance on Step 4 consumer data analysis and reporting (G. Fliedel)
Gendered Food Mapping (Step 2)	A.3- Reports on Gendered Food mapping (Step 2 full-report) (* indicates advanced draft submitted): • Boiled cassava-Uganda (NaCRRI) • Boiled cassava-Benin (UAC-FSA/IITA) • Gari/Eba-Nigeria (IITA) • Gari/Eba-Nigeria (NRCRI) • Matooke-Uganda (NARL/Bioversity) • Boiled yam-Nigeria (NRCRI) • Pounded yam-Nigeria (Bowen)* • Pounded yam-Nigeria (NRCRI)* • Fufu-Nigeria (NRCRI)* • Fried sweetpotato-Nigeria/Ghana (CIP) • Boiled Potato-Uganda (CIP)* • Attiéké-Côte d'Ivoire (CNRA)* • Fried plantain-Nigeria (IITA)
Participatory Processing Diagnosis on Quality Characteristics (Step 3)	A.4- Reports on Participatory Processing Diagnosis (Step 3 full-report) (* indicates advanced draft submitted): • Boiled cassava-Benin (UAC-FSA) • Boiled cassava-Uganda (NaCRRI) • Gari/Eba-Nigeria (IITA) • Gari/Eba-Nigeria (NRCRI) • Fufu-Nigeria (NRCRI)* • Boiled plantain-Cameroon (CARBAP) • Matooke-Uganda (NARL/Bioversity) • Boiled sweetpotato-Uganda (CIP) • Boiled potato-Uganda (CIP) • Boiled yam-Benin (UAC-FSA) • Boiled yam-Nigeria (NRCRI)* • Pounded yam-Nigeria (Bowen)* • Pounded yam-Nigeria (NRCRI)* • Fried sweetpotato-Nigeria & Ghana (CIP)*
Consumer Testing in Rural and Urban areas (Step 4)	A-5- Reports on Consumer Testing (* indicates advanced draft): • Boiled cassava-Benin (UAC-FSA)* • Boiled cassava-Uganda (NaCRRI)* • Eba-Nigeria (IITA)* • Eba-Nigeria (NRCRI)* • Fufu-Nigeria (NRCRI)* • Boiled plantain-Cameroon (CARBAP)* • Matooke-Uganda (NARL/Bioversity)* • Boiled sweetpotato-Uganda (CIP)* • Boiled yam-Benin (UAC-FSA) • Boiled yam-Nigeria (NRCRI)* • Pounded yam-Nigeria (NRCRI)*

Activities performed under 1.1.1, 1.1.2, 1.2.1 & 1.5.1	Deliverables Expected for Submission in Period 3 (Responsible Person or Data Managers)
IJFST Peer-reviewed Papers	• Food product profiles for quality characteristics, Forsythe et al. • Preferred matooke characteristics, K. Nowakunda et al. • Plantain food products in Nigeria, D. Amah et al. • Plantain food products in Cameroon, Ngoh et al. • Preferences for boiled cassava, P. Iragaba et al. • Gari preferences in Cameroon and Nigeria, Ndjouenkeu et al. • Quality Attributes of Fufu, U. Chijioke et al. • Cassava flour end user traits and physicochemical qualities, A. Nanyonjo et al. • Gender-responsive traits in boiled potato, Mudege et al. • Quality characteristics of boiled sweetpotato, Mwanga et al. • Boiled-yam quality along the food chain, Honfozo et al. • End-user preferences for pounded yam, Otegbayo et al. • Fried Sweetpotato Preferences in West Africa, Ssali et al. • Review of fried sweetpotato in West Africa, Carey et al. • Consumer segmentation for fried sweetpotato, Low et al.
Gender Study	**B1- Gender Study:** • Cross-product gender analysis of RTBfoods Step 2 Gendered Food mapping on RTB Products (Gender Working Group). [Alphabetical by institute]: Core writing team: P. Marimo (Bioversity-CIAT); S. Mayanja (CIP); F D. Olaosebikan (IITA-Nigeria); E. Stuart (IITA-Nigeria); B. Teeken (IITA Nigeria); T. Madu (NRCRI), B. Okoye (NRCRI); L. Forsythe (Natural Resources Institute). Contributors: O. Awoniyi (Bowen University); C. Kendine (CARBAP); .N. Kégah (ENSAI-Cameroon); A. Sounkoura (IITA-Benin); J. Bakpe (IITA-Benin); H.N. Hubert (IITA-Cameroon); P. Iragaba (NaCRRI), A.R. Nanyonjo (NaCRRI). • Insights and lessons from gender-responsive RTB food product profile studies in East and West Africa, Presentation at GREAT Symposium (November 2020), L. Forsythe (Natural Resources Institute) on behalf of the Gender Working Group. • Le Genre en Recherche : Retours d'Expérience du Projet RTBfoods en Afrique de l'Est & de l'Ouest, Presentation at ANR Symposium (December 2020), E. Fauvelle (CIRAD) on behalf of the Gender Working Group and the PMU. • Plantain Traits Preferred by Men and Women in Two Regions of Cameroon, Presentation at GREAT Symposium (November 2020) (G. Ngoh) • Prioritization of Cassava Stakeholders' Perceptions And Its Implications for Breeding: Lessons Learned from the RTBfoods Project in Nigeria, Presentation at GREAT Symposium (November 2020), (B. Abolore)

Activities performed under 1.1.1, 1.1.2, 1.2.1 & 1.5.1	Deliverables Expected for Submission in Period 3 (Responsible Person or Data Managers)
Uploading Raw & Coded Data + Questionnaires + Processed Data Files + Consent Forms on RTBfoods Platform	I.1- Data of Gendered Food Mapping (Step 2): Datasets, field notes and consent forms received for 11 products: 1. boiled and pounded yam (Bowen) 2. boiled and bounded yam (NRCRI) 3. Gari/Eba (IITA) 4. Gari/Eba (NRCRI) 5. Fufu (NRCRI) 6. Matooke (NARL/Bioversity) 7. boiled sweetpotato (CIP) 8. boiled yam (UAC/FSA), 9. boiled plantain (CARBAP) 10. Gari (ENSAI) 11. fried plantain (IITA) I.2- Data of Participatory Diagnosis on Quality characteristics (Step 3): 1. Boiled yam (UAC/FSA): Rq/RQ/Q 2. Boiled Plantain (CARBAP): C/Rq/RQ/Q 3. Gari/Eba (IITA): C/Rq/RQ/ Q 4. Gari/Eba (NRCRI): Rq/RQ/Q 5. Boiled Sweetpotato (CIP): C/Rq/RQ/Q 6. Matooke (NARL/Bioversity): C/Rq/RQ/Q 7. Boiled yam (NRCRI): Rq 8. Pounded yam (NRCRI): Rq 9. Pounded yam (Bowen Uni.): Rq 10. Fufu (NRCRI): C/Rq/RQ/Q 11. Boiled Potato (CIP): C/Rq/RQ/Q 12. Boiled Yam (Bowen Uni.): M 13. Fried Sweet potato (CIP): M 14. Boiled cassava (NaCRRI): M 15. Fried plantain (IITA): M 16. Boiledcassava (UAC-FSA): Rq/RQ/Q I.3- Data of Consumer Testing in Rural & Urban areas (Step 4): Raw data from Consumer testing (Step 4) have been uploaded on RTBfoods platform by: 1. FSA Benin, boiled yam 2. FSA Benin, boiled cassava 3. NaCRRI Uganda, boiled cassava 4. NARL/Bioversity Uganda, matooke 5. CARBAP Cameroon, boiled plantain 6. NRCRI Nigeria, gari/eba 7. NRCRI Nigeria, fufu 8. NRCRI – Nigeria, boiled and pounded yam 9. IITA Nigeria, gari/eba 10. CIP Uganda, sweet potato

3.1 Methodological support& guidance developed & published

If any, which main changes have been made to the methodological guidance delivered in Period 1 &/or 2? For what reasons (feedbacks from partners, more accuracy, gap mitigation)?

RTBfoods Step 1: State of Knowledge (SoK) Guidance document. CIRAD-RTBfoods Project, 33 p. (L. Forsythe). New version (L. Forsythe and G. Fliedel)https://doi.org/10.18167/agritrop/00568

The Food science part (version Period 1) has been slightly modified to harmonize the terms currently used by the WP1 partners, in the text and in the tables, to be more precise on what WP1 coordination team expects from the SoK in food science in this project. The Gender and Market components had minor revisions. Namely, clarifying the research questions, sections of the conceptual framework and phrasing of the suggested datapoints.

RTBfoods Step 2: Gendered food mapping. CIRAD-RTBfoods Project, 74 p. (L. Forsythe)

https://doi.org/10.18167/agritrop/00569

Minor amendments to the research questions and inclusion of key changes from pilots in Uganda and Nigeria. The part on Step 2 data analysis guidance on quality characteristics was corrected in details to avoid confusion and be more accurate (new version by G. Fliedel). It was included with the guidance on Step 2 reporting in that new version online (L. Forsythe).

RTBfoods Step 3: Participatory processing diagnosis and quality characteristics. CIRAD-RTBfoods Project, 29 p. New version (G. Fliedel). https://doi.org/10.18167/agritrop/00570

The part on sampling and the choice of locations to conduct the participatory diagnosis have been modified by differentiating between short processes and multi-step processes. Two figures made by A. Bouniol have been added and some edits made (new version G. Fliedel).

RTBfoods Step 4: Consumer testing in rural and urban areas. CIRAD-RTBfoods Project, 29 p. New version (G. Fliedel)https://doi.org/10.18167/agritrop/00571

The "sampling" part has been modified by distinguishing between regions with two small towns or those with a single small town in which consumer tests were conducted. Two figures made by A. Bouniol were added and some edits made (new version G. Fliedel).

Narrative on methodological paper published in the IJFST special issue:
Focus on their innovative aspect, their target audience & scope and elicit the expected implications for RTBs varietal selection [20 lines].

The WP1 coordination team and focal points published a paper entitled “An interdisciplinary and participatory methodology to improve user acceptability of root, tuber and banana varieties”, which was published in a special issue called “Consumers have their say: Assessing preferred quality traits of roots, tubers and cooking bananas, and implications for breeding” in the International Journal of Food Science and Technology (IJFST), led by the RTBfoods project. This paper was a result of a collaborative effort among food scientists, social scientists and a breeder to developed a methodology to identify the gendered demand for quality characteristics among diverse user groups along RTB food chains. This initiative presents a new basis to understand consumer preferences for RTB crops for the scientific community and development practitioners. The methodology is currently being applied, adapted and – importantly - improved by 12 interdisciplinary teams of food technologists, economists and gender specialists through this WP in five project countries: Benin,

Ivory Coast, Cameroon, Nigeria and Uganda. In addition, it has been disseminated to the NextGen Cassava project and will be applied in Tanzania and the SweetGains project in Mozambique. Part of the results from the studies have been synthesised and published in the 11 publications in the same special issue. It is expected that the results will support breeding programmes to improve adoption of new varieties and impact on food and income security in SSA.

How feedbacks from partners have been integrated to adapt/improve WP1 methodology?

Feedback from piloting the Step 2 tools in Uganda and Nigeria informed the revision of the tools that are included in the Step 2 manual. However, to date there has not been a mechanism to systematically and comprehensively collect feedback from all partners on all parts of the WP1 methodology. This will be addressed at the Period 3 Annual Meeting, which will include a lessons learned session that will revisit and improve the methodology. This will be led by Tessy Madu, WP1 Coordinator and Gérard Ngoh, WP5 Coordinator. Therefore, manuals are expected to be adapted and updated versions delivered again in Period 4.

Which new methodological guidance has been developed in Period 3? What for/Objectives? What does this guidance bring new as compared to guidance produced in Period 1 & 2 (data processing, results transfer)?

A new methodological guidance on Step 4 data analysis and reporting has been developed in Period 3. A first guidance "Step 4 Consumer testing in rural and urban areas" (29 p.) was mainly focused on how to conduct consumer tests (choice and preparation of the products, locations, development of questionnaire and fieldwork) with examples of tables and graphs for reporting.

This second guidance (50 p.) is focused on the reporting of consumer data analysis and interpretation with different chapters on the objectives, methodology and five types of results expected. Four tutorials describing step by step each type of analysis using XLSTAT software with screen print, are included as appendices. This guidance is accompanied by an Excel file regrouping all the analyses done on an example of consumer raw data (collected during WP1 Capacity Strengthening workshop in Benin) with tables and graphs to be reported by each team in their Step 4 scientific report.

3.2 Gendered food mapping (Step 2)

Complete the summary table below on Step 2 fieldwork performed in Period 3 (not reported in Period 1 & 2).

No fieldwork for Step 2, Gender Food Mapping, was conducted in Period 3.

Possible Annotation concerning the "Data uploaded on RTBfoods platform":

The data uploaded on the RTBfoods platform is largely complete for Gendered Food Mapping (Step 2). In total, datasets, field notes and consent forms have been received and uploaded for 11 products: boiled and pounded yam (Bowen); boiled and bounded yam (NRCRI); Gari/Eba (IITA); Gari/Eba (NRCRI); Fufu (NRCRI); Matooke (NARL/Bioversity); boiled sweetpotato (CIP); boiled yam (UAC/FSA); boiled plantain (CARBAP); Gari (ENSAI); fried plantain (IITA). However, we are missing single items for four products: notes from boiled cassava (NaCRRI), one region from Attiéké (CNRA), database on boiled cassava (UAC-FSA) and fried sweetpotato (CIP). We hope to have this completed in period 4.

*Narrative on Key Scientific findings from Step 2 (for teams who have not yet delivered in Period 2) disaggregated **by Country x Product Profile** - Mention Specific Challenges faced by the team if any (e.g. methodological, scientific). [± 15 lines by Product Profile x Country]*

NRCRI in Nigeria on Gari-Eba

Differences among communities were found to be along lines of ethnicity, migration status and wealth category, and influenced farming practices and roles in the cassava/gari value chain. Cassava was ranked as the most important crop for both men and women due to its role as a food staple and means of income. Poorer people, predominately women and female headed households, had smaller and poorer quality land. This means that agronomic characteristics such as quick maturity, minimal labour requirements, and the ability of the crop to thrive in intercropping conditions (maize, okra, vegetables, melon) without fertiliser, will be important. In terms of planting techniques, men and women plant their crops on mounds and ridges because it yields more crops and eases weeding. In some areas only men planted on ridges as they could afford the labour. Other communities had "soft" land where ridges and mounds were not possible to make.

Local varieties were ranked as the most important cassava varieties (in general) for men and women. Daberechi is and Durungwo (yield) (both local) in Uzoagba and Ihitte Uboma, respectively, were the most important varieties for both men and women. However, in Akwakuma, Nwanyiocha (local) was the most important for women (best for gari, high gari yield, best white colour, rises well), whereas Imo-best (released) was ranked the best for men (good yield, good gari, does well in all soils and early maturing). In 2 communities, only women could provide names of cassava varieties. The best varieties for gari/eba, among a small sample of women were: Imobest, Aguoegbulem, Daberechi, Yellow Root, Nwanyi Umuahia, Durungwo, among others. All women accessed planting material from neighbours, and the most significant source for men was the ADP.

There were variations in gari processing at peeling and fermenting stages. Processors cited a number of important traits in raw cassava for a high quality gari/eba: "big roots", "moisture on the peel" and "very fresh". Good processability of a raw cassava root for gari was assessed when: peeling- dry although not too dry, grating- less water, toasting- moderate temperature, easy to peel, strong peel and little chaff after grating. Examples of high quality gari are: attractive yellow or white colour, crispy, well dried and moderate size particles, doesn't clog or clump together, sour taste, clean.

All people are said to consume gari daily, regardless of wealth, gender and age, and demand is increasing with population growth. Individual consumers are the largest consumer segment, followed by restaurants. Dryness, non-powdery, swelling ability and odourless (eba) are the preferred attributes for gari consumers. There are three types of gari: yellow, white and sour. Consumers prefer sour gari because it has very little starch, and generally men were found to prefer the yellow, and women the white. The most preferred characteristics are drawability, swellingability, and odourless.

IITA in Nigeria on Gari-Eba

A major breeding trait that was identified and might not receive attention is the 'stem longevity' and stem quality (related to good sprouting). Early maturity is also a trait that had major importance and that also came up in earlier studies. Furthermore, the branching habit of cassava is associated with high yield and good canopy cover, the latter reducing weeding activities. This trait importantly sets apart the product profile for large scale mechanized farming (for which branching is a limited factor) from smaller and medium scale farming using predominantly manual labour. Given the importance of intercropping in many of the smallholder and medium scale farming contexts non branching varieties still might find their niche but the widespread preference for branching varieties to reduce weeding work indicates its importance. Although some people indicate that too large roots are difficult to handle in hand, the individual interviews all mention large roots as preference.

Processors process cassava into two major food products: gari, akpu/fufu. It is therefore unlikely that varieties that only well suit one product will be adopted. A focus on gari should therefore also include the evaluation of akpu/fufu.Results importantly indicate also that colour related issues such as 'discoloration during processing', 'the eba holding its shape (cohesiveness, that it does not sack out)', 'easy water release during processing (which might only be partially related to dry matter content)' as well as woody filament (crude fiber) related issues should be addressed with priority. Five important characteristics of gari are: dense/heavy gari; bright or attractive color; level of sourness; level of dryness; smoothness (homogenous size of gari "grains" and fine but still substantial size of gari "grains"), and limited amount of woody filaments. High quality gariis sold for higher price. Across regions/states eba varies in terms of drawability, softness and sourness. However, the preferred characteristics are: good swelling of gari when making eba; mouldability / firmness (should be cohesive and not stick to the hand); softness; drawing (elasticity), and smooth eba (particles of gari nicely merged).

Mechanization of some farming and processing activities, establishment of more and healthier gari processing centres channelling away the smoke during toasting or toasting units based on other more environmental and health friendly energy sources would highly improve the processing working conditions of women. Furthermore, stable power/electricity, ready profitable market and a stable price system are factors that can increase income for users as well as the demand and consumption of gari for the next ten years. Most women who have a large role in drudgery involving processing activities such as peeling and sieving indicate the need for mechanisation and indicate that they will have more time for good marketing strategies and better-quality control, if processing centres can offer such services. This indicates that more mechanized processing will not deprive women from their employment. However, the results show that in most cases women discuss with their husband on how profits are spent meaning that especially in larger scale automated processing factories the role of women as processing and marketing custodians might be taken over by men. The promotion of smaller mechanisation units to add to the existing processing centres (e.g. peeling services) can reduce drudgery and unhealthy working conditions at smaller scale while still keeping existing local smaller and medium scale institutions intact. This can be part of promoting a bottom-up approach to mechanisation.

NaCRRI in Uganda on Boiled Cassava

Cassava is grown by all wealth categories and men and women, but in different ways, and thus likely to influence breeding priorities and/or distribution of new varieties. People who are poor, who were noted to be predominately women and heads of household, cultivated small land sizes on marginal soils. They practiced intercropping to maximise food output, often with beans and maize. They have few livestock to access fertiliser. It is important that new cassava varieties can thrive in these low-input conditions. Men (in general), and wealthier farmers, typically monocrop during the dry seasons, while they practice intercropping typically with beans during the rainy season. Common practice is farming on sharedplots, therefore varieties will need to meet multiple use requirements, and cassava used for a numerous number of products.

The most common and preferred varieties from the two regions (Apac and Luwero) for both men and women were:Nase 14, Bao, and NAROCASS 1. Overall, for both sexes and regions, local landraces were preferred due to their inherent preferred attributes: sweet taste, easy to peel, cook fast and soft after boiling, produce white boiled roots, have large roots, all coupled with stable texture and physiology irrespective of environmental changes. Farmers also liked released varieties but not to consume.In Apac, local variety Bao was the most preferred for both men and women owing to its superior attributes tagged to boiled cassava. In Luwero, Nankinga also referred to as NASE 14 (officially released variety) ranked the best owing to early maturing. Another released variety NAROCASS1 was equally popular among women because it was good for making local brew and has high yields (these remarks were also observed in Apac). Constraints associated with use of released varieties were limited availability, high cost of seed (stem cuttings) purchase, disease susceptibility, short in-ground storability, bitterness especially during dry season.

Both men and women indicated that softness of boiled roots and in-ground storability in addition to high fresh yield, non-bitter roots, disease resistance, early maturity and drought resistance are the predominant attributes preferred by end users. The most undesirable attributes of boiled cassava roots included: bitterness, hardness, fibrousness, disease susceptibility, yellow root colour, tasteless and watery boiled cassava. Differences in cassava processing techniques were noted between the districts.

Cassava root quality attributes preferred by traders included: big and slender roots, pink outer skin colour, soft, sweet and non-fibrous roots when chewed, roots with white flesh, and easy to peel roots. It suffices to note that some people preferred pink skin while others preferred white. Women resident in urban areas were ranked as the main buyers of cassava, as they are less likely to grow it. Purchases by restaurants were also high. Overall, highest sales were recorded in Apac district. The quantity of cassava roots traded varied between seasons. For example, on Apac, trade was highest during festive and/or wet seasons. On the contrary, sales were low during planting seasons owing availability of alternative staple crops e.g., matooke.

NARL/Bioversity in Uganda on Matooke

Banana was ranked as the most important crop in each of the focus groups, irrespective of gender or region, due to its importance for food security, as matooke is a staple food in the study areas, and income generation. Each wealth category, even the poor, had access to a banana plantation. Differences in the quality of soil and farm management practices among the wealth categories therefore may have trait implications for breeders. The majority of farm plots are shared, and there is variance in practices between communities of what tasks men and women do.

Farmers in both districts prefer and grow local landraces. There are slight differences in the cultivars grown in the 2 districts and the rankings, for example Mpologoma is only prevalent in Nakaseke, whilst Enyeru seems to be more prevalent in Mbarara. In Mbarara, women ranked Nakitembe as the best variety and men ranked Kibuzi. Overall, in both regions, Nakitembe was the preferred variety due to its high yield, quick maturity, and production of medium to big sized bunches, big fingers, and good, soft, tasty food. Close to three quarters of farmers indicated that they source banana planting material from their own farm, a small percentage sourced from Government initiated programs such as NAADS. Interesting, a higher proportion of women purchased varieties compared to men.

The main characteristics that were found to drive variety preferences were agronomic (big bunch, big fruits) and quality (soft texture, good taste, good aroma, yellow food). There were minimal geographical and gender differences for trait preferences. Quality characteristics need to be defined in terms of physical–chemical underpinnings so that breeding programmes can apply accurate high-throughput systems, thereby improving adoption and impact of new banana varieties. The results show minimal differences in the preferred characteristics for men and women in the two sampled districts. Consumption related traits should be given priority in the cooking banana breeding program.

UAC-FSA/IITA in Benin on Boiled Cassava

Cassava is processed into a large range of end products with specific characteristics; and therefore, it is important that varieties are bred with the quality characteristics in relation with derivated products (e.g. gari, boiled cassava, lafun). Concerning boiled cassava, a good raw cassava for making a highquality boiled cassava was evaluated through the appearance of the peel and that of the flesh of the root, the humidity level (low moisture content) of root and the taste (no bitter) of the root flesh. As far as peel appearance is concerned, cracked and thick peel have been cited as good quality while smooth and red/dark were recognized as poor quality of cassava intended to be boiled. The white colour of the flesh was recognized as good quality characteristic for raw cassava, whereas too yellow colour is not appreciated. To a certain extent, the presence of fibres was also cited as poor quality. Quality characteristics of the final product – boiled cassava – can be grouped into four categories including appearance, texture (crumbliness/friability), odour and taste. Accordingly, all

socio-demographic consumer groups like the sugary taste, the crumbly texture and the white color of the flesh, irrespective of age, gender and marital status.

New varieties should include farming characteristics such as the ability to thrive in mixed-cropped farms, unfallowed lands, and poor, stoney and dry soils where crop spacing can be minimal. A medium sized root (easy to transport, including on bicycles) with short maturity duration is in high demand. These characteristics are particularly important for poor women who often prepare and sell the crop.Men and women agreed on the quality of the two best varieties for boiled cassava (Agric and Dossi) in Dangbo, while, Kpèkè and Attinwéwé were considered to be the best varieties in Bonou district. When breeders are selecting varities for their trials, it is hopeful to consider the four aforementioned varieties.

Other important findings are that farming practices are different by district, which could affect production; in one district: weeding (clear stumps), plowing, ridging, fertilizer application (spreading), plant cassava cuttings (preferably in rainy season) and regular clearing to remove weeds; in another district, cassava is planted by making the ridges and planting the cuttings without clearing and spreading of fertilizers. Cassava is processed to a range of products, and therefore it is important that varieties are bred with the quality characteristics of other important cassava products (e.g. gari) in mind. Men and women were found to agree and prioritise the same quality characteristics for the product, from raw to final stages. However, there were some characteristics only raised by men. There were differences by district, both in terms of the quality characteristics cited, their prioritisation and preferred varieties. This will need to be taken into account for breeders when designing a variety for multiple areas.

NRCRI in Nigeria on Pounded Yam

It was observed that social segments, wealth categories and livelihood activities played important roles in the life of the respondents that affected their farming practices and gender. Yam is the most important crop in the region, this might be because of the social value attached to it as the king of all crops. It is one of the major staple food and a very good source of income to the rural farmers, Yam is valued high in eastern region of Nigeria because it is usually celebrated around August to September (New yam festival) before it is moved to the market for sale. It is normally used for different social events like traditional marriage, thanksgiving in Church and also as a gift to important visitor. It has high market value. This was followed by other food crops which were seen as female crops. Most of the activities in yam production were done by men ranging from bush clearing, land preparation, planting, staking, harvesting and as well tying in the barn while the women help in other agronomic practices like weeding, gathering the yam after harvest ready for tying in the barn etc.

Among men and women gender groups in Onueke and Abakaliki communities, they ranked Igum (early maturing, sweet, big size and high yielding) as first and best yam variety same is applicable in Ezzangbo and Ishiagu communities that ranked Utsekpe and Jiigwe respectively by both gender groups. In Ezzangbo, Obela was ranked second by both gender groups and Ogomodo third by both gender groups. In Ishiagu, Obiaoturugo is ranked second by female gender group but was ranked third by male gender group. Igum was rated last by female groups in Ishiagu and Mbana last by male group in Ishiagu community. On the other hand in the male group discussion in Onueke Ezzah said they like planting Igum because it is poundable, has sweet taste, white in colour used for thanksgiving ceremonies, and marriages. In Umuebe community, the males show that Utsekpe is early maturing variety (6 months) and sweet also, it is good for pounding. However, it was discovered that both men and women in all the communities studied plant more of the local varieties.It was observed from the responses that majority of the farmers bought their planting materials from the market. About 37 % of the male farmers got from their father.

The study conducted in the selected communities revealed that big sized tubers are important for processors and consumers (because they prefer heavy tubers for pounded yam). Other major important agronomic breeding traits were; “smooth skin, White coloured skin, Fresh skin and Round and sturdy” (related to quality product). Most importantly, there was indication that colour related

issues such as 'yellow tint', Lines on the skin, Dark Colour on the head, Rough body, and Spots on the head, are related issues to be addressed with utmost priority according to the processors.

NRCRI in Nigeria on Boiled Yam

Farming is the major livelihood activity for all the communities studied (male and female). They are mainly engaged in the production of food crops like cassava, cocoyam, potato, rice, tomato, pepper, vegetables, cucumber, yam, etc. that provides food for the family and serves as source of income for their livelihood. In addition to food crops, Obinagu Ishiagu women indicated that they were also known for other things for sustainability such as: pottery, blacksmithing, mining of stones and excavation of soil to get lead as their source of livelihood. However, the eight communities studied also boil yam both for market and home consumption to meet up with other household requirements.

The results show that the respondents were predominantly Indigenes. It also identified three wealth categories - Poor, Moderate and very wealthy farmers. The majority of the farmers in each of these communities were made up of Indigenes, poor, moderately wealthy and very wealthy except for Onueke-Ezza which revealed less number of poor farmers (3%) with the rate of boiled yam consumption as 45%.

A lot of gender roles in farm practices were observed in the study area. Men in Onueke, Ezzah South Lga identified Land clearing, weeding, gathering as the role played by women except for gathering of yam seeds that children are involved, while burning of trashes, land preparation, preparation of sets, planting, staking of yam, earthening up are roles done by men. Men in Amagu Community indicated weeding, gathering the yams, packing the yams to the barn as mainly roles of the women. The men focus more on land preparation, planting, staking, earthening up, harvesting, except land clearing that is done by both male and female. However, majority of the activities are done by the male farmers. The respondents stated lack of awareness and non-performance of the new varieties as the factors that limit the communities under study from using improved yam variety.

However, there are similarities among the different communities under study as their important characteristics of focus for boiled yam for both raw materials, processing and final product includes: Smooth skin, big sized tuber, matured yam, bright colour (white or yellow), moderately soft, pleasant aroma and sweet taste. Apart from Amagu and Umuebe Ezzamgbo community men that indicated there are no different types of processing, others noted variations exist, yam could be boiled before removing the peel. Mostly in boiled yam, you wash, slice, boil, peel and then eat.

The results clearly showed communities and varieties of yam planted in order of preference. Among both men and women gender groups in Onueke, Ezzah community, they ranked Igum as first, same is applicable in Umuebe Community Ezzamgbo and Umuebe Izzamgbo, Ohaukwu where both gender groups ranked Utsekpe as the best, this result agreed with the individual interview that indicated Utsekpe variety as very prominent in Umuebe community. In Obinagu Ishiagu community, both women and Men's group ranked Ji Igwe as the best variety.

NRCRI in Nigeria on Fufu

Farming was the major livelihood activity for all the communities in the sample. They specialized in the production of mainly food crops like cassava, plantain, maize, yam, vegetables, and oil palm that provides them with food for the family and serves as a source of income for their livelihood. However, men in Umundugba and Ihitte Uboma in Imo State reported fishery and other livestock like poultry, sheep, and goat production as an additional means of livelihood activities they are involved in. Women group in Umundugba reported that cassava and other food crops are majorly produced by women while men specialize in yam production. The six communities studied intercrop Cassava with other crops and also process their cassava into fufu and sell to meet up with other household needs of the family. Very few people in Uzoagba, Okwuta Isieke are involved in trading, artisans, and other craft by both men and women groups.

There are two levels of farmers: (i) those that cultivate for home/family consumption and (ii) those that cultivate for home use and also for commercial purposes. There are rich and poor farmers. The poor farmers are those in the second level which are people that farm and sell to the market, they are not rich but they have enough to pay for their children's school fees, solve other problems like buying of rice and beans to eat, they will not have enough to build a house while wealthy farmers, can afford to buy enough, at least a bag of fertilizer, to farm on a large expanse of land. They also have enough money to take care of their family and also help others.

It was discovered that both gender groups (men and women)farmers in various community mainly plant their crops on mounds and ridges because it yields more crops and ease weeding unlike planting on flat land, it was reported in women FGD Umundugba that why some people plant on flat is because some areas are very soft that cannot permit any form of land preparation, also, most communities practice intercropping mainly peasant farmers because they do not have enough land, rotational cropping and shifting cultivation is practiced by female farmers in Ihitte Uboma, Ameke Afarata and Okwuta Isieke that have enough land. It was also discovered that some crops like cassava, rice and yam are planted sole in Men FGD in Ihitte Uboma. Even though that men and women perform most activities in the farm together, Men are mostly involved in land preparation activities like bush clearing, ploughing, harrowing and ridging / mound making while women are mostly involved in planting, maintenance of the farm like fertilizer application and harvesting.

Local varieties were ranked as the most important cassava varieties (in general) for men and women in the study area except for Agric and Nwabibi that were ranked first and second by both Men and women in Okwuta Isieke. Daberechi a local variety is most prominent in Uzoagba community, it ranked first in both gender groups, and Nwayiocha came first position in Akwakuma community. Imobest is an improved variety that is very prominent in Umundugba community, it took the first position, Durungwo came out the best in Ihitte Uboma by both men and women gender groups while Maduabuchi and Ogwuruego were the best varieties in Ameke Afarata community, by female and male farmers, and the most significant source of these varieties is Imo ADP.

There are variations in the processing of the product among the communities in the study areas, the result shows that Men in Imo state were not so knowledgeable about the processing method so they referred back to the women while the women said they use the pounding method although some of them use the stirring method but exclusively used by women that were married into their community. The common form of processing fufu is by pounding not turning. For fufu processing -2 variations exist; either you soak for fermentation with or without the peel. Most of the other variations are more knowledgeable to women While in Abia state, the result shows that both men and women said they use the stirring method which is the traditional method used within the communities however they said that the pounding method gives smoother fufu than the stirring method.

The evaluation of the preferred quality characteristics that drive the purchase and utilization of fresh cassava roots for *fufu* processing within the study area. The results show divergent views in choice of trait preferences among the male and female participants. Four root quality attributes were identified as the main traits of preference, and they include root size (moderately-sized roots equivalent to 1 litre capacity bottled water in diameter), the heaviness of the root (weight/density of root when held by the hand), appearance/smoothness of root skin (dark coloured peel and roots without rough/wrinkle skin), and colour of root flesh (white coloured root flesh; without dark discoloration. Neatness, white colour fufu, easy to form dough, drawability and not sticking to the hand are the preferred attributes for fufu consumers in the study area.

IITA in Nigeria on Fried Plantain-Dodo

The report presents the findings of a gendered product mapping (Step 2) of plantain products in Nigeria, conducted based on surveys in 12 rural communities in Osun in Nigeria's South west, in Delta and Rivers in Nigeria's South South, and across major urban centres and secondary towns.

Plantain is an important food security crop for farming households in Nigeria, but little is known about the main food products of plantain across regions in Nigeria. This report presents the findings of the relative importance of plantain food products in the sampled states, while identifying the quality characteristics along the food chain by different stakeholders.

It was found that farming practices vary across the study locations, influenced by household composition, ethnicity and migrant status. Dodo (fried plantains), boli (roasted plantains), boiled plantain, plantain with beans and porridge were the most common food products identified in the study areas. Fruit size, pulp texture (firmness/softness), colour, maturity stage and taste were identified as the most critical characteristics, with impact on quality of processed food products. Although there were significant differences between states regarding the importance of plantain food products, little interstate and gender differences were found for fresh fruit and food product quality characteristics.

In the following chapters, the report describes the socio-economic context of plantain production, product preferences, varieties and important characteristics of the crop, product processing and characteristics, and marketing of plantain in Nigeria.

CNRA in Côte d'Ivoire on Attiéké

The study was carried out in central and southern Côte d'Ivoire, which are major production regions of cassava and attiéké in the country. The population in these two regions largely consist of the Akan ethnic group; however, the group is composed of many different clans and customary systems. Agriculture is the main activity in both regions and cassava was considered as the most important crop in both areas according to focus group discussions (FDGs), regardless of ethnicity and gender, because it contributes to food security and is a source of income for the people. Cassava and attiéké production activities, for the most part, are generally inclusive which also means that breeding objectives should consider the range of preferences among these groups. The crop is also processed into a number of dishes, with attiéké being one of the more important dishes and which has experienced increasing demand according to interviews with processors and traders over the past ten years.

Production of cassava was considered by respondents to be increasing in the two regions, and the majority of farmers were found to sell the majority of their cassava. Monocropping cassava and planting in mounds is the main cropping system in the South, whereas intercropping yam, cassava, and vegetables and planting in mounds is the common practice in the Centre. Men and women typically farm on separate plots, but both produce cassava, and women partake in most tasks regarding cassava processing and selling. Women have significant independence in making decisions on their plots, but often require consultation with their spouse. Few areas found different farming practices between men and women. However, there were differences in general roles with specific farm tasks, which may impact of particular crop traits on men and women e.g. large canopy with weed reduction would have a positive impact on women's time. Processing activities are mainly performed by women, except for pressing and grinding, which were done by men. Interestingly, pressing and grinding were both raised as constraints for women, which is likely because they depend on other people and funds to perform.

The most popular varieties in the South for processing attiéké are, in order of importance: Yacé and Essakpl, and in the Center, Agbalé, Yavo and Yacé. There were no gender differences in varietal preferences but women mentioned a slightly higher number of varieties compared to men (23 and 20, respectively). The most highly cited reason why a variety was considered good was because it made a good attiéké, followed by placali, another cassava-based product. The most important characteristic of cassava among men and women's FGDs were 'lots of roots', followed by 'big roots'. Interestingly, only a women's FDG mentioned 'white flesh', 'early maturity' and 'green foliage' and only a men's FGDs mentioned 'does everything' (meaning, multiple products) and 'big stems'. The quality that cassava is considered versatile and could be processed into many different products. This finding is important for breeders to consider, when there may be a drive to make product-specific

varieties. High quality characteristics of cassava used for attiéké are white flesh, hard, not containing a lot of water, and minimal amount of fiber. A high quality attiéké has a slightly sweet taste, not sour and the granules are very round, hard, and not sticky. It will be important that cassava breeding initiatives verify quality characteristics among different ethnic groups such as those mentioned above to ensure suitability across ethnicity.

According to interviews with market women selling attiéké, cassava supply mostly comes from the Center region. Abidjan is supplied with attiéké from nearby areas of Dabou, Aboisso, Bonoua, Bingerville, along with the Center region, showing a significant level of demand from the urban centre. There is significant levels of consumption in rural areas. Marketing of attiéké is dominated by women in all regions, and women have decision making control over the income from selling, but also required consultation and agreement with their husband. For this reason, assumptions around profits going to the direct benefit of women is not entirely supported. According to retailers, in rural areas, adults and elders want attiéké that is not sour and has visible granules. Traders mentioned the same cassava varieties as women processers as being high quality for attiéké.

Essential characteristics for the product profile are: raw material: White flesh, hard flesh, white skin, cassava with less water, striated skin; processing: hard flesh, crushed pulp with less water, 3 days ferment, cassava easily peeled, dry flesh; final product: slightly sweet attiéké, non-sticky Attiéké, no sour taste, hard granules, round granules. There were no gender differences but some slight variations for region. Easy to peel and minimal fiber will reduce women's labour spend peeling and sorting/winnowing, respectively.

Bowen University in Nigeria on Pounded Yam

Yams are starchy tubers produced by about 600 known Dioscorea species (Obidiegwu and Akpabio, 2017). Yam is processed into a large range of end products with specific characteristics; and therefore it is important that varieties are bred with the quality characteristics in relation to the derived products (e.g. boiled yam, yam flour, fried yam and pounded yam). With respect to pounded yam, yams that will make good quality pounded yam were evaluated through the physical appearance of the yam (such as having regular shape, having spikes on the skin), no colour change when peeled, low moisture content among others. The white colour of the flesh was recognized as good quality characteristic for raw yam and the white colour should be retained throughout all the processing stages. Quality characteristics of the final product – pounded yam – can be grouped into four categories including appearance (colour), textural quality (hardness, mouldability, stickiness, smoothness, stretchability), odour and taste. In terms of appearance good quality pounded yam should have pure white colour (except if it is yellow yam) which makes it more appealing to the eye. The important textural characteristics for good pounded yam is that it should give a dough that is stretchable, mouldable and smooth (without lumps). The preferred pounded yam must also have good taste and aroma. It is therefore desirable for breeders to inculcate these attributes when trying to develop yam varieties for yam farmers, processors and all other relevant stakeholders. The preferred traits would be linked with biophysical and functional properties of yam tuber in order to provide breeders with criteria for high throughput screening.

CIP in Uganda on Boiled Potato

There are a number of important potato products in the study area of Kabale and Rakai, including boiled, baked/roasted. Ware and seed potato are also important types of potatoes sold and consumed. Lightly fried potato, deep fried, and potato crisps. It is also used as animal feed. FGD facilitators asked men and women farmers to list their most preferred traits. While initial analysis shows that women prefer big sized tubers, bright and shiny skin, nice buds and eyes, mature potato and red skin and yellow flesh, men prefer a wider range of characteristics although they mostly mentioned big size tuber, pest and disease resistance, drought tolerance and early maturity. Restaurant owners (n=19) preferred the following traits: Faster cooking, easiness of cooking, not needing too much oil, firm when boiled, High dry matter/Mealy/Not watery, High market demand, not mushy, medium size and oval shape.

Big sized potatoes saved women labour in terms of peeling, while disease tolerance reduced women's labour demands related to spraying fungicides. Many of the preferred traits are related to market demand but have no direct observable impact on women. For example, women's ability to benefit from any of the marketable traits depend on household and community dynamics. For instance, decision making was not linked to traits but the social-cultural configurations of the society.

Deo deo, Rwangume, Victoria, Kiningye, Kachpot 1, Rutuku, NAROPOT 1 potato were varieties were mentioned in FGDs as addressing some of the key trait preferences by men and women farmers. There was no significant difference between men and women with regards to varieties which they cultivated or regarded as important. Initial data analysis of the survey instrument shows that the most common varieties cultivated by both men and women are Deo deo, Naropot 4 (Rwangume) and Kinigi.

For selecting potatoes on the market, both men and women preferred big size tubers, potatoes that are firm when touched, are not damaged and have smooth skin. In the market, men and women stated that they could identify potatoes that are bad for boiling quite easily because these potatoes are damaged, dead buds or eyes oozing of a milky substance, and bad smell. When it came to marketed potatoes 61.2% of women and 77% of men showed a preference for big size tubers.

3.3 Participatory processing diagnosis with processors (Step 3)

*Narrative on Key Scientific Findings from Step 3 in Period 3 disaggregated **by Country x Product Profile** - Mention Specific Challenges faced by the team if any (e.g. methodological, scientific).*

[± 15 lines by Product Profile x Country]

NRCRI in Nigeria on Boiled & Pounded Yam

Summary based on advanced version of the report

Boiled Yam:

1. Quality characteristic and major findings at raw material level

The skin of a good yam is ash in colour and matured when you touch it. The tuber should be heavy as stone (it should have weight of six inches solid block), if it is light in weight, you know that it is rotten; it should also have a smooth skin, short and brown thread like lines on its body and the shape must be “stout” with white or yellow colour. The flesh should be white when you brake it into two, and been fresh.

2. Quality characteristic and major findings at processing level:

The skin should be fresh (not burnt), It should have no spot or beetle attack, fresh and not decayed or rotten. It should be easy to peel but not too much, it should be a little bit strong to peel, with a minimum of peel loses and when cut it should be whitish or a little yellow. During peeling and washing, the yam will be clean and neat with no spots of any disease. After washing the colour should stay white or a little yellow.

The yam should be bringing out foams during cooking to show that the yam is a good one.

3. Quality characteristics and major findings at final product level:

The colour should still be white after cooking, with a bright colour. The texture of the boiled yam should be soft to touch and soft to be eaten, heavy in the mouth but not too strong, smooth in mouth, does not stick to hand. It should have a pleasant fresh yam aroma, with a sweet taste.The goo yam is the one that “stays long in body after eating”. If cooked with the peel, it should be easy to peel.

Pounded Yam:

1. Quality characteristic and major findings at raw material level:

The tuber should be very big, very long but stout in shape, with a big head, a weight like six inches block. The skin should be brown in color (even if depending of the soil characteristics), fresh, without any rot or black spots on it. The skin will be smooth and soft with no abrasion or bruises.

2. Quality characteristic and major findings at processinglevel:

The tuber should be easy to peel. The flesh should be smooth, with a white and bright, easy to cut without lumps. The odour should be no offensive colour. It should be easy to pound and the dough should be soft (for those that love soft dough) and moderate (not soft and not too hard) for those that do not take soft dough.

3. Quality characteristics and major findings at final product level:

The dough should draws well, be smooth, easy to eat and have a pleasant aroma. The colour should be milk colour and be very neat in the eye. It should not be scattering, not be sticky to hand or in mooth, without lumps. It should have no offensive odour when perceived.

NRCRI in Nigeria on Gari-Eba

Report finalized.

1. Quality characteristic and major findings at raw material level:

The cassava root should be mature, have weight, presence of fresh sap on the root, no brown colour nor traces of diseases on the skin. The colour of the peel should be dark brown, the peel should be strong and hard and no odour should be perceived from the root.By looking and touching the cropthe cassava roots must be numerous, with a long shape, fresh, strong when pierced with nails and root should have a whitish or yellowish colour inside when broken into two. The cassava roothas to look dry and shouldn’t be decayed.

2. Quality characteristic and major findings at processing level:

The cassava should be easy to peel, not been watery, very strong on hand and should not be foamy(burnt) (as a result of bush burning). During washing, the root should not float in water which traducing a high dry matter content, the colour should be white and yellow and been neat at the end of the operation. After rasping the flesh should not contain too much chaff.

3. Quality characteristics and major findings at FINAL PRODUCT level:

The gari appearance should be good with bright colour and also neat, it should not look burnt and dirty. The gari should be sharp to touch, crispy, not dusty and must be dry (if you squeeze it, it will spread on you palms). The obtained Eba should be sour, have a good gari smell, doesn’t stick to hand and should draws.

NRCRI in Nigeria on Fufu

Report finalized.

1. Quality characteristic and major findings at raw material level

The cassava root that should be used for fufu must be fresh to be able to give good fufu, suppose not to be over matured (at least not more than 12 months old) if it's over mature, it will not draw. By looking and touching the crop and it must have the following characteristics: the roots must be numerous in number, big, stout or sturdy in shape, strong when pierced with nails, have weight when weighed with hand and have a whitish color inside when broken in two. The crop must not be foamy when its touched. It must have dark skinned peel and brings out whitish fluid on its head and the skin must be smooth. There should be no rotten smell but it must smell fresh.

2. Quality characteristic and major findings at processing level:

The fufu processing need cassava roots that can ferment fast. They also should have a skin easy to peel (soft peel) and that is a bit yellow inside in order to makes more fufu after processing. It should not discolour after peeling, and shouldn't have a woody texture (fibers). During washing the body should not be slimy like a snail. During fermentation the softening of the roots should not exceed four days. During fermentation it should not float in water; If the root floats in water during washing, the cassava will be foamy and will not give good yield in fufu.

The cassava flesh should be good and white in color without any spot or rot, when soaked it should produce enough bubbles (a sign of fermentation) to show that the cassava is a good one. When sieving it, it should draw a little like pap, this will help it to get done quickly the drawing ability should help to be done. The texture after grinding (it should be free of any lumps or chaff).

During cooking the fufu should not disintegrating into fragments and stay together without scattering. It should draw gradually as the operator pound; this indicate that it will be good after pounding step. During this step the fufu should be swelling as the operator add water to it, and draw while stirring without lumps.

3. Quality characteristics and major findings at final product:

The fufu should be smooth and neat with a good fufu smell and have a pure white colour. It should also be soft in the mouth. In term of texture the fufu should draw enough.

IITA in Nigeria on Gari-Eba

Report finalized.

Elicited important characteristics of fresh roots were: root weight (29%), root size (26%), quality and quantity of products that can derived from the roots (23%), less water in the root pulp (14%), root colour (9%),

Elicited important gari qualities were: granule size (24%), weight/density (16%), colour (16%), taste (14%), well-cooked (14%), loose on fingers (11%) and crunchiness (5%)

Elicited important eba qualities were: smoothness (24%), moldability (18%), drawability (18%), taste (9%), easy to swallow (9%), softness (3%) and moderately hard (3%) were eba qualities identified.

The local varieties in both Benue and Osun state were rated as the best but portrayed the highest weight of chaff to be removed per unit of fresh roots. An improved variety TMS14F1278P0003 also

had relatively high chaff weight but was nevertheless very well appreciated by the processors and consistently ranked second for gari quality and ranked first during the pretest.

The improved variety 14F1022P0003 provided the highest product (gari) yield but was clearly rated lowest for gari quality (in the pretest and final testing) mainly because of dull appearance/colour, stressing the importance of colour/appearance.

As expected, the biofortified low dry matter cassava variety IITA-IBA011412 provided the lowest product yield and by far the longest peeling time due to irregular root shape (water content was high so should have provided shorter peeling time) and was not well appreciated in Osun state while its gari was better appreciated in Benue (where people are more used to yellow gari) although it got remarks that it was powdery and light in hand.

The good gari and eba quality evaluated earlier at the breeding unit for variety TMS14F1195P0005 (reason why the variety was included in the pretest) appeared to be the worst variety when evaluated during the pretest in this study. This urges for good realistic protocols on food product quality assessment.

Bowen Univ. in Nigeria on Pounded Yam

1. *Summary based on advanced version of the report* Quality characteristic and major findings at raw material level:

Quality expected in the raw material as indicated by the processors: white fleshed yam, without colour change when it is being peeled; Appearance of tuber should :i) not be too hairy tuber, some processors prefers the ones with smooth appealing peel/ dark coloured skin, ii) straight shaped tubers for ease of peeling, iii) processors prefer yam tuber to be long, rotund and not too big, with low water content.

Thus, maturity, time of harvest, length of storage and morphology as well as the variety of a yam tuber contributes also to the quality of pounded yam.

2. Quality characteristic and major findings at processing level:

- Peeling: The variance in the peeling yield could be attributed to shape, postharvest storage/handling. The peeling time can affect the colour of the resultant pounded yam because if the yam changes colour during peeling it may reduce the preference of the pounded yam by consumers due to the length of exposure. Improper peeling can affect smoothness of pounded yam, sharpness of the knife used can also affect the peeling time.
- Washing: Processors prefer less cloudy wash water
- Cooking time:it was observed that the energy source for the cooking either (wood or gas) can affect the cooking time by increasing length of time to cook the yam and this may eventually affect the quality of the pounded yam because the pounded yam may absorb too much water and become overcooked or soggy. Thus, the pounded yam will be too soft and unacceptable by the consumers.
- Pounding: Ease of pounding of the pounded yam was described as ability of the boiled tuber to form a dough easily and not running around in the mortal. The quality of the pounded yam can also be affected by the strength of the process intensity of pounding applied and how fast the processor can be. Some varieties became too soft, not mouldable, less sticky no matter how hard it is pounded because of their inherent characteristics. During pounding, little or no water is added as well. Some processors use the cooking water to pound while most others simply use cold water. The use of cold water to pound the yam is believed to make the pounded yam keep longer (lower rate of retrogradation) before it begins to ferment or get spoilt. This is because the customers do not come to the canteen at the same time to buy pounded yam. Most processors do not like the yam in mortal to become sticky or gummy

from the onset of pounding as this makes it lumpy. This is part of the reason why some yam varieties are said not to be good for pounding but best as boiled yam. When water is added to pounding mash before it forms a glutinous dough, it produces a poor quality pounded yam.

3. Quality characteristics and major findings at final product:

The pounded yam should have a white, butter and light colour avoiding darkish aspects. The texture should be smooth, stretchable, a little bit soft (not too much) sufficiently sticky in order to be mouldable. It should not be sticky to the hand or too hard or too soft and no get lumpy. The taste of the pounded yam should be sweet and without bland or bitter taste.

The food quality attributes of pounded yam from other wise non-preferred varieties changes and become accepted by the consumers due to biochemical changes in the yam tuber during storage.

NaCRRI in Uganda on Boiled Cassava

Report finalized.

Profile was made on processing of cassava root into the boiled product in Apac and Luweero districts in Uganda. The main processing steps in both locations are; peeling, trimming and steaming. There is variation in processing cassava roots after trimming by and within location. Accordingly, cassava slices in Luweero are wrapped in banana leaves and steamed while in Apac, slices are immersed in water and boiled. Moreover, some consumers in Apac eat boiled slices of cassava while others pound the slices into a mash before eating.

There were no significant differences between genotypes for yield during processing. However, varieties such as Alanyo dyer and Nase13 which are susceptible to CBSD had low yield after processing. Preferred end-user traits during processing cassava roots in Apac are; white flesh colour, ease of peeling and firm root. On the other hand, least preferred characteristics were hard to peel, spongy in the middle, and roots which do not cook easily. Similarly, in Luweero the desirable end-user processing traits include; easy to peel, white flesh colour, no fibres on the surface of peeled root, a non-lignified/woody, no bitter taste, smooth root surface, has a firm flesh. The undesirable end-user processing traits include; lignified/woody root and spongy in the middle.

NARL/Bioversity in Uganda on Matooke

Summary based on advanced version of the report

Participatory demonstrations and consultations were done with eight ‘semi-commercial’ women processors (4 in Nakaseke, 4 in Mbarara districts) to collect their opinion on the quality characteristics of 4 varieties at the different preparation steps for steamed-mashed matooke. Each processor prepared the following varieties: (Nakaseke: Nakitembe, Mpologoma, M30 and NARITA 21; Mbarara: Nakitembe, Kibuzi, M30 and NARITA 2). Nakitembe, Mpologoma and Kibuzi are popular local cooking varieties grown in the study areas and produced for both home consumption and the market. M30 (Syn. ‘NAROBAN5’ or ‘NABIO 808) is a hybrid which was officially released in 2019. NARITA 21 and NARITA 2 are hybrid varieties that have not been officially released and are still under evaluation.

Preliminary results indicate that Mpologoma had the heaviest bunch (45kg) followed by Nakitembe (28kg). M30 had the lowest weight (19.8kg). There were significant differences in the average finger weight -in Mbarara, there were no differences for Kibuzi, Nakitembe and M30 whilst NARITA21 had significantly lower weight; in Nakaseke, there were no significant differences between M30, Nakitembe and NARITA21 whilst Mpologoma had the highest average finger weight (219g) and significantly differed from the others. There were no significant differences between the varieties in the peeling, washing wrapping, steaming, pressing, simmering, mashing and global cooking productivity. Report writing and analysis is ongoing.

CIP in Uganda on Boiled Sweetpotato

Report finalized.

1. Raw material characteristics:

In Lira, the most preferred raw sweetpotato characteristics were smooth skin, big size roots, white flesh colour and heavy in the hands. Least preferred characteristics were rough skin, too much sap, soft and watery roots. In Kamwenge, the most important characteristics of raw sweetpotato were sappy, nice skin colour (red skin colour, free of spots), hard root, firm peel and mealy. Fibrous sweetpotatoes with a bad skin colour (pale or non-uniform in colour, or with black spots) were identified as poor quality.

2. Processing and Final Product:

Preparation of sweetpotato in Lira was by boiling whereas steaming was used in Kamwenge. Good processing characteristics, in both regions, included easy to peel (firm peel, less pulp is lost), firm root, smooth peel and flesh surface while the undesirable ones were difficult to peel (soft peel, more pulp is lost in the process of peeling) and soft root. Average processing yield from peeling to boiled product for Lira varieties was 74.4% while for Kamwenge (steaming) it was 81.5%.

In Lira, preferred boiled sweetpotato descriptors were absence of sap, mealiness, sweet taste and good smell of sweetpotato. Processors here disliked boiled sweetpotatoes which were sappy, fibrous, and not sweet and did not have a characteristic smell. In Kamwenge, preferred steamed sweetpotato had a nice colour (yellow, white, whitish on the inside), was mealy, firm, had a sweet taste and good sweetpotato smell. Least preferred characteristics for steamed sweetpotatoes were; pale colour, fibrousness, not sweet and off odour.

CIP in Uganda on Boiled Potato

Report finalized.

1. Raw material characteristics:

Processors in Kabale preferred potatoes that were medium to big in size, hard, heavy with smooth red skin and firm peel. The least preferred potatoes were those that were not firm, immature, small, cracked, not round in shape; wrinkled skin which easily peeled off and soiled ‘eyes’. The most preferred characteristics by processors in Rakai were; smooth red skin, yellow flesh colour, good eyes (not oozing water) and firm skin whereas soft tuber, bad smell (diseased), oozing milky substance from the eyes, pale skin and big & deep eyes were the least preferred characteristics.

2. Processing and Final Product:

Potatoes were prepared similarly by boiling in both Kabale and Rakai. When processing, in both regions, ease of peeling (associated with ease of removing ‘eyes’), firmness and tubers which were not watery (low water content) were preferred. Potatoes which were not good for processing were; difficult to peel (deep eyes), watery and soft. Average processing yield from peeling to boiled product for Kabale varieties was 79% while for Rakai it was 68%.

In Kabale, the most preferred boiled potato characteristics were firmness, mealiness, good potato taste and smell whereas the least preferred were white colour, too soft, watery, not mealy, lacking good potato taste and smell. Processors in Rakai liked mealiness, firmness, softness and smoothness (in the mouth), good potato taste and smell. The poor characteristics were; not mealy, too soft, watery, hard, no potato taste and smell.

CIP in Nigeria & Ghana on Fried Sweetpotato

Summary based on advanced version of the report

Desirable characteristics at different processing units of the fried sweetpotato product

Characteristic	Importance
A. Characteristics of the raw sweetpotato root. Source: Champion Fryers	
Firm	The roots are usually hard to slice, an indication of low moisture content which is associated with less frying time and subsequently using less oil
Smooth skin	Makes it easy to peel i.e., in the absence of *lumps* (described as 'bumpy nature' by fryers) peeling takes less time and more slices are obtained
Regular shape	Makes it easy to peel and slice the root for frying, minimizing excess weight loss during peeling
No holes	Makes the root easier to peel and yields more slices i.e., less to discard; also an indication of no pest infestation and by inference, no rots
No off odors	An indication of no rots or pest infestation
Earliness	Ensures the crop is available at most of the times in the year; more than one harvest possible, especially in irrigated lowlands
Stores well	Reduces losses after the roots have been harvested, which ensures a longer marketing window and availability during off season
Medium-bigroot size	Important to fryers because it is easier to peel and slice (with lesser risk of injuring oneself) and yields more slices
High yield	Ensures more slices from high yielding varieties per unit of land, thus more income
B. Characteristics of the peeled, sliced and washed sweetpotato. Source: Champion Fryers	
Hard to slice	Indicates low moisture content and thus high dry matter content to give the desired end product characteristics
Does not stick to hand and not slippery	An important property during peeling and washing; further indication of low moisture content
Slices withuniformcolour	Indicates that the final product will also have a uniform colour which is attractive to consumers
Slices with no or slight surface moisture	Gives an indication of low moisture content and thus, high dry matter, making it easy to fry
Slices not too sticky	Attribute indicated as important when peeling/slicing; an indication of low moisture content and thus, high dry matter
Slices with no off odours	Important attribute particularly during processing (slicing). Indicates no rottenness and to an extent, no pest infestation or disease.
C. Characteristics of the fried sweetpotato final product.Source: Champion Fryers	
Uniform light brown (for white-fleshed); uniform yellow with a brown tint	An indication fries are cooked – well fried and crisp; gives better consumer appeal

(for yellow-fleshed); uniform orange with a brown tint (for orange-fleshed)	
Dry/filling/satisfying	A desired consumer attribute – an indication of high dry matter and to an extent, mealiness (just like yam); sometimes expressed as "Spreads in the mouth"
Hard/strong, at first bite	A desired consumer attribute which is an indication of crispness
Crispy	A desired consumer attribute
Not soggy	An indication of crispness and being "dry"
Not oily	An indication of crispness and being "dry". Such varieties do not consume too much oil
Moderatelysugary	Sugariness – has to do with the flavor and more specifically, taste: a desired consumer attribute
Slightlysugary	A segment of consumers also preferred this as observed from preferences for Obare (slight sugariness) and Kuffour (moderate sugariness)

UAC-FSA in Benin on Boiled Yam

Report finalized.

Concerning the yam tuber choice, the external morphologic observation of the phenotype of tubers together with flesh characteristics can help to predict the final quality of boiled yam. Thus, i) the tuber should preferably be cylindrical or conical, have a slightly wide head and pointed tail, ii) the skin of the tuber should be smooth, with the presence of thin lines on the peels, iii) the presence of small rootlets and sometimes the roughness buttons were also considered. The flesh colour must be preferably white or slightly yellow and her texture should have a given level of moisture and firmness.

The easiness of peeling, the stability/constancy of colour during peeling and cooking, the stickiness of yam in the hand during peeling and slicing, the viscosity of cooking water were the characteristics considered to select the best preferred varieties or to reject the least preferred ones.

The productivity of peeling unit operation is linked to the size of the tuber. The cooking unit operation is controlled by mastering the ratio [Quantity of yam / Q of water] and the cooking time. During the cooking, the behaviour of varieties differs with more or less loses of dry matter content inducing different textural properties.

The end product preferred characteristics were a white, shiny and yellowish color. A friable, soft, slightly sticky, easy to break, tender and easy to chew texture. A sweet taste and an odour of cooked yam. The poor characteristics were a red, pink, dark and ugly color. A hard, gluey, sticky unbreakable and fibrous texture. An uncooked, bitter and unsweet taste and an unpleasant smell of root.

UAC-FSA in Benin on Boiled Cassava

Report finalized.

Concerning the cassava root choice, the external morphologic observation of the phenotype of roots together with flesh characteristics can't help to predict the final quality of boiled cassava.

With regard to the peeling unit operation, one main observation is that it is important to identify big size roots with a skin easy to separate from the flesh.The size of cassava pieces destined to be cooked is correlated with the size of initial roots. the cooking unit operation, the data collected revealed thati) the control of the [Qw/Qc] ratio is important in the quality of the boiled cassava, and in particular its textural homogeneity, the friability and the level of stickiness ; ii) There isn't significant differences of cooking time according the cooked variety ; iii) The texture of the boiled cassava pieces and the behaviour of the roots during cooking appear to be related in one hand to the initial dry matter content and in other hand to the ability of the matrix to lose dry matter while absorbing water.

In our conditions, the variety which is known as the preferred variety for boiled cassava production, is the variety Dossi which had the higher raw material dry matter content and the higher processing yield, mainly due to a good capacity to absorb water during cooking step. These characteristics and behaviour let appear that this variety allowed processors to reached the final quality characteristics desired with the obtention of a friable, non-sticky, white, sweet and no bitter end product. This variety giving them also a good profitability with one of the best global yield (w.b).

CARBAP in Cameroon on Boiled Plantain

Report finalized.

Processing demonstrations were carried out in Cameroon with six processors (restaurant cooks) in Bafoussam and Douala (three processors for each town). During these activities, each processor was given four plantain varieties: a variety considered to be good, corresponding to the local variety frequently used by the processor in his/her restaurant; two intermediate quality varieties (Batard and Big ebanga), and one poor variety (a plantain-like hybrid), CARBAP K74.

Boiled plantain is obtained after a series of five (05) preparation steps including detaching fruits from the bunch, fruit washing, fruit peeling, pulp scraping and boiling. The cooking chronology varied depending on whether processors cook plantain pulps with or without peel.

During processing, Big ebanga presented the highest "peeling + scraping" yield [51.08-52.55 % wet basis (w.b)], while local varieties exhibited the least values (44.88-45.31 % w.b). Cooking yield was high for Batard and Big ebanga (59.35-61.35 % w.b) and low for local varieties (53.59-54.67% w.b) in both towns. Irrespective of the towns, Big ebanga presented an overall process yield greater than 30% (w.b). Dry matter content of raw plantain pulps revealed values ranging between 30.0 and 41.7 % (w.b) with CARBAP K74 having the lowest values.

High-quality boiled plantain should be attractive, wet, soft in the mouth with a good/plantain taste; while poor or bad quality boiled plantain is pale in colour, with a taste of sap or banana and is hard in the mouth. An overall analysis of some of the parameters measured on these plantain varieties, using Agglomerative hierarchical clustering (AHC) denoted the presence of three classes among which a class represented by the plantain-like hybrid CARBAP K74 was different from the other classes. Parameters such as fruit thickness, fruit length and dry matter contents are accountable for this, in addition to the firmness of the pulp. This better explains why of all the varieties, Batard and Big ebanga were preferred most by the processors, while CARBAP K74 was liked least.

Fieldwork completion &Possible Annotation concerning the "Data uploaded on RTBfoods platform":

Step 3 performed in Period 3			Period of Field Work	Regions surveyed	Name of Localities: Cities Small Towns Villages	Nb of Individual Interviews (processors)		Data uploaded on RTBfoods platform	
Product Profile Step 3	Primary or Spillover Country	Country				M	F	Yes	No
Boiled cassava	Primary country	Uganda (NaCRRI)	September 2019	Apac	Small Town		3		X
				Luweero	Small Town		2		
Boiled yam	Primary country	Benin (UAC-FSA)	January 2019	Bohicon	Small Town		3	X	
				Djidja	Small Town		3		
Boiled Plantain	Primaryco untry	Cameroon (CARBAP)	August 2019	Baffoussam	Small Town		3	X	
				Douala	City		3		
Boiled cassava	Spillover country	Benin (UAC-FSA)	June 2019	Bonou	Small Town		3	X	
				Dangbo	Small Town		3		
Gari/Eba	Primary country	Nigeria (IITA)		Ilupeju	Small Town		4	X	
				Tyomu	Small Town		4		
Gari/Eba	Primary country	Nigeria (NRCRI)	September 2019	OssahIbeku	Small Town		4	X	
Boiled Sweetpotato	Primary country	Uganda (CIP)	September 2019	Lira	Small Town		4	X	
				Kamwenge	Small Town		4		
Matooke	Primary country	Uganda (NARI – Bioversity)	September 2019	Nakaseke	Small Town		4	X	
				Mbarara	Small Town		4		
Boiled yam	Spillover country	Nigeria (NRCRI)	November 2019	Ndigazu	Small Town		4	X	
Pounded yam	Primaryco untry	Nigeria (Bowen university)	September 2020	Iwo	Small Town		2	X	
				Oluponna	Small Town		2		
				Ile-ogbo	Small Town		2		
Pounded yam	Primary country	Nigeria (NRCRI)	November 2019	Ndigazu	Small Town		4	X	
Fufu	Primary country	Nigeria (NRCRI)	September 2019	OssahIbeku	Small Town			X	
				Umukara	Small Town				
Boiled Potato	Primary country	Uganda (CIP)	December 2019	Rakai	Small Town		4	X	
				Kabale	Small Town		4		
Fried Sweetpotato	Spillover country	Nigeria & Ghana	September 2019	Kano (Nig.)	Small Town		20		X
				Kwara (Nig.)	Small Town				
				Bawku (Gha.)	Small Town				

3.4 Consumer testing in rural & urban user segments (Step 4)

*Narrative on Key Scientific Findings from Step 4 in Period 3 disaggregated **by Country x Product Profile** - Mention Specific Challenges faced by the team if any (e.g. methodological, scientific).*
[± 15 lines by Product Profile x Country]

UAC-FSA in Benin on Boiled Yam

Field surveys and the processing diagnosis provided reliable descriptors that were mapped with overall liking scores to better understand the consumers' demand for quality characteristics of boiled yam. Five yam varieties named *Laboko, Kodjèwé, Gnidou, Paina* and *Kpètè* were processed into boiled yam pieces and evaluated by 301 consumers in three locations: Dassa and Djidja (rural

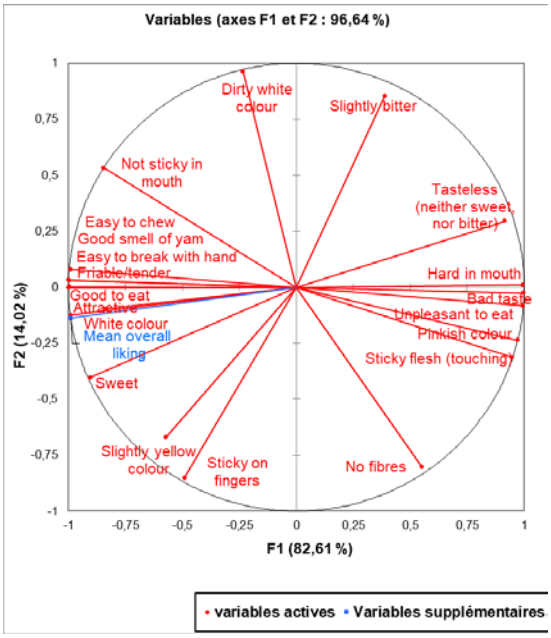
areas), Bohicon (a small town) and Cotonou (a big city). *Laboko* was the most liked variety by consumers (score of 7.6, 'like very much'), followed by *Kodjèwé* (score of 7.0, 'like moderately'), while *Kpètè* was scored the least ones (3.7, 'dislike slightly'). *Gnidou* and *Paina* varieties were scored around 6 'like slightly' and can be considered as intermediate varieties. Boiled yam samples made from *Laboko* and *Kodjèwé* varieties were qualified as high-quality products and were specifically described as 'attractive' (with a 'slightly yellow colour' for *Laboko* and 'white colour' for *Kodjèwé*), 'easy to break with hand', 'easy to chew', 'friable/tender', 'good to eat', 'not sticky in mouth', with a 'good smell of yam', and a sweet taste. *Kpètè*, the least liked variety, was described as too dark in colour (pinkish), too hard in hand, not enough sweet taste (tasteless or bad taste) and not enough friable in mouth. Boiled yam from *Paina* and *Gnidou* were characterised by dirty white colour, slightly bitter, not sticky on fingers and with fibres. Thus, the sensory characteristics associated with *Laboko* and *Kodjèwé* could be considered as the drivers of consumers' liking while the sensory characteristics associated with *Kpètè* could represent a reason for consumers' rejection.

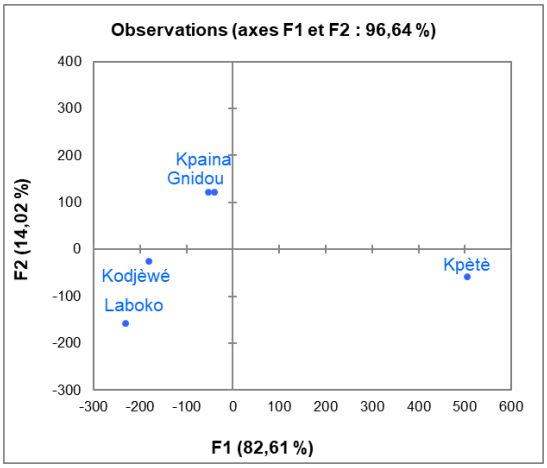
Quality characteristics used for building the CATA table

Groups	Characteristics	Step 2	Step 3
Appearance	Pinkish colour		×
	White colour	×	×
	Attractive	×	×
	Slightly yellow colour	×	×
	Dirty white colour		×
Texture in hand	Sticky flesh (mucilage)		×
	Sticky on fingers	×	×
	Easy to break with the hand	×	×
Texture in mouth	Hard in the mouth	×	×
	Friable/tender	×	×
	Not sticky in the mouth		×
	No fibres		×
Odour	Good smell of yam	×	×
Taste	Sweet	×	×
	Good to eat	×	×
	Easy to chew	×	×
	Tasteless (neither sweet, nor bitter)		×
	Unpleasant to eat		×
	Bad taste	×	×
	Slightly bitter		×

Location	Yam varieties				
	Laboko	*Kodjèwé*	*Gnidou*	*Paina*	*Kpètè*
Rural areas (n=129)	7.79^{a1}	7.17^{b1}	5.98^{c1}	6.02^{c1}	3.33^{d1}
Small town (Bohicon, n=52)	7.44^{a2}	7.17^{a1}	6.38^{b1}	6.23^{b1}	$3.60^{c1,2}$
City (Cotonou, n=120)	7.51^{a2}	6.73^{b2}	6.35^{bc1}	6.28^{c1}	4.11^{d2}
Mean overall liking score	7.62^{a} Like very much	6.99^{b} Like moderately	6.20^{c} Like slightly	6.16^{c} Like slightly	3.68^{d} Dislike slightly

Cos^2 (Overall liking) = 0.980





UAC-FSA in Benin on Boiled Cassava

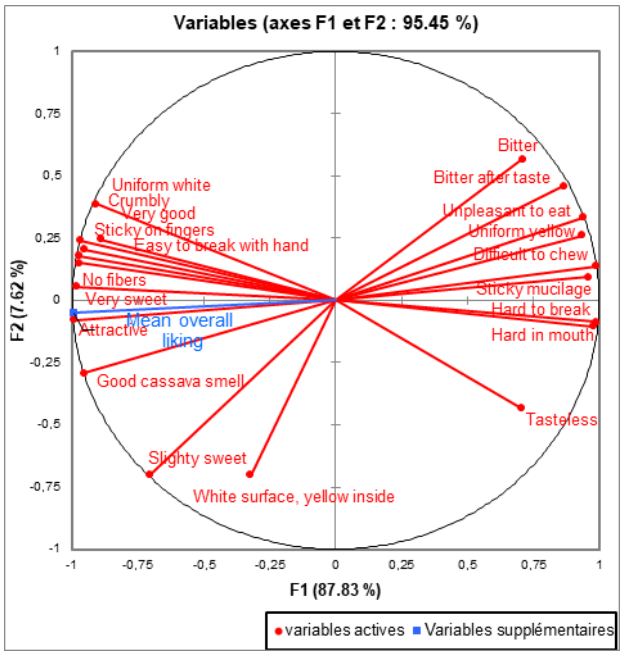
Five cassava varieties (*Adjaha, Alanmandou, Atinwéwé*, *Dossi* and *Koléhaomè*) were processed into boiled cassava pieces and tested by 240 consumers in rural (Bonou and Dangbo) and urban (Porto-Novo) areas. Consumer testing was performed using hedonic, JAR and CATA tests. The overall liking of boiled cassava varied widely with cassava varieties (from a score of 2.7 'dislike moderately' to 8 'like very much' for Koléahomè and Dossi respectively). For *Atinwéwé* and *Alanmandou* varieties, the mean overall liking depends also on the locations where consumer testing was conducted (rural and urban areas). Three classes of consumer's liking were identified with the five cassava varieties studied. Boiled cassava samples made from *Dossi* and *Atinwéwé* varieties were qualified as high-quality products and were specifically described as, 'attractive' with 'white homogenous' or 'white outside and yellow inside' colour, 'crumbly in the mouth', 'easy to break with the hand', 'sticky between fingers', with 'no fibres', a 'sweet taste' (very or slightly) and a 'good cassava smell'. *Alanmandou* and *Koléahomè* varieties were considered as making poor quality boiled cassava (mean overall liking score < 4). They were defined as 'unpleasant to eat' and characterized by their colour ('yellow homogenous'), taste ('bitter' and 'bitter aftertaste' for *Koléahomè* and 'tasteless' for *Alanmandou*, respectively) and texture ('hard to break with the hand', 'hard in the mouth', 'difficult to chew', with a sticky mucilage). Irrespective of cassava varieties, the overall liking of boiled cassava is greatly penalized by a too strong yellow colour, a texture such as 'not easy enough to break with the hand' and 'not crumbly enough in the mouth', and a too much bitter taste and a bitter aftertaste. Thus, the sensory characteristics associated with *Dossi* and *Atinwéwé* could be considered as the drivers of consumers' liking while the sensory characteristics associated with *Koléahomè* and *Alanmandou* could represent a reason for consumers' rejection of the boiled cassava.

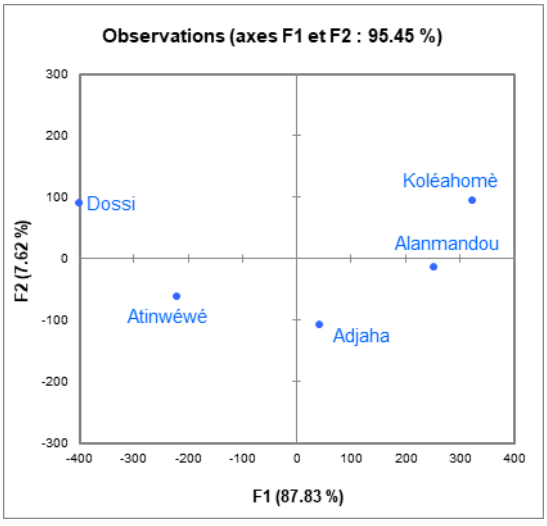
Quality characteristics used for building the CATA table

Groups	Characteristics	Step 2	Step 3
Appearance	Attractive	×	×
	White homogeneous	×	
	White outside and yellow inside		×
	Yellow homogeneous	×	×
Texture in touch	Sticky between fingers		×
	Easy to break with the hand	×	×
	Hard to break with the hand		×
	No fibres		×
	Sticky mucilage		×
Texture in mouth	Crumbly in the mouth	×	×
	Hard in the mouth		×
	Difficult to chew	×	
	Unpleasant to eat		×
Odour/aroma	Cassava smell	×	×
Taste	Bitter	×	×
	Slightly sweet		×
	Very sweet		
	Tasteless		×
	Very good		×
Aftertaste	Bitter aftertaste		×

Location	Cassava varieties				
	Dossi	*Atinwéwé*	*Adjaha*	*Alanmandou*	*Koléahomè*
Rural areas (n = 127)	7.9^{a1}	6.4^{b1}	5.0^{c1}	3.4^{d1}	2.7^{e1}
Urban areas (n = 113)	8.0^{a1}	6.8^{b2}	5.2^{c1}	4.0^{d2}	2.7^{e1}
Mean overall liking (n = 240)	8.0^{a} Like very much	6.6^{b} Like moderately	5.1^{c} Neither like nor dislike	3.7^{d} Dislike slightly	2.7^{e} Dislike moderately

Cos^2 (Overall liking) = 0.989



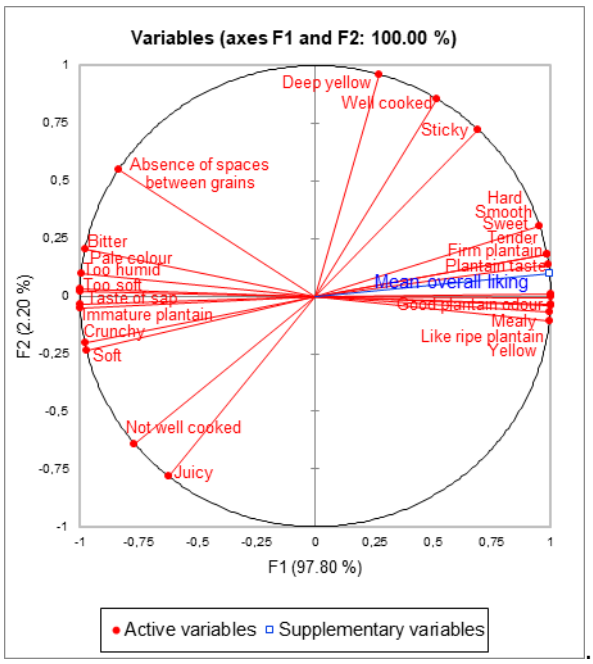


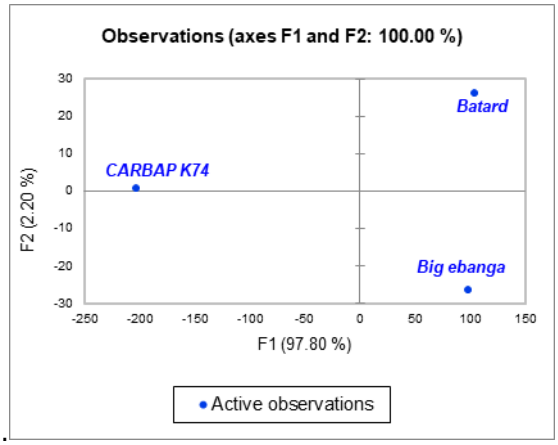
CARBAP in Cameroon on Boiled Plantain

In order to understand consumers' demand for boiled plantain quality characteristics, consumer testing was carried out in the West and Littoral regions of Cameroon. Three plantain cultivars *Batard*, *Big ebanga* and *CARBAP K74* (a plantain-like hybrid) were harvested from CARBAP's experimental plot in Njombé, processed on-field into boiled plantain samples and tested by 300 consumers. Consumer testing was conducted using a hedonic, JAR ("Just About Right") and CATA ("Check-All-That-Apply"). The most liked boiled plantain samples were *Batard* and *Big ebanga* with a mean overall liking of 7.0 and 6.9 respectively (like moderately). The least liked sample was *CARBAP K74* with a mean overall liking of 5.8 (like slightly). JAR tests revealed that the characteristics such as "colour", "humidity", "texture in the mouth" and "sweet taste" were scored JAR by more than 60% of consumers for the most liked boiled plantain samples (*Batard* and *Big ebanga*). About 40% of consumers perceived the colour of the *CARBAP K74* sample "Too clear", while more than 60% found that sample "Not sweet enough". Principal Components Analysis of frequencies of citations of CATA terms explained 100% of the variance of the sensory characteristics. High quality characteristics of boiled plantain should be yellow, a firm plantain, like ripe plantain, smooth, with a good plantain odour, mealy, hard, sticky, tender, with a plantain taste, sweet. Low quality characteristics of boiled plantain on the other hand are mostly: a plantain with pale colour, immature, too humid, too soft, with an absence of spaces between grains, not well cooked, crunchy, bitter and with a taste of sap.

	List of the most liked characteristics	List of the least liked characteristics
Quality characteristics of the boiled plantain In red: characteristics from Step 2 In blue: characteristics from Step 3 In green: characteristics from Steps 2 & 3	*Appearance* - Deep yellow colour - Yellow colour - Like ripe plantain - Firm Plantain - Absence of spaces between grains *Odour* - Good plantain odour *Texture when touching* - Soft - Smooth - Tender - Mealy *Taste* - Sweet taste - Juicy (taste) - Plantain taste *Texture in mouth* - Well cooked	*Appearance* - Pale colour *Texture when Touching* - Too soft *Taste* - Taste of sap - Bitter taste *Texture in mouth* - Crunchy - Too humid - Immature plantain - Not well cooked - Sticky - Hard

Boiled plantain samples	Mean Overall liking scores (300 consumers)	Groups	
Batard	7.0		B
CARBAP K74	5.8	A	
Big ebanga	6.9		B





Cos^2 (Overall liking) = 0.991

NARL/Bioversity in Uganda on Matooke

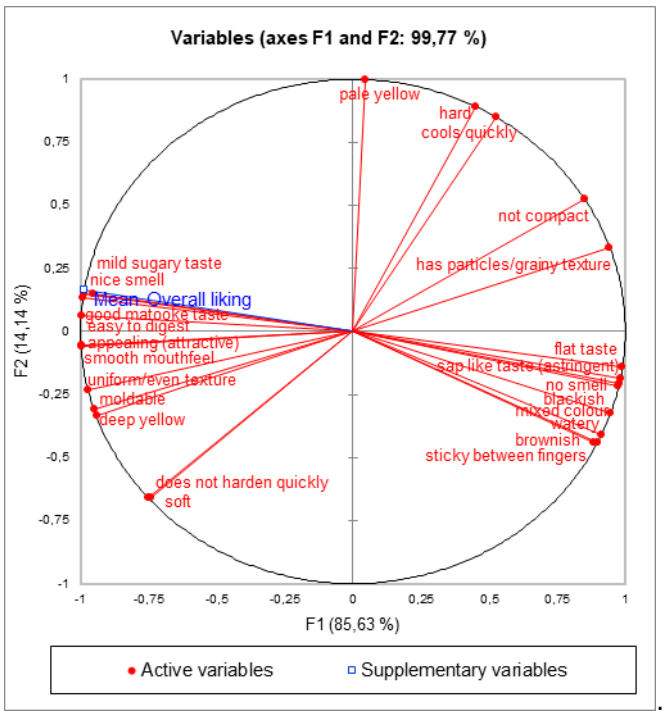
Consumer testing was conducted in rural and urban locations in two major banana growing and consuming regions of Uganda, represented by Mbarara and Nakaseke districts. Four matooke varieties per site, with different quality characteristics, were processed into steamed matooke products and presented to a large number of consumers. In Mbarara district, two local varieties *Nakitembe* and *Kibuzi*, and two hybrids *NARITA 2* and *M30* were tested by 132 consumers. In Nakaseke, two local varieties *Mpologoma* and *Nakitembe*, and two hybrids *NARITA 21* and *M30* were tested by 124 consumers. The consumers evaluated the products using a hedonic test, a just-about-right (JAR) test, and a check-all-that-apply (CATA) test.

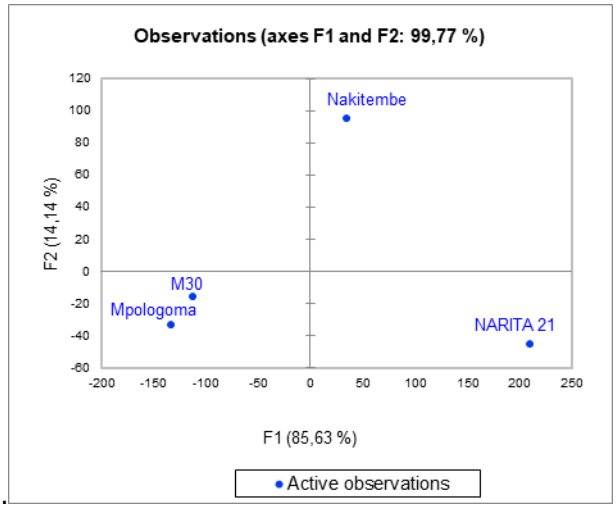
Consumers perceived differently the four matooke products made from the four varieties. In Mbarara, the most liked were the matooke prepared from *Kibuzi* and *Nakitembe* with a mean overall liking score of 7.7 (like very much) and 7.3 (like moderately) respectively. Matooke made from hybrids *NARITA 2* and *M30* got a medium mean overall liking score of 4.7 (neither like nor dislike) and 5.9 (like slightly) respectively**.** *NARITA 2* was found "Too light" in colour, "Not soft enough" and "Rough" in mouth by 40.5%, 64.9% and 70.2% of consumers respectively. In Nakaseke, the most liked matooke were made from the local variety *Mpologoma* and the matooke hybrid M30 with a mean overall liking score of 8.2 and 7.9 (like very much) respectively. The least liked was the matooke hybrid *NARITA 21* with a mean overall liking score of 2.1(dislike very much). Nakitembe, a local variety with an overall mean score of 6.2 (like slightly) was evaluated as an intermediate quality matooke product. Consumers considered the matooke hybrid *NARITA 21* as too dark (88.3% of people), too soft (40.3% of people) and too rough (53.3% of people).

Whatever the region, the high quality characteristics associated to the most liked matooke samples were the followings: an attractive appearance "Appealing" with a "Deep yellow" colour, a "Nice smell", "Does not harden quickly" and "Moldable" in the hand, with a "Good matooke taste" and a "Mild sugary taste", "Soft", "Smooth", with a "Uniform/even texture" in the mouth, and "Easy to digest". The poor quality characteristics associated to the least liked matooke samples were: "Pale yellow", "Blackish", "Browish", or a "Mixed colour", "No smell", with a "Flat taste", "Sap like taste", "Has particles/grainy texture", "Not compact", "Watery" "or Hard".

Liked characteristics	Soft texture Good smell Yellow colour Good matooke taste Holds together when mashed (compact) Elastic/starchy Uniform/homogenous texture Smooth mouthfeel Does not separate/break when served Not sticky Homogenous colour Does not harden quickly Satisfying
Disliked characteristics	Hard Watery White colour Separates easily/ not compact Poor/flat taste No steamed banana smell Blackish colour Non-homogenous Not yellow in colour Non-homogenous texture Brownish colour Cools fast after serving With thread like materials

Steamed matooke Samples in Nakaseke	Mean Overall liking scores* (n = 124 consumers)	Groups**		
NARITA 21	2.065 Dislike very much	A		
Nakitembe	6.179 Like slightly		B	
M30	7.944 Like very much			C
Mpologoma	8.202 Like very much			C





Cos^2 (Overall liking in Nakaseke) = 0.972

CIP in Uganda on Boiled Sweetpotato

Boiled and steamed sweetpotatoes were tested by a total of 245 consumers in two locations in Uganda (124 consumers in Kamwenge and 121 consumers in Lira including Kampala). Steamed sweetpotatoes were prepared in Kamwenge from four varieties (*NASPOT 8* an orange-fleshed improved variety, and 3 local varieties *Kiribwamukwe, Otandibata* and *Ndererabana*) while boiled sweetpotatoes were prepared in Lira from four varieties (*NASPOT 8,* and 3 local varieties *Arakaraka, Otada* and *Okonynedo*). In Kamwenge, *NASPOT 8* was the most liked variety with an overall liking close to 8 (like very much) and this was significantly different from the others ($p<0.05$, one-way ANOVA). *Kiribwamukwe* and *Otandibata* had similar liking close to 7 (like moderately). *Ndererabana* had the lowest overall liking tending towards 6 (like slightly). The overall liking of sweetpotatoes from Lira did not vary significantly ($p>0.05$) among the four varieties. All the sweetpotatoes tested had similar overall liking score of 7 (like moderately). Most varieties were rated JAR for colour, sweetness, firmness and mealiness by more than 50% of consumers in the two districts, except *Ndererabana* which was found 'not firm enough' and 'not mealy enough' by 51% and 60% of consumers respectively in Kamwenge, and *Okonynedo* 'not mealy enough' by 54% of consumers in Lira.

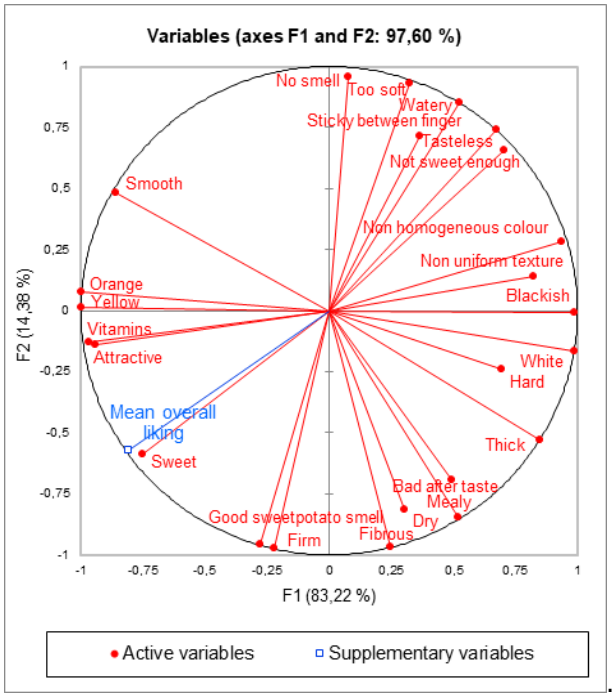
For steamed sweetpotatoes from Kamwenge, a positive mean overall liking was associated with the sensory characteristics 'yellow', 'orange', 'vitamins', 'attractive', 'smooth' and 'sweet' related to the improved orange-fleshed variety *NASPOT 8*. *Kiribwamukwe* and *Otandibata* were associated with 'blackish', 'white', 'non-homogeneous colour', 'thick', non-uniform texture, 'not sweet enough' and 'hard'. The slightly liked *Ndererabana* was associated with 'Too soft', 'Watery', 'No smell', 'Tasteless', and 'sticky between fingers'. For boiled sweetpotatoes from Lira the sensory characteristics such as 'orange', 'vitamins', 'smooth', 'yellow', 'not sweet enough' and 'fibrous' were associated with *NASPOT 8*. *Arakaraka* was associated with 'white', 'no smell' and 'tasteless'. *Otada* and *Okonynedo* were associated with 'watery', 'blackish', 'bad aftertaste', 'non-uniform texture', 'non-homogeneous colour', 'too soft' and 'sweet'.

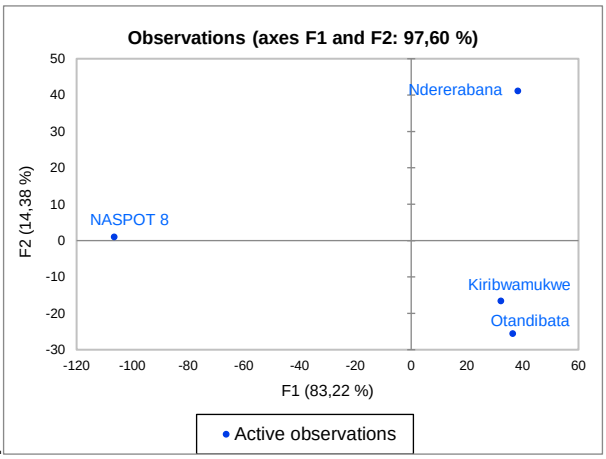
Quality characteristics of Boiled/Steamed sweetpotato *Blue – Step 2; Red – Step 3; Green – Both Steps 2 & 3	
List of the most liked characteristics	List of the least liked characteristics
Appearance - Attractive - Orange - Vitamins - White - Yellow *Odour* - Good sweetpotato smell *Texture when touching* - Firm *Taste* - Sweet *Texture in mouth* - Dry - Mealy - Smooth - Thick	*Appearance* - Blackish - Non-homogeneous colour *Odour* - No smell *Texture when Touching* - Non-uniform texture - Sticky between finger *Taste* - Not sweet enough - Tasteless *Texture in mouth* - Hard - Too soft - Fibrous - Watery *Aftertaste* - Bad after taste

Boiled sweetpotato samples in Lira	Mean overall liking scores n = 121 consumers (Like moderately)	Groups
NASPOT 8	7.041	A
Arakaraka	6.785	A
Otada	6.661	A
Okonynedo	6.479	A

Steamed sweetpotato samples in Kamwenge	Mean overall liking scores n = 124 consumers	Groups		
NASPOT 8	7.508 Like very much	A		
Kiribwamukwe	6.726 Like moderately		B	
Otandibata	6.524 Like moderately		B	
Ndererabana	5.634 Like slightly			C

Cos^2 (Overall liking in Nakaseke) = 0.649



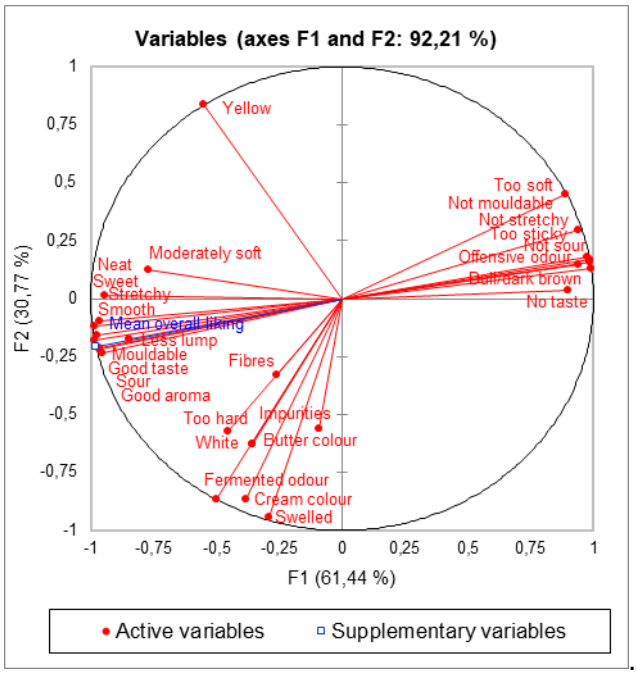


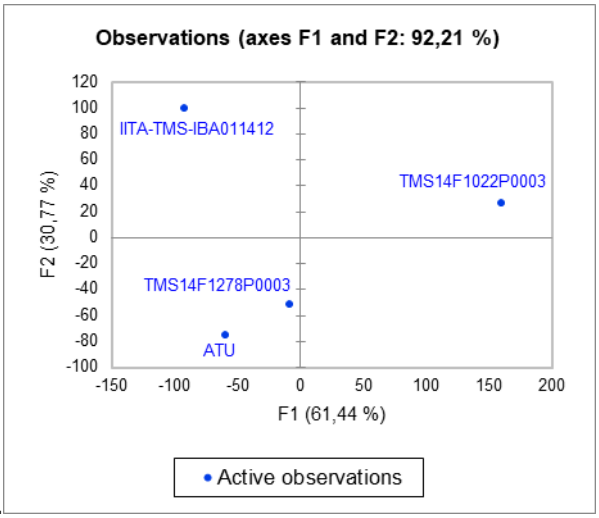
IITA in Nigeria on Gari-Eba

To understand the relationships between Overall liking and quality characteristics of *Eba*, hedonic, JAR and CATA tests were conducted with 301 consumers at eight locations (4 villages, 2 towns and 2 cities) in Osun (151 consumers) and in Benue (150 consumers) states, using *Eba* made from four cassava varieties in each state: two improved varieties (TMS14F1022P0003 and TMS14F1278P0003), one biofortified variety (IITA-TMS-IBA011412) and one local variety (Atu in Osun and Barnada in Benue). In Osun, sensory characteristics associated to the least liked *Eba* sample (TMS14F1022P0003) and a lower overall liking (score of 4.2, dislike slightly) were: “dull/dark brown“, “not sour”, “too sticky”, not stretchy”, “offensive odour”, “not mouldable”, “no taste” and “too soft”. At the opposite, the characteristics highly related to a high overall liking were: “stretchy”, “good taste”, “smooth”, “mouldable”, “good aroma”, “sweet”, “sour”, “neat”, and “less lumps”. IITA-TMS-IBA011412 sample (mean Overall liking score of 7.4 ‘like moderately’) was related to “Yellow”, and Atu sample (mean Overall liking score of 7.7 ‘like very much’) to the terms “swelled”, “fermented odour” and “cream colour”. In Benue, sensory characteristics associated to the most liked *Eba* sample Barnada and a higher overall liking (score of 7.2, like moderately) were “stretchy”, “white”, “sweet”, “not sour”, “good taste”, “good aroma”, “neat”. At the opposite, the characteristics slightly related to TMS14F1022P0003 and TMS14F1278P0003 samples and a lower overall liking (scores of 4.1, dislike slightly and 5.6, like slightly respectively) were “fermented odour”, “not stretchy”, “sour”, “fibres”, “impurities”, “offensive odour”, “dull/dark brown”, “moderately soft”, “too hard”. IITA-TMS-IBA011412 sample (mean Overall liking score of 6.3, ‘like slightly’) was related to the terms “smooth” and “yellow”.

Eba samples in Osun	Mean Overall liking scores (n=151 consumers)		Groups		
TMS14F1022P0003	4,172	Dislike slightly	A		
TMS14F1278P0003	6,868	Like moderately		B	
IITA-TMS-IBA011412	7,377	Like moderately			C
Atu	7,662	Like very much			C

Cos^2 (Overall liking in Osun) = 0.956





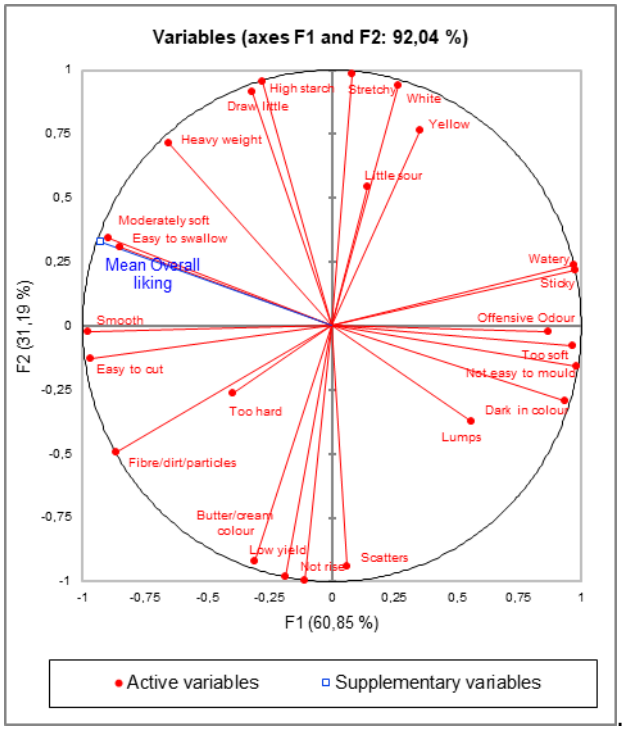
NRCRI in Nigeria on Fufu

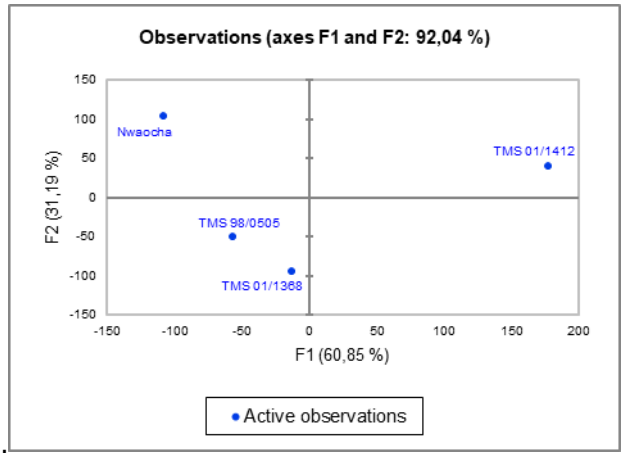
Consumer testing of Fufu was conducted in rural and urban areas of two states (Abia and Imo) in South-East Nigeria with 300 consumers. Four fufu products were made by processors from varieties with very different quality characteristics: TMS/01/1368 (Improved), TMS/01/1412 (Improved), Nwaocha (local variety), and TMS/98/0505 (Improved). The most liked Fufu sample was Nwaocha with a mean overall liking score close to 7 (liked moderately), followed by TMS 98/0505 and TMS 01/1368 with a mean overall liking score close to 6 (like slightly). The least liked was the TMS 01/1412 sample with a mean overall liking score of 4.54 (neither like nor dislike). The Agglomerative Hierarchical Clustering analysis of the mean overall liking scores identified three groups of consumers named 'Nwaocha & TMS 01/1412 likers' (32%), "All likers" (21%), and 'TMS 01/1412 dislikers' (47%). Majority of the consumers were satisfied with the colour and the softness of all the Fufu samples except for TMS 01/1412 which was found 'too hard' by 47.5% of consumers. Stretchiness was scored JAR by more than 50% of consumers for only Nwaocha, while the other varieties were characterized as 'not enough stretchy'. The sensory characteristics most frequently cited by the consumers were: "Easy to cut", "Smooth", "Easy to swallow" and "Moderately soft" with a frequency of citation between 950 and 700, followed by "High starch", "Yellow", "Heavy weight" and "Draw little" (500-575 citations). The least frequently cited were "Dark in colour" (20 citations) and "Lumps" (93 citations). The PCA plan shows that axis 1 was mainly explained negatively by the terms such as "Smooth", "Easy to cut", "Moderately soft", "Easy to swallow" but also "Fibre/dirt/particles" associated to the Fufu sample Nwaocha and a higher mean Overall liking (r=086). At the opposite, axis 1 was positively explained by the terms such as "Not easy to mould", "Sticky", "Watery", "Too soft", "Dark in colour" and "Offensive odour" related to a lower mean Overall liking score and associated to the lower liked Fufu sample TMS 01/1412 (mean Overall liking score of 4.5). Axis 2 was explained negatively by the terms "Not rise", "Low yield", "Scatters" and "Butter/cream colour" related to the Fufu sample TMS 01/1368. Positively, axis 2 was explained by the terms "Stretchy", "White", "Draw little", "Heavy weight".

	Quality characteristics of the Fufu
List of the most liked characteristics	*Appearance* - White - Butter/cream colour *Texture when touching* - Smooth - Stretchy - Easy to cut - Heavy weight - High starch - Draw little *Taste* - Little sour *Texture in mouth* - Easy to swallow - Moderately soft
List of the least liked characteristics	*Appearance* - Dark in colour - Yellow - Fibre/dirt/particles - Lumps - Low yield - Not rise *Odour* - Offensive odour *Texture when Touching* - Not easy to mould - Sticky *Texture in mouth* - Too soft - Scatters - Too hard - Watery

Fufu Samples	Mean Overall liking scores (n=300)		Groups**		
TMS 01/1412	4.543	Neither like nor dislike	A		
TMS 01/1368	5.770	Like slightly		B	
TMS 98/0505	5.867	Like slightly		B	
Nwaocha	7.210	Like moderately			C

Cos^2 (Overall liking) = 0.864





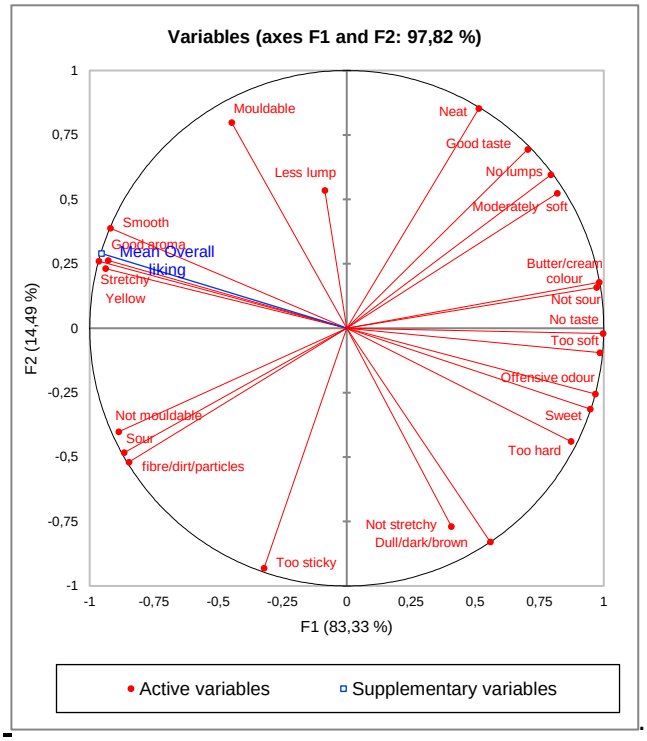
NRCRI in Nigeria on Gari-Eba

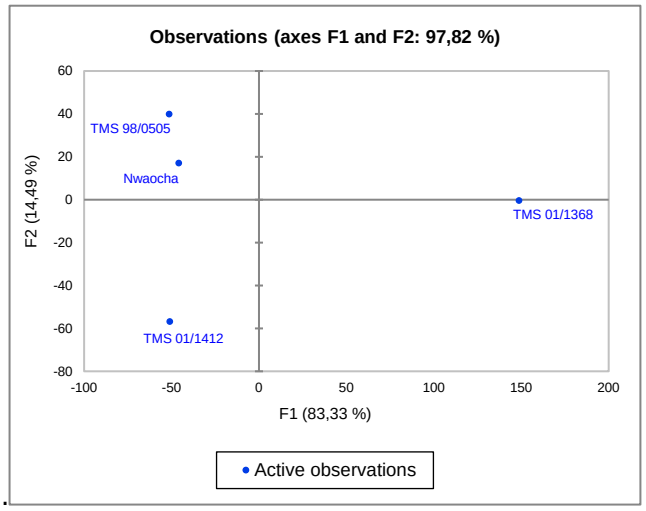
Consumer testing of Eba was conducted with 150 consumers in rural and urban areas of Imo state in South-East Nigeria. Four Eba products were made by the processors from varieties with very different quality characteristics: TMS 01/1368 (Improved), TMS 01/1412 (Improved), Nwaocha (local) and TMS 98/0505 (Improved). The most liked Eba sample were TMS 98/0505 and Nwaocha, with a mean overall liking score close to 6 (like slightly). TMS 01/1412 got a medium score of 4.8 (close to 5, neither like nor dislike). The least liked was TMS 01/1368 sample with a mean overall liking score of 2.1 (dislike very much). The Agglomerative Hierarchical Clustering analysis of the mean overall liking scores identified three groups of consumers named 'TMS 98/0505 & TMS 01/1412 likers' (38%), 'TMS 01/1368 & TMS 98/0505 dislikers' (25%), and 'TMS 01/1368 & TMS 01/1412 dislikers' (37%). The sensory characteristics most frequently cited by the consumers were the following: ‘Moderately soft’, ‘No lumps’, ‘Mouldable’, ‘Neat’, ‘Good taste’, ‘Not stretchy’, ‘Good aroma’ and ‘Smooth’ (280-420 citations). The least used terms were ‘Too hard’ and ‘Sweet’ (56 and 98 citations respectively). The sensory characteristics such as ‘good aroma’, ‘yellow’, ‘stretchy’, ‘smooth’, ‘not mouldable’, ‘sour’ and also ‘fibre/dirt/particles’, were related to a high mean overall liking and the most liked Eba samples (TMS 98/0505 and Nwocha). The characteristics such as ‘no taste’, ‘too soft’, ‘not sour’, ‘butter/cream colour’, ‘offensive odour’, ‘sweet’, ‘too hard’, moderately soft’ and ‘no lumps’ were related to a low overall liking and the least liked Eba sample TMS 01/1368. The terms ‘too sticky’, ‘dull/dark brown’ and ‘not stretchy’ were associated to the Eba sample TMS 01/1412.

	Quality characteristics of Eba product
List of the most liked characteristics	*Appearance* - Butter/cream colour - Yellow - Neat *Texture when touching* - Stretchy - Mouldable - Less lumps *Taste* - Not sour - Sweet - Good taste *Texture in mouth* - No lumps - Smooth - Moderately soft *Aroma* - Good aroma
List of the least liked characteristics	*Appearance* - Dull/dark/brown - Fibre/dirt/particles *Odour* - Offensive odour *Texture when Touching* - Not mouldable - Too Sticky - Not stretchy *Taste* - Sour - No taste *Texture in mouth* - Too soft - Too hard

Eba samples	Mean Overall liking scores (n=150)	Groups		
TMS 01/1368	2.142 Dislike very much	A		
TMS 01/1412	4.840 Neither like nor dislike		B	
Nwaocha	5.453 Neither like nor dislike		B	
TMS 98/0505	6.120 Like slightly			C

Cos^2 (Overall liking) = 0.911





NRCRI in Nigeria on Boiled Yam

The boiled yam products made by the processors from 4 yam varieties (TDA 1100477 (289), TDA 1100203 (463), TDR 1100497 (135), and TDR 11/0010 (721) with different quality characteristics were tested during the Step 3 “Processing diagnosis” by 300 boiled yam consumers. The most liked product sample was (TDR 1100497 - 135) with a highest mean overall liking score close to 7 (like slightly). Majority of the consumers interviewed were used to consuming the product several times a week (48%). 19.33% every day, 12.67% once a week, while 12% several times a month and 8% once a month respectively.

The consumers were satisfied with the three sensory characteristics of the TDR 1100497 product sample: Colour was scored “Just About Right” by 40.3% of consumers respectively, the softness was scored JAR by 33.3%, mealiness (70.7%) of consumers respectively, and was scored too sweet by 48.7% by consumers. The result shows that actually, Just About Right (JAR) scale was used to determine the optimum level of intensity as perceived by the consumers for some important sensory quality characteristics of the boiled yam samples.

The sensory characteristics most frequently cited by the consumers were considered the best for describing the products. They were the following: “Sweet taste”, “Moderately soft”, “Good aroma”, “soft”, “Easy to break”, “Attractive y”, “Easy to swallow”, “Smooth”, “Milk/cream”, “White”, The least used terms were “dark/dull”, Dark spot and “Thread-like lines”.

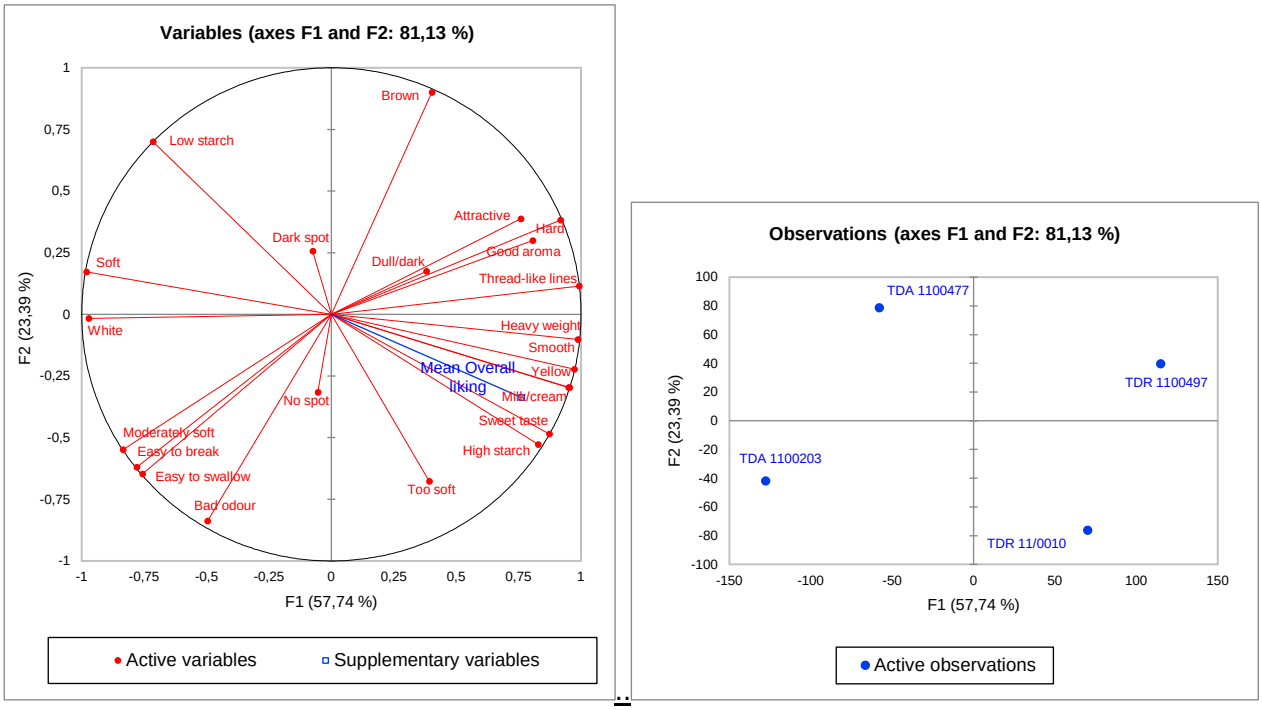
The TDR11/0010 product sample was described as “Sweet” by consumers (157 citations), “” easy to swallow and “smooth” (156 and 201 citations respectively), “attractive” (222citations) and “milk/cream” (145 citations). Consumers used the same characteristics to describe the TDR 11/0010 and product sample with almost the same frequencies of citation. The TDA 1100477 product sample was qualified as “Dull/dark”” (77 citations), “Dark spot” (137citations).

Principal component analysis (PCA) was used to summarize the relationships between CATA sensory characteristics, product samples, and mean Overall liking of each product scored by all the

consumers. The PCA plot explained 81.13% of the variance of the sensory characteristics, the first and second axes accounting for 57.74% and 23.39% respectively. Most of the variance was explained by the first axis.

The sensory characteristics on PCA plan shows that axis 1 was mainly explained positively by the terms such as “moderately soft”, “easy to swallow”, “easy to break”, “white”, related to TDA1100203 and negatively by the terms such as “bad odour”. Also in axis 1, TDA 1100477 was mainly explained negatively by dark spot (least liked), low starch and soft. In axis 2, TDR 1100497 (most liked product) was mainly explained positively by “good aroma”, “attractive”, “hard” and negatively by “dull/dark colour” and “thread like lines”. Also, TDR 11/0010 in axis 2 was mainly explained positively by the terms such as “Yellow” “sweet taste”, “heavy weight”, “high starch”, “milk cream” and negatively as “too soft”. Axis 2 was mainly explained positively by the terms such as “good aroma, attractive, sweet taste and good aroma” related to TDR 1100497 Product sample, and negatively by the terms such as “dark spot”, “dull/dark”, and “thread-like lines”. A high Mean Overall liking scored by consumers were associated to the most liked boiled yam samples (TDR 1100497 & TDR 11/0010), made from good yam varieties).

Cos^2 (Overall liking) = 0.579



NRCRI in Nigeria on Pounded Yam

The 4 pounded yam products made by the processors from varieties with very different quality characteristics during the Step 3 “Processing diagnosis” were tested by 150 pounded yam consumers. This is however, to showcase the major objective of pounded yam consumer testing “Step 4” which is to understand the consumers’ demand for the quality characteristics of this product in addition to present WP2 with a clear and visual mapping of the most liked products associated with high-quality characteristics and high Overall liking scores, and of the least liked products associated with low-quality characteristics and low Overall liking scores.

The pounded yam products were derived from the following cultivars: TDA 1100477 (289), TDA 1100203 (463), TDR 1100497 (135), and TDR 11/0010 (721). There were two-most liked product samples {TDR 1100497 (135) and TDA 1100203 (463)}.

Consumption pattern reveals that many of the consumers interviewed consumes the product once a month (12%). 11.25% several times a week, 10.5% once a week, while 10% several times a month and 8% daily respectively. The determination of the optimum level of intensity as perceived by the consumers for some for some key sensory features of pounded yam samples was actualized with Just About Right (JAR) method. Majority of the consumers were satisfied with the three sensory characteristics of the TDR 11/0010 product sample: Colour was scored "Just About Right" by 53% of consumers respectively, the softness was scored JAR by 59% of consumers respectively, and the smoothness was also scored JAR by 52% of consumers.

The TDR 11/0010 and TDR 1100497 product samples were perceived "not enough stretchy" by 8%, 3% of consumers respectively. Additionally, the TDR 1100497 product sample was found " too hard" by 40% of consumers. The sensory characteristics most frequently cited by the consumers were considered the best for describing the products. They were the following: "easy to swallow", "milk/cream", "White", "easy to cut", "attractive", "starchy", "drawy", "heavy weight", "mouldable", "not sticky", "easy to pound", "good aroma", and "No lumps" with a frequency of citation between 73, 45,71, 71,55,60, 55,93,71, 51,88 followed by "Smooth" "sweet taste and "good aroma" with a frequency of citation between 55, 75 and 86. The least used terms were "dark/dull", sticky and "lumps".

The TDR11/0010 product sample was described as "Mouldable" by consumers (93 citations), "" Heavy weight and "easy to pound" (60 and 51 citations respectively), "drawy" (55 citations) and "starchy" (55 citations). Consumers used the same characteristics to describe the TDR 1100497 TDA 1100203 and product sample with almost the same frequencies of citation. The TDA 1100477 product sample was qualified as "lump"" (58 citations), "sticky" (51citations).

Principal component analysis (PCA) was used to summarize the relationships between CATA sensory characteristics, product samples, and mean Overall liking of each product scored by all the consumers. The PCA plot explained 81.05%% of the variance of the sensory characteristics, the first and second axes accounting for 57.37% and 23.68 % respectively. Most of the variance was explained by the first axis.

The sensory characteristics on PCA plan shows that axis 1 was mainly explained positively by the terms such as "white", "easy to cut", "Sweet taste", easy to swallow, moderately soft, yellow and good aroma related to the most liked Product samples (TDA1100203 & TDR1100497) and negatively by the terms such as "lumps" and "sticky" related to the least liked Product sample (TDA1100477).

Axis 2 was mainly explained positively by the terms such as "easy to cut, milk/cream, sweet taste and good aroma" related to TDA1100203 Product sample, and negatively by the terms such as "bad odour", "sticky", and "dull/dark".

A high Mean Overall liking scored by consumers was related to the high quality characteristics such as mouldability, attractive, No lumps, not sticky, easy to cut, good taste, and good aroma which were associated to the most liked eba samples (TDA110023 & TDR1100497), made from good yam varieties).

NaCRRI in Uganda on Boiled Cassava

Consumer testing of boiled cassava was done in rural areas (Luweero and Apac) and urban areas (Kampala) of Uganda, using hedonic, JAR and CATA tests, with a total of 274 consumers (94 in Apac, 87 in Luweero and 95 consumers in Kampala). In Apac, five varieties were evaluated (*Alanyoderi, Bao, NAROCASS 1, TME 14, NASE 14*), while four varieties were evaluated in either Luweero (*Nabwangu, Bwanjule, NASE 13, NASE 14*) or Kampala (*Bwanjule, Nabwangu, NAROCASS 1, NASE 14*). The local varieties included (*Bao, Alanyoderi, Bwanjule and Nabwangu*), while improved varieties included (*NASE14, NAROCASS 1, TME14 and NASE13*). Highly significant differences in overall liking were noticed among varieties in Apac, Luweero and Kampala at $p<0.05$. In Apac, *Bao* had the highest mean score for overall liking (6.0, like slightly) followed by *NASE 14*

(5.4, neither like nor dislike), while *Alanyoderi* had the lowest mean score (3.8, dislike slightly). In Luweero and Kampala, *Bwanjule* had the highest score (7.4 = like moderately and 7.6 = like very much, respectively), while *NASE 14* and *Nabwangu* had the lowest scores (4.6 = neither like nor dislike in Luweero for *NASE 14* and 3.3 = dislike moderately in Kampala for *Nabwangu* respectively). All improved varieties had intermediate scores in Apac (from 4.4 to 5.4) and in Luweero (from 4.6 to 5.8). JAR test in Apac showed that softness was perceived JAR for the varieties of boiled cassava *TME 14* and *Bao* by 57.4 and 56.4 % of consumers respectively. *NAROCASS 1* and *Alanyoderi* were perceived Not enough soft by 62.8% of consumers. For sweetness, only Bao was perceived JAR (60.6% of consumers), while all the other varieties were perceived Not enough sweet (from 54.3 % for *NASE 14* to 64.9 for *NAROCASS 1*). *Alanyoderi, NAROCASS 1* and *NASE 14* were evaluated Not enough mealy (by 67.0, 63.8 and 55.3% of consumers respectively). *TME 14* and *Bao* were found JAR for their mealiness by only 54.3 and 51.1% of consumers.

Fieldwork and reporting in Year 4:

- Bowen Univ. in Nigeria on Pounded Yam
- CNRA in Côte d'ivoire on Attiéké
- ENSAI/IITA in Cameroon on Gari

For these three teams, Step 4 fieldwork could not be conducted because of Covid 19, and political constraints (elections) in Period 3.

Complete the summary table below on Step 4 fieldwork performed in Period 3 (not reported in Period 1 & 2).

Step 4 performed in Period 3			Period of Field Work	Regions surveyed	Name of Localities: Cities Small Towns Villages	Number of consumers		Data uploaded on RTBfoods platform	
						M	F	Yes	No
Product Profile	**Primary or Spillover Country**	**Country**							
Boiled cassava	Primary country	Uganda (NaCRRI)		Luweero	Small Town	49	38		
				Apac	Small Town	57	37		
				Kampala	1 Big city	42	53		
Boiled yam	Primary country	Benin (UAC-FSA)	February 2019	Dassa	4 Villages	31	33		
				Djidja	4 Villages	20	45		
				Bohicon	1 Small Town	28	24		
				Cotonou	1 Big city	100	20		
Boiled Plantain	Primary Country	Cameroon (CARBAP)	November 2020	West region	4 villages	31	29		
					Dschang	15	15		
					Bafoussam	30	30		
				Littoral region	4 Villages	30	30		
					Pouma	15	15		
					Douala	30	30		
Boiled cassava	Spillover country	Benin (UAC-FSA)	July 2019	Bonou	4 Villages	32	29		
				Dangbo	4 villages	23	43		
				Porto Novo	1 City	63	50		
Gari/Eba	Primary country	Nigeria (IITA)		Benue state	4 villages	31	29		
					Small town	16	14		
				Osun state	4 villages	29	31		
					Small town	15	15		
					1 Big city	60	61		
Boiled Sweetpotato	Primary country	Uganda (CIP)	September 2019	Lira	4 Villages	10	7		
					1 Small Town	19	25		
				Kampala	1 Big city	28	32		
				Kamwenge	4 villages	13	18		
					1 Small Town	16	17		
				Masaka	1 city	32	28		

Step 4 performed in Period 3			Period of Field Work	Regions surveyed	Name of Localities: Cities Small Towns Villages	Number of consumers		Data uploaded on RTBfoods platform	
						M	F	Yes	No
Product Profile	**Primary or Spillover Country**	**Country**							
Matooke	Primary country	Uganda (NARI – Bioversity)	September 2019	Mbarara	Villages	40	27		
					Small town	15	15		
					Big city	13	22		
				Nakaseke	Villages	38	35		
					Small town	9	42		
Boiled yam	Spillover country	Nigeria (NRCRI)		Amagu Izzi	Rural	21	39		
				Nkwagu	Small town	12	18		
				Onueke	City	22	38		
				Umuebe Ezzamgbo	Rural	22	38		
				Obinagu Ishiagu	Small town	13	17		
				Abakaliki	City	21	39		
Pounded yam	Primary Country	Nigeria (NRCRI)							
Fufu	Primary Country	Nigeria (NRCRI)		Abia	Rural	24	36		
					Small town	10	20		
					City	30	30		
				Imo	Rural	33	27		
					Small town	10	20		
					City	15	45		

3.5 Deciphering of WP1 findings for WP1 product profile consolidation

Progress in the consolidation of WP1 Product Profiles: Which Product Profile x Country completed in Period 3?

Year 3 was devoted to finalising Step 2 reports (for some teams), writing articles on the quality characteristics of each product in the IJFST special issue, completing Step 3 fieldwork and reporting. It was only at the end of the year that, after receiving the guidance for Step 4 data analysis and reporting, partners were able to start analysing and reporting on Step 4(for those who had completed the fieldwork). Data from Steps 2, 3&4are needed to build the WP1 Product Profile. Few teams have completed the three reports. They have been contacted to start the process.

Approach for WP1 Product Profile Consolidation:
How are the results from WP1 (Step 2, Step 3&Step 4) used toconsolidateWP1 Product Profiles? [± 15 lines].

All the results on the identification of the high- and poor-quality characteristics of the raw crop, the crop during processing, the raw final product and the ready to eat final product will be considered. The same for the varieties recognized for giving high- and poor-quality product. These results have been collected during Step 2 Focus Group Discussions and Individual interviews, and during Step 3 Processors' interviews. Finally, the consumer mapping regrouping the high-quality characteristics (from Steps 2 & 3) related to the most liked products and a high overall liking on one hand, and the low-quality characteristics (from Steps 2 & 3) related to the least liked products and a low overall

liking on the other hand, will be useful to consolidate the WP1 Product Profile. The WP1 consumer mapping will be related to WP2 sensory mapping.

Provide details on how the quality characteristics are being prioritized for each product profile [± 15 lines].

The high- and poor-quality characteristics of the raw crop, the crop during processing, the raw final product and the ready to eat final product identified during Steps 2&3will not be prioritized. The similar terms will be regrouped and all the different terms will be classified in different categories useful for WP2.

How is or will the Product Profile from WP1 be transferred to WP2 counterparts? Detail the process to be implemented in close interaction with the Product Champions.

The similar terms will be regrouped and all the different terms will be classified in different categories useful for WP2. The information (if available) on how the processor during Step 3 Processing diagnosis or the respondent during Step 2 Individual interview, perceive the high or the bad quality characteristics of the crop or the product will be added to each term and will help WP2 to understand what is a good (or poor) quality characteristic (mainly when terms seem similar such as hard, firm, mealy or dry for a sweet potato, for instance). This will help WP2 biochemists to translate these more complex quality characteristics in simple physico-chemical components which will be transferred to WP3.

Provide information on next steps planned for Period 4 & 5.

In Period 4, the WP1 Product Profile Focal Point will support the teams in building their WP1 Product Profile. Priority will be given to the 5 products defined as support priorities during the Annual meeting in Kampala, namely: boiled yam, boiled cassava, matooke, boiled sweet potato and Gari/ba. We will start with the team who has completed the reporting of the three Steps 2, 3 & 4, and who are available to come back on their Steps 2 & 3 raw data (for some specific questions regarding the quality characteristics). As requested by biochemists and breeders at the Annual meeting in Kampala, no differentiation between gender will be considered at this stage. All data will be analysed in global, except if significant differences between regions have been highlighted.

All the Product Profiles will be built with teams during Year 4 & 5, once Steps 2, 3 & 4 reports are completed. All WP1 Product Profiles will be published between Year 4 & Year 5.

3.6 Gender study

Summarize the Approach, Share of Responsibilities, Countries/products concerned& Activities performed in Period 3. [± 15 lines]

The “Gender Study” is an output that is split over Period 3, 4 and 5. As there are six gender-relevant research questions for WP1, we have focused on three research questions for Period 3 and 4, respectively. The approach is to co-develop each study in a participatory way, with partners and the Step 2 focal point sharing responsibilities for cross-product and country data aggregation and analysis and report writing.

The study has been facilitated through the creation of the RTBfoods Gender Working Group (GWG), which consists of 16 members from 9 institutes. Participation in the Gender Working Group is open and voluntary. The group was developed as a response to the criticism regarding the development of the WP1 methodology paper in IJFST, which was authored by the coordination team.The WP1 leader/Step 2 focal point then asked for participation in the GWG to co-develop the output and reflect on the gender elements of the research. Each product team identified key findings for group discussion. Following this, volunteers for a core writing team for the Gender Study Period 3 was established.

To date, the GWG has worked extremely well: we developed and presented our initial findings at the GREAT gender-responsive crop breeding conference*; wrote a blog on the presentation for the RTBfoods website**, our findings informed PMU's presentation to the ANR conference on gender research methods, and we have co-developed a first draft of the Period 3 gender report submitted alongside this report.

Members of the GWG include (alphabetical, by institute, core writing team members in bold): **P. Marimo (Bioversity-CIAT)**; O. Awoniyi (Bowen University); C. Kendine (CARBAP); **S. Mayanja (CIP);** F.N. Kégah (ENSAI-Cameroon); A. Sounkoura (IITA-Benin); J. Bakpe (IITA-Benin); H.N. Hubert (IITA-Cameroon); **D. Olaosebikan (IITA-Nigeria); E. Stuart (IITA-Nigeria); B. Teeken (IITA Nigeria)**; P. Iragaba (NaCRRI), A.R. Nanyonjo (NaCCRI); **T. Madu (NRCRI), B. Okoye (NRCRI); L. Forsythe (Natural Resources Institute)**. The products covered are matooke, boiled sweet potato and boiled cassava in Uganda; gari, plantain and boiled/pounded yam in Nigeria, and gari in Cameroon.

*https://www.greatagriculture.org/symposium-gender-responsive-crop-breeding

** https://rtbfoods.cirad.fr/en/news/lforsythe-great-symposium

Provide a summary of Key Research Findings & Lessons learned from the Gender Study in Period 3. [± 1 page]

This report presents the findings for three research questions against seven Root, Tuber and Banana (RTB) products. These three research questions are:

1. What are the gender roles along the crop and product food chain?
2. Are there gender differences in varietal and quality characteristic preferences and priorities for the crop and product?
3. Are there gender differences in quality characteristic preferences for the crop (in general) and the product?

The products covered are matooke, boiled sweet potato and boiled cassava in Uganda; gari, plantain and boiled/pounded yam in Nigeria, and gari in Cameroon.

What are the gender roles along the crop and product food chain?

Regarding gender roles along the crop and product food chain, our evidence confirms women's high level of participation in most aspects of RTB production, processing, sale and food preparation for our products in Uganda, Nigeria, Benin and Cameroon. However, while there are clear gender norms regarding which gender participates in particular activities, there were many examples in the research where trends contradicted the norms. For example, it is a broadly held assumption that men are primarily active in the production of plantain in Nigeria. However, Esme Stuart (IITA-Nigeria) found regional differences and high levels of women's involvement in some locations. Therefore, consultation with women is vital to understanding demand at each stage in the food chain. This underlines the importance of questioning our assumptions about gender, and perhaps, on interviewing one gender alone in relation to certain tasks or assumed knowledge. It also raises the issue of how social scientists can present findings in a more nuanced way – not relying on gender norms but using evidence – and what type of data they need to do so.

Another finding was that there were high levels of women reporting they had 'control over income' and independence in decision making regarding what variety to plant, how much to sell and when to sell. Women reported that while they needed to consult with their spouse, it was their ideas and their decision. Equally, men's responses were similar. This also has a number of important implications: that there are no crops are products that men or women have more or less control over, or that men and women perceive the decision-making process differently, that they themselves have the greater

say in decisions. Similar to the issue regarding gender roles, it also points to the need to thinking of alternative ways to source the information we need about household decision making and control over benefits.

Lessons on methodology on gender roles

- *need to reflect on what information we need from this question, and why, and how best to ask it. Our data and experience show that it asking about who produces, who processes and who sells are not easy to answer. Breaking roles into tasks helps add greater specificity and nuance, but with that, one can also lose sight of the implications of the findings by become lost in showing the detail. A delicate balance is needed.*
- *Could collect the information to identify TASK GROUPS to consult – however, this runs the risk of consulting a subset of people who share similar background and not the variance of people involved in that activity*
- *our results lack in showing the role of power within the food chain, and how gender relations organise and privilege tasks and roles to certain people. is there a way we can being this back in.*

Are there gender differences in quality characteristic prioritised for the crop (in general) and the product?

Another major finding that has arisen from the cross-product and country comparison is that the type and extent of gender differences in preferences for quality characteristics differ by product. Some products have minor gender differences in characteristics cited or in their ranking, and others are more pronounced. This means that overall, men and women do not have similar preferences for each crop and product, but also that men and women do not have different preferences for each crop and product. More analysis is needed to identify if there are particular crops, products or regions that are more likely to show differences. However, gender differences in preferences are very likely tied to multiple use crops, or products that have strict gender differences in preparation or consumption.

Overall, there were 'slight' differences in the top five quality characteristics prioritised by men and women – strengthening the case of integrating the top-quality characteristics into breeding profiles. Boiled cassava (NaCCRI, matooke in Uganda (Bioversity/NARO), gari in Cameroon (ENSAI) and Benin (UAC-FSA), plantain and boiled yam in Nigeria (IITA, NRCRI, Bowen). are all cases in point which showed minimal differences. However, when examining the longer list of desired quality characteristics, men and women cited different characteristics, and women often cited many more characteristics and richer description, compared to men. For example, with boiled sweet potato in Uganda (Sarah Mayanja, CIP), men did not mention sweet taste (raw), appearance (during processing), which came in women's top five characteristics. With gari in Cameroon (ENSAI), men did not mention yield, long length and width, width stalk, long production cycle, and easy to harvest as women did.

When respondents were asked in individual interviews the most preferred characteristics of roots/fruits in relation to the final food products*, the gender differences in preferences and the importance of these preferences become less apparent* for some products*.*

There was also contrary evidence to relate gender differences in the quality characteristic mentioned or prioritised to gender roles. On the one hand, there were examples which highlight women's greater likelihood to site characteristics related to their roles in food processing and preparation across the products and countries. For example, more women mentioned ease of peeling, thin peel & soft peel (all non-significant, however) for Matooke, Uganda (Bioversity, NARO); easy to peel, drawingability and thickness of the wet mash for Fufu, Nigeria (NRCRI), and thin peel boiled yam, Benin (UAC-FSA).

However, there were other food products with similar gender roles, with no significant gender differences in quality characteristic preferences. For example, processing qualities (like peeling) were not mentioned more often by women with plantain, Nigeria (IITA), and short cooking time is mentioned as important by both men and women Matooke, Uganda (Bioversity/NARO).

More analysis is required to identify if there are areas where quality characteristics preferred by men and women may 'clash' when looking at multiple use crops, which will be completed early 2021. Currently, there are quality characteristics that contradict. For example, with gari in Cameroon (ENSAI), women preferred cassava that was both easy and difficult to peel. This is likely because "Difficult to peel" may reflect the desire for a "firm" cassava or cassava "containing less water", and therefore act as a signpost for another quality. Another example is from boiled yam, in Benin (UAC-FSA: significantly more men than women preferred rough, shaggy or a humped yam as it was seen to indicate maturity and that it is ready to harvest. But men and women also prefer smooth peels and without humps.

Lessons on methodology on characteristic preferences

Interviewing women is crucial at the raw, during process and final cooked-product stages to obtain a long list and rich description of preferences for quality characteristics, despite the difficulty it is to uncover tacit knowledge about preferences.

Overall lessons

Gender analysis is crucial. This is because often some of the most valuable information is in the context of the research, and that a good analysis of the context will enable gender specialists to make and assessment of what important priorities for breeding programmes, given the needs of women, men, different ethnic, wealth and regional preferences. In addition, surprising findings that challenge stereotypes are everywhere, particularly when analysing results intersectionality, showing the importance and the contribution of the RTBfoods work.

How could/should gender be considered & integrated into RTB breeding pipelines? How could WP5 contribute to this? [± 1 page].

L Forsythe (WP1 Leader and Step 2 focal point) and H. Tufan (former WP1 co-leader) developed and proposed a process in Period 2 where multidisciplinary teams, consisting of gender specialists, food scientists (WP1/WP2) and breeders, went through a guided data interpretation exercise to identify characteristics or traits for breeders to prioritise in their breeding programmes by reviewing their product profile tables and the broader context illuminated from the research. It is felt, by the WP1 leader, that this type of process could establish a way to inform the RTB breeding pipeline.

In this process, participants are asked to consider gender and region, and other factors of social difference. The output was for each product team to create a summary table of prioritised characteristics. This has already been completed by teams for Step 2 data but has not been adopted more broadly. The guidance includes the following broad steps:

- A: Visioning - what type of variety do we want to deliver and what impact could it have, considering rural vulnerability and insecurity and gender inequality in product value chain.
- B: Demand and foresight – identify the market demand, segments and growth potential for characteristics.
- C: A closer look at your data – what are the key characteristics important by gender, ethnicity, wealth and region?

At a project level, WP1 and WP5 will need to work closely together as a priority in Period 4, to identify if and how the characteristics identified in WP1, in each Step (2, 3 and 4) separately, have been taken up by the next WPs.

In terms of the adaption of breeder's selection tools of quality traits from a gender and diversity perspective, it is envisioned that the aforementioned interpretation guidance will be readapted for a selection tool, but include similar decision making and data points. Furthermore, the GWG will co-develop this guidance and review the draft document already prepared. WP5 will also need to agree and participate in this process. This is expected to commence in early 2021.

Provide information on next steps planned for Period 4 & 5.

The next steps for Period 4 and 5 include:

- Co-develop with the GWG and WP5 guidance and/or tools to include gender and diversity in breeders' selection tools (Period 4)
- Answer the remaining three research questions in a report (Period 4)
- A minimum of two publications in a peer-reviewed journal (Period 4 and 5, respectively)

4 COVID-19 IMPACT ON WP WORKPLAN IN PERIOD 3

*Narrative on the impact of Covid-19 crisis on the completion of WP workplan in Period 3, in each country of WP implementation. For each set of activity impacted, mention the **level of impact** (i.e. postponed field or lab work, missing harvests, support gaps, delays in data analysis, etc.), the **consequences** on sub-sequent activities (including activities performed in other WPs) & the impact on the **capacity to deliver** in Period 3 – NB: This section aims to provide elements to the PMU to justify eventual deficiencies in reaching Period 3 milestones/targets & to request a budget reallocation for Period 4 (if applicable)[1-2 page].*

Covid-19, in addition to political challenges in some countries (e.g. Nigeria, Ivory Coast), has had the following impact on the completion of the WP1workplan in Period 3:

- Boiled Plantain, CARBAP (Cameroon): Step 4 fieldwork on Boiled plantain was delayed until mid-November. Draft report received late December.
- Gari, ENSAI/IITA (Cameroon): Steps 3 & 4 fieldwork could not take place and the cassava harvest period was missed. Activities will be conducted in Period 4.
- Attiéké, CNRA (Ivory Coast): Steps 3 & 4 should be conducted in Period 4.
- Boiled yam, CNRA (Ivory Coast): Step 2 is scheduled for early Period 4, and Steps 3 & 4 will follow.

COVID-19 has also notably affected the work programmes of individuals across all partner organisations with care responsibilities, including coordination team members. Closures of nurseries, schools, in addition to measures to reduce inter household mixing, have severely affected the ability of some team members to deliver to the standard of which they would like. It is important going forward that deadlines are scheduled close to national holidays and national lockdown to reflect these challenges (Research Professional, 16 December 2020). It is also very welcomed that PMU are enabling virtual attendance to main and side meetings for the annual meeting to enable people with care responsibilities and vulnerability to participate in strategic planning.

In the table below, summarize the consequences of Covid-19 crisis on each activity planned initially, team by team. Report the impact on completion level& the adaptation strategy chosen in agreement with WP coordination team (postponing, cancellation, etc).

Country	Institute	Product Profile	General Consequences	Step 2 (Impact & Coping Strategy)	Step 3 (Impact & Coping Strategy)	Step 4 (Impact & Coping Strategy)
Nigeria	Bowen University	Pounded Yam	Postponed fieldwork to Period 4	N/A	N/A	Fieldwork could not be carried out - postponed to Period 4
Cameroon	CARBAP	Boiled Plantain		N/A	N/A	Fieldwork postponed to mid-November 2020 – report received late December.
Cameroon	ENSAI / IITA	Gari	Postponed fieldwork to Period 4	N/A	Fieldwork could not be carried out - postponed to period 4	Fieldwork could not be carried out - postponed to Period 4
Côte d'Ivoire	CNRA	Attiéké	Postponed fieldwork to Period 4	N/A	Fieldwork could not be carried out - postponed to period 4	Fieldwork could not be carried out - postponed to Period 4
Côte d'Ivoire	CNRA	Pounded Yam	Postponed fieldwork to Period 4	Fieldwork could not be carried out, planned for early Period 4	Postponed to period 4	Postponed to Period 4

5 WP1 COORDINATION

5.1 Scientific collaborations between partners

Narrative on collaborations between WP teams - Describe activities concerned & type of collaboration (methodology development, share of equipment & facilities, share of responsibilities on a specific activity) – The list hereunder is a proposition and can be extended/modified [10-15 lines each].

As mentioned in section 3.6, the GWG was established in Period 3 to co-develop and co-author the results from WP1 studies, namely, Step 2. This has involved 16 members from 9 institutes (alphabetical by institute): P. Marimo (Bioversity-CIAT); O. Awoniyi (Bowen University); C. Kendine (CARBAP); S. Mayanja (CIP); F.N. Kégah (ENSAI-Cameroon); A. Sounkoura (IITA-Benin); J. Bakpe (IITA-Benin); H.N. Hubert (IITA-Cameroon); D. Olaosebikan (IITA-Nigeria); E. Stuart (IITA-Nigeria); B. Teeken (IITA Nigeria); P. Iragaba (NaCRRI), A.R. Nanyonjo (NaCCRI); T. Madu (NRCRI), B. Okoye (NRCRI); L. Forsythe (Natural Resources Institute).

So far, the GWG has worked collaboratively on the presentation for GREAT gender-responsive crop breeding and the ANR conferences, a blog, and the Period 3 gender output. The Period 3 Gender Report was developed by a core writing team. The core writing team was divided into sub-groups who each worked on one of three research questions. This resulted in the following collaborations between individuals from the following institutes, with input from WP1 Leader:

- IITA-Nigeria and NRCRI (E. Stuart, B. Okoye);
- Bioversity and IITA – Nigeria(P. Marimo, B. Teeken), and
- CIP and IITA (S. Mayanja, D. Olaosebikan).

There are also continuing partnership between NRCRI and Bowen in Nigeria on Boiled & Pounded Yam, and NRCRI & IITA in Nigeria on Gari-Eba. Data on the products and reports were circulated between partners for comments and inputs.

ENSAI & IITA in Cameroon on Gari: ENSAI & IITA in Cameroon have collaborated in Year 2 on Step 2 Gari data collection. The team was composed by a Food scientist and a post-PhD fellow from ENSAI, a PhD student and a Socio-economist from IITA, several masters from both institutions, and the support of the Food scientist WP1 coordinator who translated all the Step 2 questionnaires in French (and established a contract with ENSAI, funding WP1 Cirad). In Year 3, the two teams collaborated on the writing of two articles already published in the IJFST special issue: “From cassava to gari: mapping of quality characteristics and end-user preferences in Cameroon and Nigeria” lead by ENSAI, and “A review of cassava semolina (gari and eba) end-user preferences and implications for varietal trait evaluation” lead by Nigeria.

5.2 Support strategy from WP1 coordinators & activity focal points

Describe briefly how has been (re)organised the coordination of the WP in Period 3 and how Responsibilities have been shared between activity focal points – Highlight Strengths & Complementarities [± 1 page].

Period 3 has seen changes to the coordination of WP1. This includes Hale Tufan’s resignation as Co-Leader due to other project commitments, and the acceptance of the role by Tessy Madu, NRCRI. We are very happy to have Tessy as part of the coordination team.

Pinpoint Gaps observed & Challenges faced in the coordination of the WP & elicit Risk Mitigation Strategies adopted to tackle these challenges & solve these problems [± 1 page].

As observed by Genevieve Fliedel, during the WP1 Leader's maternity leave (from August 2019 to May 2020), there was minimal availability of the WP1 interim leader and the leave of the second co-leader, the Food Scientist WP1 co-leader (Step 4 Focal Point) took the responsibility of many WP1 activities during this period : reviewing the last Step 2 Product Profiles (data analysis of quality characteristics was not well-understood by partners during WP1 Capacity Strengthening in Cotonou and Abuja), two presentations on the WP1 methodology and on WP1 achievements (with interim leader and Step 3 Focal Point for the latter) in Year 2 for the Annual meeting in Kampala, reviewing deeply 8 papers for publication in the IJFST special issue including the paper on WP1 methodology, support the partners on the choice of important characteristics from Steps 2 & 3 for developing the questionnaires of Step 4.No new co-leader was named by RTBfoods PMU during that period to occur in the absence of the other co-leader who left. The involvement of the Food scientist WP1 co-leader was, in agreement with the interim leader, motivated to support partners to produce good quality Step 2 data, in view of building a good quality WP1 Product Profile.

6 INTERACTION MECHANISMS BETWEEN WPS

Fill-in the table below with a brief description or bullet-point lists of interactions with other WPs (successful ones & gaps) & propositions for risk mitigation:

	Successful Interactions/ Coordination with other WPs (specific actions concerned, frequency, tool sharing)	**Gaps in Interactions/Coordination with other WPs: What is needed from other WPs ?** **(NR = not relevant)**	**Risk Mitigation : How to Improve (specific actions to be taken, frequency, tool sharing?)**
WP2			Interactions with WP2 will start more effectively with the delivery of the WP1 Product Profile and the establishment of relationships between consumer mapping (WP1 Step 4) and sensory mapping (WP2).
WP3			
WP4			Interactions with WP4 will start more effectively with the delivery of the WP1 Product Profile including good and bad varieties, and good and bad crop quality characteristics.
WP5	Participation in B. Teeken's webinar, setting the stage for WP5 methodology. Interaction with WP5 leadership to show interest and enthusiasm in working together to input into breeding selection tools.		
WP6/ PMU	Interaction with PMU has been regular, consistent and supportive.		

7 COMPLEMENTARITY WITH OTHER PROJECTS OR BREEDING PROGRAMS ON RTB CROPS

Narrative on Activities performed in complementarity with other projects or breeding programs from national partners (e.g. NextGen, AfricaYam, SweetGAINS, CRP RTB, ABBB, HarvestPlus). Describe the types of complementarity (students, equipment share, facilities, participation of WP coordinators in partner projects, other events or initiatives on RTB breeding, etc.).

The interdisciplinary and participatory five-step methodology developed in WP1, to identify demand for quality characteristics among diverse user groups along RTB food chains, was disseminated and used in the NextGen Cassava project in Tanzania and will be applied in the SweetGains project in Mozambique. Part of the results from the studies have been synthesised and published in the 11 publications in the same special issue, with the support of WP Leader and Co-Leaders.

The WP1 Leader and other RTBfoods project members were invited to a number of events on integrating gender into breeding programmes, including those hosted by the Gender and Breeding Initiative and Excellence in Breeding. The WP1 Leader also represented the GWG at the GREAT Gender and Breeding Conference to present interim findings, and the findings were also used in a presentation by PMU to the ANR for a gender and research methods conference.

8 CONCLUSION & PERSPECTIVES

8.1 WP1 progress & key scientific achievements in period 3

Synthesis on Key Achievements at WP level in Period 3 & Level of Progress toward the completion of overall WP objectives in RTBfoods framework [± 1 page].

The WP1 team has made a number of achievements in Period 3, that I am particularly proud of. We have, quite substantially, surpassed our target in output 1.1.1 of 15 studies on quality characteristics, demands and consumption patterns for 11 RTB food products. In Period 3 alone, we have finalised 16 reports among Step 2, 4 and 5. Furthermore, uploading data and consent forms to the RTBfoods platform for all the research is close to completion – this is an incredible task and requires considerable logistical support. The WP1 coordinators applaud the work and diligence of the teams.

We have also established a collaborative process, the Gender Working Group, for the development of the gender output that we hope will continue beyond the length of the project. We also feel it sets a good example of empowering north-south collaboration and representation in the co-design of research and co-development of research outputs. Since the development of the GWG in the summer 2020, we have already produced a paper, given a conference presentation, informed another conference presentation, and wrote a blog on our work. Feedback from the team and other observers has been positive.

The WP1 coordinators have also established the WP1 methodology, which has been, or is currently, being applied, adapted and – importantly - improved by 12 interdisciplinary teams of food technologists, economists and gender specialists in five project countries: Benin, Côte d'Ivoire, Cameroon, Nigeria and Uganda. It is also being used in the NextGen Cassava project to be applied in Tanzania and the SweetGains project in Mozambique. The methodology was published in a paper entitled "An interdisciplinary and participatory methodology to improve user acceptability of root, tuber and banana varieties", as part of a special issue called "Consumers have their say: Assessing preferred quality traits of roots, tubers and cooking bananas, and implications for breeding" in the International Journal of Food Science and Technology (IJFST).

Part of the results from the studies drawing on the WP1 methodology are synthetized and published in the 11 publications in the same special issue (see success story 1 and list of publications), of which the coordination team helped support.

The publication also encouraged the coordination team to update the methodology support materials. Revisions were made to the activity manuals (informed by pilots of the tools in Uganda, Nigeria, Côte d'Ivoire and Benin), and adapting them to the five steps as laid out in the paper in IJFST. This includes the state of knowledge, gendered food mapping, participatory processing diagnosis and quality characteristics and consumer testing in rural and urban areas. New guidance on Step 4 methods, data analysis and reporting, was also developed in Period 3.

We have also been engaging with a number of external partners and projects, such those hosted by the Gender and Breeding Initiative and Excellence in Breeding, GREAT, ANR, among others.

We fully expect Period 4 to proceed in a similarly successful manner.

Success Story 1:

Root, tuber and banana (RTB) crops play a vital role in household food and income security across sub-Saharan Africa (SSA). As such, breeding programmes have worked for decades to genetically improve these crops, particularly in terms of yield and pest and disease resistance, to increase the security they provide to millions of people. Despite the progress made in these areas, there remains a gap in understanding of varietal traits and preferences for RTB varieties in terms of processing and consumption characteristics for a range of RTB products. This has contributed to low levels of adoption of new varieties and its potential benefits. There is also limited understanding of the socio-cultural influences on RTB product preferences and the differentiated needs of men, women, and other social groups involved in RTB food chains in SSA.

To address these challenges, an interdisciplinary and participatory five-step methodology was developed to identify demand for quality characteristics among diverse user groups along RTB food chains. This initiative was part of work package 1 of the 'Breeding RTB Products for End User Preferences' or RTBfoods project, which aims to link local consumer preferences with breeders' selection criteria to ensure adoption along the value-chains of cassava, yam, sweetpotato, potato and cooking banana products. This methodology has been presented in a paper entitled 'An interdisciplinary and participatory methodology to improve user acceptability of root, tuber and banana varieties' published in a special issue called "Consumers have their say: Assessing preferred quality traits of roots, tubers and cooking bananas, and implications for breeding" in the International Journal of Food Science and Technology, led by the RTBfoods project.

The methodology includes an evidence review, consultations with key informants and rural communities, processing diagnosis with experienced processors and consumer testing in urban and rural areas. Quality characteristics are then prioritised into a Food Product Profile by user group to inform further work of biochemists and breeder sin developing improved selection tools. Importantly, the methodology incorporates a sampling and conceptual foundation to enable analysis by gender and other factors of social difference, to help crop breeders identify and prioritise specific traits in their breeding programmes.

This initiative presents a new basis to understand consumer preferences for RTB crops. The methodology is currently being applied, adapted and – importantly - improved by 12 interdisciplinary teams of food technologists, economists and gender specialists in five project countries: Benin, Ivory Coast, Cameroon, Nigeria and Uganda, in addition to being disseminated to the NextGen Cassava project to be applied in Tanzania and the SweetGains project in Mozambique. Part of the results from the studies have been synthesised and published in the 11 publications in the same special issue (see table below). It is expected that the results from profiling the preferences of value chain actors with their gender-differentiated trait and product preferences will support breeding programmes to improve adoption of new varieties and impact on food and income security in SSA.

Product profiles	Content	Status
Boiled cassava	Preferences for boiled cassava	https://doi.org/10.1111/ijfs.14878
Gari-Eba	End-user preferences of cassava roots and gari	https://doi.org/10.1111/ijfs.14790
Fufu	Quality Attributes of fufu	https://doi.org/10.1111/ijfs.14875
Boiled yam	Boiled-yam quality along the food chain	https://doi.org/10.1111/ijfs.14707
Ponded yam	End-user preferences for pounded yam	https://doi.org/10.1111/ijfs.14770
Matooke	Preferred matooke characteristics	https://doi.org/10.1111/ijfs.14813
Boiled plantain	Raw & boiled plantain quality characteristics	https://doi.org/10.1111/ijfs.14812
Fried plantain	Plantain food products in Nigeria	https://doi.org/10.1111/ijfs.14780
boiled sweetpotato	Quality characteristics of boiled sweetpotato	https://doi.org/10.1111/ijfs.14792
fried sweetpotato	Fried Sweetpotato Preferences in West Africa	https://doi.org/10.1111/ijfs.14764
boiled potato	Gender-responsive traits in boiled potato	https://doi.org/10.1111/ijfs.14840

Success Story 2:

The RTBfoods Gender Working Group (GWG) consists of 16 members from 9 institutes, who are committed to progressing the research agenda on gender-responsive breeding. The group was developed as a response to the criticism of the lack of co-development of methods and research findings. From this critical and difficult realisation, we created something great that we hope will serve as an example to others, and be a group that can take forward other initiatives related to more gender-transformative work in the sector. To date, the GWG has worked extremely well: we developed and presented our initial findings at the GREAT gender-responsive crop breeding conference; wrote a blog on the presentation for the RTBfoods website, our findings informed PMU's presentation to the ANR conference on gender research methods, and we have co-developed a first draft of the Period 3 gender report submitted alongside this report.

Members of the GWG include (alphabetical, by institute, core writing team members in bold): P. Marimo (Bioversity-CIAT); O. Awoniyi (Bowen University); C. Kendine (CARBAP); S. Mayanja (CIP); F.N. Kégah (ENSAI-Cameroon); A. Sounkoura (IITA-Benin); J. Bakpe (IITA-Benin); H.N. Hubert (IITA-Cameroon); D. Olaosebikan (IITA-Nigeria); E. Stuart (IITA-Nigeria); B. Teeken (IITA Nigeria); P. Iragaba (NaCRRI), A.R. Nanyonjo (NaCRRI); T. Madu (NRCRI), B. Okoye (NRCRI); L. Forsythe (Natural Resources Institute). The products covered are matooke, boiled sweet potato and boiled cassava in Uganda;Gari, plantain products and boiled/pounded yam in Nigeria, and Gari in Cameroon.

8.2 Perspectives for period 4

Draft Period 4 WP Roadmap:
Identify major Next Steps at WP level in Period 4 & Priority Activities to be performed to reach these targets [± 1 page].

In Period 4, efforts will be made to transfer knowledge generated within Step 2, 3 & 4 under appropriate format to enable other WPs develop laboratory analysis methods. There will also be a number of activities performed jointly with WP2 (e.g. correlation between consumer mapping & sensory mapping) – transfer (or co-building) of WP1 Food Product Profiles.

Period 4 will also involve continuing the work of the GWG. This includes co-development of the WP5 guidance, recommendations, and/or tools, to inform breeders' selection tools with a gender and diversity perspective. We also plan to co-develop Period 4 output that answer the remaining three research questions and agree on plans for the Period 5 output. We also expect to produce a minimum of two publications in a peer-reviewed journal (Period 4 and 5, respectively). The WP1 Leader and Co-Lead (Lora Forsythe and Tessy Madu) are expected to continue facilitating this work and linking with other project and initiatives such as Excellence in Breeding and the Gender and Breeding initiative.

A lesson learning event will also be held as part of the annual meeting, facilitated by WP1 Co-Lead Tessy Madu and WP5 Co-Lead G. Ngoh. This initiative will invite all WP1 teams to reflect on their experience with WP1 activities and methodology and, through using their experience in using the tools, provide recommendations for improvements. It is expected that this will result in revisions to the manuals and possible a revised methodology paper in Period 5.

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