Laboratory Standard Operating Procedure

Sensory Characterization of Boiled Cassava

Biophysical Characterization of Quality Traits, WP2

Kampala, Uganda, October 2020

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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 panelists and from consumers participating in activities.

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RTBfoods

WP2: Biophysical Characterization of Quality Traits

SOP: Sensory Characterization of Boiled Cassava

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ABSTRACT

The sensory evaluation by trained panelists was conducted to establish a standard operating procedure (SOP) for routine undertaking of sensory evaluation to determine the quality of boiled cassava roots by by breeders to improve consumer acceptability of new varieties. Accordingly, we worked with the trained panellists to come up with a list of descriptors that could be used to assess the quality of boiled cassava roots. In total, 21 descriptors associated with appearance, texture, taste and aroma of boiled roots were determined. Having learnt from consumer-testing and surveys, there was need to establish standard descriptors that can be routinely used by sensory panelists to assess quality attributes during varietal development process by breeders. To this end, roots from different clones were harvested and prepared for cooking in a food science laboratory. After cooking, one clone was served to the panelist at a time, and requested to evaluate the sample based on their prior knowledge regarding appearance and texture both in mouth and touch; taste and aroma were also assessed. The panelists were given plain paper to write descriptors, after which a discussion was held with all panelists and the team facilitating the activity. The panelists were requested to highlight the key terminologies they had used to evaluate the attributes of cooked cassava. The highlighted descriptors were written on flip charts that were pinned on the wall of the training room so that everybody could easily follow the discussion. The highlighted descriptors were carefully grouped into categories such as texture by hand, aroma, appearance, taste, and texture by mouth. In the end, after a series of discussions and evaluating a number of cassava clones, a catalogue of 21 descriptors for boiled cassava was developed.

Key Words: Texture, aroma, appearance, taste, consumer, breeding, quality, cassava

1 SCOPE OF THE STUDY

1.1 Scope

This study was conducted to establish a standard procedure for undertaking sensory evaluation of boiled cassava roots while using a trained panel.

1.2 Prerequisite

The setting up and managing a sensory analysis tasting panel is explained in the deliverable: RTBfoods_F.2.2_2018.pdf

2 PRODUCT

2.1 Product Preparation in Laboratory conditions

Step 1: Harvesting and packaging roots for laboratory analyses

Harvest seven randomly selected plants in a cassava field of interest. From all the plants harvested, randomly select 10 marketable roots taking care of root representation of the whole sample set. Remove soil and debri from the roots and pack them in labelled bags for safe transportation (Figure 1).

Figure 1: Harvesting and selection of roots appropriate for sensory analyses

Step 2: First washing of the cassava roots to remove soil debris

Wash the cassava roots with clean water to remove dirt and/or adhering soil debris (Figure 2a).

Step 3: Trimming and Peeling of the roots

Cut off and discard about 5cm from both the proximal and distal ends of the roots, thereafter, peel the remaining middle/ central portion of the roots (Figure 2b).

Step 4: Cut the peeled roots into equal root sections (full cylinders) and second washing

Cut the peeled roots into equal root sections (full cylinders) of about 6cm long. Thereafter, randomly sample 14 to 15 root sections, wash and rinse them in clean water (Figure 2c).

Figure 2a: Cassava roots being washed to remove soil debris

Figure 2b: Cassava roots being peeled

Figure 2c: Washing of the cut root sections

Step 5: Wrapping the cassava root sections in banana leaves

Wrap the cassava root sections using banana leaves and tie the wrapped sections using banana fibres into a bundle (Figure 3a).

Step 6: Preparing the saucepan where to cook from

I. Obtain a sizable saucepan (measuring at least 29 cm in diameter and height of 15 cm) where to cook from,;

II. Lay the base of the saucepan with banana sheath (*emizingonyo*) to cover up an eighth of the saucepan (Figure 3b).

III. Thereafter, add approximately 1500 ml of clean water into the saucepan for each of the 14-15 sections representing a sample. This water is enough to cook one sample.

IV. Consequently, place a proportionate banana leaf such that it seals off both the water and banana sheath in the saucepan (Figure 3c).

V. Thereafter, place the labelled and wrapped cassava roots in their bundles on top of the banana leaf laid (Figure 3d).

VI. Ensure that equal numbers of marketable roots are sampled per accession to generate 14-15 root sections so that the wrapped cassava root sections are all about the same weight for each of the accessions being evaluated.

VII. Next, cover the wrapped cassava roots bundles with 2 to 3 paired layers of large banana leaves (Figure 3e) to ensure that the steam generated during cooking does not escape since the cassava roots are cooked by this steam.

VIII. Afterwards, cover with another saucepan of relatively similar size (Figure 3f).

Figure 3a: Wrapping of the cleaned cassava root sections in banana leaves

Figure 3b: Saucepan laid with banana sheath

Figure 3c: Saucepan laid with banana leaf to seal off the water and banana sheath

Figure 3d: Wrapped root sections awaiting to be put in the saucepan laid with banana sheath in preparation for cooking

Figure 3e: Wrapped cassava roots covered with additional banana leaves to avoid loss of steam

Figure 3f: Wrapped cassava roots sealed with saucepan prior to boiling. Additionally done to avoid loss of steam

Step 7: Cooking

Start cooking the prepared cassava immediately once procedures described in step 6 are completed. This should be done using an electric or gas cooker.

1. Place the covered saucepan with wrapped cassava root sections on one of the burners of the gas cooker (Figure 4), and cook for 55 minutes. Use a stop clock with an alarm to set the time. Ensure that for all the samples, you use same size of burners and set the temperature to maximum. It is important that maintain the same amount of water, temperature and cooking time across all test samples. A summary of critical procedures to adopt during preparation of boiled roots for sensory analysis is outlined in Figure 5.

Figure 4: Cooking taking place on a four-burner gas cooker

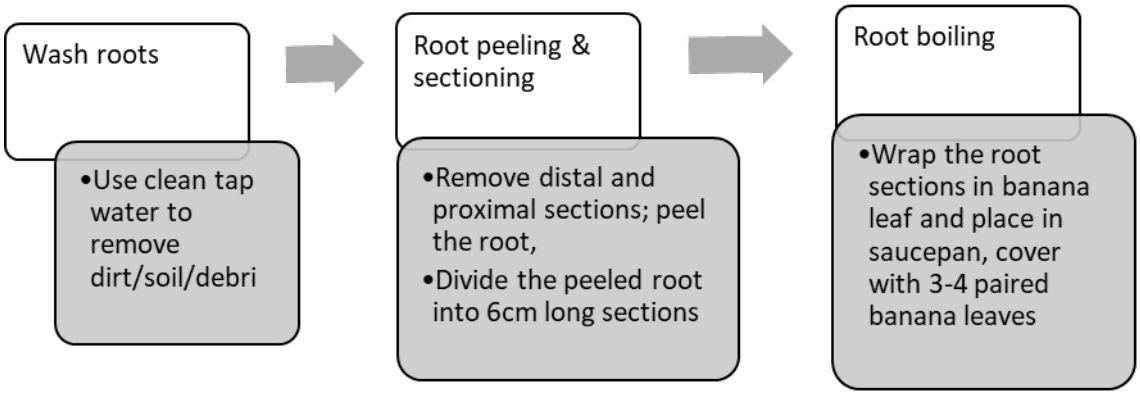

Figure 5: A summary of the critical steps involved in preparation of cassava roots for boiling

2.2 Sample storage conditions before sensory evaluation

I. At the end of the cooking time (55 minutes), turn off the gas cooker, but leave the saucepan covered to avoid cooling.

II. After 10 minutes from when cooking time ended, serve the boiled roots to panelists for evaluation (Figure 6).

2.3 Serving and assessing of the cooked samples for sensory evaluation

I. Serve a reference sample and insert a thermometer ensuring that the probe is in the middle of the sample as shown in figure 7 below.

II. Then serve and present test samples to the panellists. The panellists immediately assesses the attributes related to appearance.

III. Thereafter, the panellists should be told to wait to assess the texture attributes until when they are signalled as soon as the temperature of the reference sample dropped to **65 °C** (Figure 7).

IV. After assessing texture, the panellists should proceed with taste and end with aroma-related attributes.

3 TASTING SEQUENCE

3.1 General Information

3.1.1 Test Responsible Person/Group Animator

Ms. Elizabeth Khakasa, Food Scientist, NARL-Uganda, lizkhakasa@gmail.com

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Ms. Ann Ritah Nanyonjo, Gender Responsive Cassava Breeder, NaCRRI-Uganda, nanyonjoritah@gmail.com

3.1.2 Date/Time Phase of the test

The tests were done between 10th August 2020 and 14th August 2020; sensory evaluations were conducted between 12.00 and 1.00 PM.

3.2 Sample

3.2.1 Quantity of sample to be given to each panellist

Each panellist was served with one root section of each sample.

3.2.2 Type of dish

Disposable Plastic plate

3 	
Samples being served on the disposable plastic plates	Sample on a disposable plastic plate being evaluated by one of the panelists

Figure 6: Serving of boiled cassava roots on disposable plastic plates in preparation for sensory evaluation by a panelist

Temperature of tasting

To limit variability, all panelists were signaled to start the evaluation at the same time when the temperature of the root samples was at 65 °C (Figure 7).

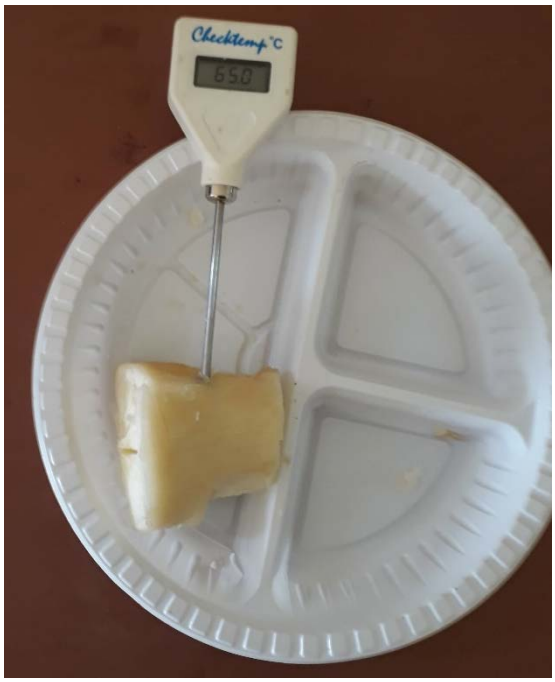

Figure 7: A thermometer inserted in the reference sample to ensure all panelists evaluate texture at the same temperature

3.2.3 Repeated sample

For each day, at least one boiled root sample was replicated for sensory evaluation as highlighted in Table 1. The purpose was to find repeatability of both individual panellists and the entire panel as whole.

3.2.4 Table 1: An example showing summary of cassava sample codification

Accession_name	*Categorisation*	*Replication*	*Sample Code*	*Tasting date*	*Tasting Code*
UG15F064P087	Elite	1	125	10thAUGUST2020	125
UG15F079P011	Elite	1	432	10thAUGUST2020	432
UG15F079P002	Elite	1	467	10thAUGUST2020	467
UG15F079P002	Elite	2	542	10thAUGUST2020	542
UG15F192P017	Elite	1	712	10thAUGUST2020	712
UG15F007P013	Elite	1	782	10thAUGUST2020	782
UG15F140P003	Elite	1	259	11thAUGUST2020	259
UG15F306P028	Elite	1	324	11thAUGUST2020	324
UG15F034P001	Elite	1	417	11thAUGUST2020	417
UG15F170P507	Elite	1	477	11thAUGUST2020	477
UG15F201P517	Elite	1	544	11thAUGUST2020	544
UG15F140P003	Elite	2	549	11thAUGUST2020	549
UG15F258P002	Elite	1	209	12thAUGUST2020	209
UG15F176P502	Elite	1	276	12thAUGUST2020	276
UG15F258P002	Elite	2	498	12thAUGUST2020	498
UG15F173P007	Elite	1	527	12thAUGUST2020	527
UG15F158P001	Elite	1	893	12thAUGUST2020	893
UG15F020P001	Elite	1	896	12thAUGUST2020	896
MKUMBA	Elite	1	288	13thAUGUST2020	288
UG15F233P046	Elite	1	432	13thAUGUST2020	432
UG110017	Released variety	1	502	13thAUGUST2020	502
UG15F302P016	Elite	1	774	13thAUGUST2020	774
UG110017	Elite	2	875	13thAUGUST2020	875
UG15F196P004	Elite	1	943	13thAUGUST2020	943
UG15F177P005	Elite	1	141	14thAUGUST2020	141
UG15F106P002	Elite	1	352	14thAUGUST2020	352
UGC14142	Elite	1	442	14thAUGUST2020	442
MM14_0629	Elite	1	615	14thAUGUST2020	615
UGC14083	Elite	2	808	14thAUGUST2020	808
UGC14083	Elite	1	825	14thAUGUST2020	825

Repetition = number of replications; Sample Code = label on the sample from the field; Tasting date = day on which the sensory evaluation was conducted; Tasting Code = the label assigned to the sample in the laboratory

3.3 Service

3.3.1 Number of samples tasted by session

The number of samples tasted per session ranged from 5 to 6.

3.3.2 Type of service

Monadic: the samples are served one after the other i.e. serve the next sample after all the panellists have tasted the given sample.

3.4 Panel

The number of trained panellists ranged between 10-12 members.

3.5 Vocabulary

There are 21 sensory attributes defined in this SOP as indicated in the table 2 below. 16 attributes were evaluated in intensity on a 0-10 scale and 5 in presence / absence. The definition of the sensory attributes is facilitated by the norm ISO standard NF 5492-2009.

Table 2: Sensory attributes evaluated on boiled cassava roots

Type	Attributes	Definition	How to measure?	Scale
Appea-rance	Yellow	Colour of cassava root surface varies from light yellow to bright yellow	When you receive a cassava root sample, observe the surface and evaluate the intensity of the colour, homogeneity, translucency, and surface smoothness.	0: Non-yellow 10: Bright yellow
	White	Colour of cassava root surface varies from cream to bright white		0: Cream 10: Bright white
	Homogeneity of colour	Uniformity of cassava root surface colour		0: Heterogeneous 10: Homogeneous
	Surface Smoothness	Absence of roughness, lumps, holes, fibre lines, and ridges along the cassava root		0: Very Rough 10: Very Smooth
Texture in mouth	Softness	Mechanical textural attribute relating to the force required to achieve a given deformation, penetration, or breakage of a product.	Put a part of boiled sample into the mouth, evaluate during the first bite (between molars) how hard the sample is.	0: Soft 5 : Firm 10: Hard
	Moisture	Perception of moisture content of food by the tactile receptors in the mouth, and also in relation to the lubricating properties of the product	Put a part of boiled sample into the mouth, chew and evaluate the quantity of water within the sample.	0: Dry 10: Moist
	Smoothness	Geometrical textural attribute relating to lack of presence of particles in a product	Put a part of boiled sample into the mouth, chew it and after 10 chews, evaluate between tongue and palate the number and the size of the particles.	0: Lumpy 5: Grainy 10: Smooth
	Fibrousness	Feeling of threads/fibres as you chew	Put a part of boiled sample into the mouth, chew it and after 10 chews, evaluate between tongue and palate the presence and amount of fibre you feel.	0: Non Fibrous 5: Medium Intensity 10: Very Fibrous
	Mealiness	Characterised by being dry and crumbly like boiled egg yolk	Put a part of boiled sample into the mouth, chew it and after 5 chews, evaluate between tongue and palate the extent of dry and crumbly	0: Not mealy 5: Medium Mealiness 10: Very mealy
	Kiwuta	Characterised by any of the following: "*oozes upon squeezing*" "*crunchy like raw carrot*" "*remains raw after cooking*" "*glassy appearance*" "*tasteless*", "*sweeter than original*" and usually have off-flavour	Put a part of boiled sample into the mouth, chew it and after 5 chews, evaluate between tongue and palate the presence of the given characteristics	YES/NO

Type	Attributes	Definition	How to measure?	Scale
Texture in mouth	Stickiness	Mechanical textural attribute relating to the force required to remove material that sticks to the mouth	Put a part of boiled sample in the mouth, chew it and evaluate: Amount of product adhering on/in the teeth after product mastication, and force required to remove product completely from the palate, using the tongue, after complete compression of the sample between tongue and palate	0: Non sticky 10: Sticky
Texture by touch	Mealiness	Characterised by being dry and crumbly like boiled egg	Put a part of the boiled sample between thumb and index fingers and try to press it, evaluate the dryness and ability of product forming into powder	0: Not mealy 5: Medium Mealiness 10: Very mealy
	Moldability	Mechanical textural attribute relating to the degree to which a substance can be deformed before it breaks	Try to make a ball (agglomerate) of the boiled sample and evaluate how easy it is to deform or break it	0: Crumbly 10: Moldable
	Stickiness	Mechanical textural attribute relating to the force required to remove material that sticks to the finger	Put a part of the boiled sample between thumb and index fingers and using tapping motions, evaluate the amount of product adhering on them	0: Non sticky 10: Sticky
Taste	Sweetness	Basic taste produced by dilute aqueous solutions of natural or artificial substances such as sucrose	Put a part of the boiled sample into the mouth and evaluate the intensity of taste of sugar	0: No sweetness 3: Low intensity 6: Medium intensity 10: High intensity
	Bitterness	Basic taste produced by dilute aqueous solutions of natural or artificial substances such as quinine	Put a part of the boiled sample into the mouth and evaluate the intensity of bitterness	0: No bitterness 3: Low intensity 6: Medium intensity 10: High intensity
	Bitter after taste	Feeling of slight bitterness after swallow	Put a part of the boiled sample in the mouth and evaluate whether bitter after swallowing	YES/NO
Aroma	Cassava	Aroma of the steamed cassava	Put a part of the boiled sample and by retro-olfaction, evaluate the presence and the intensity of this specific aromas	0: Low intensity 5: Medium intensity 10: High intensity
	Roasted Cassava	Aroma of roasted cassava		YES/NO
	Yam	Aroma of yam		YES/NO
	Sweet Potato	Aroma of sweet potato		YES/NO

3.6 Pictures to illustrate the tasting sessions

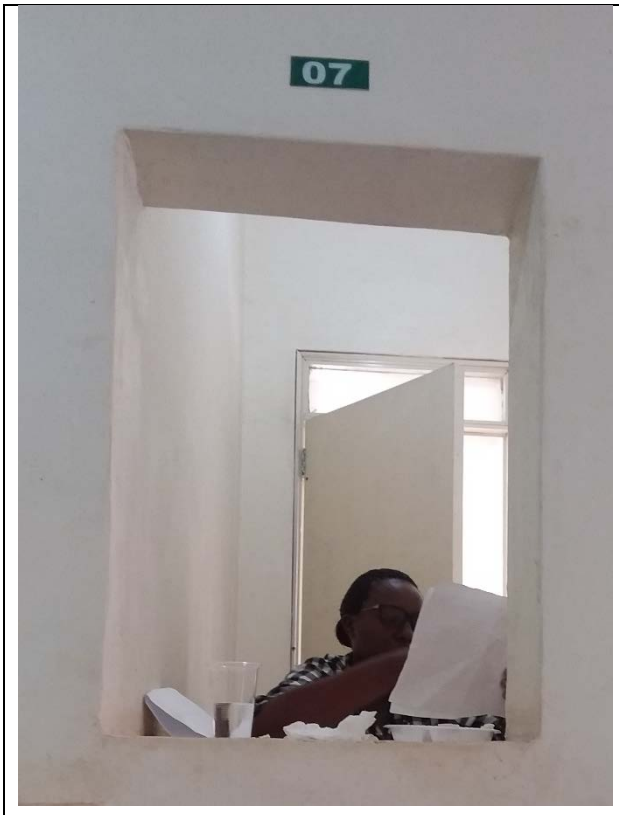	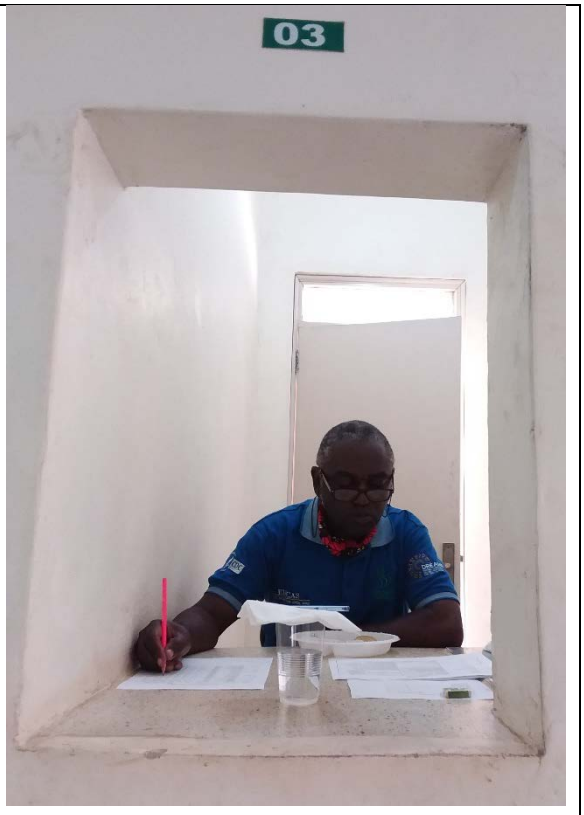
Panellist in booth 07 tasting one of the samples	*Panellist in booth 03 tasting one of the samples*

Figure 8: Some of the pictures of panellists undertaking sensory evaluation

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