Field Scientific Report

Participatory Processing Diagnosis of Boiled Sweetpotato in Uganda

Understanding the Drivers of Trait Preferences and the Development of Multi-user RTB Product Profiles, WP1

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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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CONTENTS

Table of contents

List of figures

List of tables

ABSTRACT

The purpose of this activity was to understand the important quality characteristics of boiled/steamed sweetpotato from the perspective of processors, through participatory processing demonstrations from raw material to finished product. The activity was conducted in Northern (Lira) and Western Uganda (Kamwenge). 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 characteristics 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. Overall, in Lira, Otada (local) was the most preferred variety followed by Okonynedo (local) with NASPOT 8 (improved) and Arakaraka (local) jointly ranked third. In Kamwenge, NASPOT 8 (improved) was most preferred, followed by Kiribwamukwe (local), Otandibata (local) and lastly Ndererabaana (local).

Key words: sweetpotato, participatory processing, boiling, steaming, quality characteristics

1 STUDY CONTEXT AND GENERAL OBJECTIVES

This activity involved participatory preparation of boiled sweetpotato together with processors to understand their preferred quality characteristics before, during and after cooking. This activity contributed to the overall boiled sweetpotato profile by augmenting findings from Step 2 (gendered food mapping). The most important key processing unit operations to ensure quality boiled sweetpotato were also identified. This information was fed into Step 4 (consumer testing) and provided reference processing methods for preparing boiled sweetpotato. Also, the variety quality characteristics obtained were integrated into the questionnaire in the following Activity.

2 METHODOLOGY

2.1 Study area

The activity was conducted in Lira (northern Uganda) and Kamwenge (western Uganda) in October 2019. Step 2 had also been conducted in the same areas.

2.2 Raw material choice

Four sweet potato varieties (landraces and improved) were selected from each of the two sites under study using preference ratings from Focus Group Discussions (FGDs), Key Informant Interviews (KII) and individual interviews (IIs) in Step 2. The varieties used included the most, intermediate and least preferred varieties to cover the range of preference by location. In Lira these were Araka raka (local), Okony nedo (local), NASPOT 8 (improved) and Otada (local). While in Kamwenge, they were Kiribwamukwe (local), NASPOT 8 (improved), Ndererabaana (local) and Otandibata (local) (**Figure 1**). Eight processor demonstrations were conducted in total, 4 at each location.

Kiribwamukwe Ndererabaana NASPOT 8 Otandibata

Figure 1 Sweetpotato varieties - Kamwenge

2.3 Product profile processing

At each location, four experienced domestic or semi-commercial processors were identified with the help of our partners; World Vision in Lira and Samaritan's Purse in Kamwenge. Women usually prepare the food in these areas and all processors were female in line with the culture. The processors were interviewed individually before, during and after each processing step to obtain views and opinions on the sweetpotato varieties under study. Qualitative and quantitative data were collected simultaneously. Qualitative data was collected using a structured questionnaire and quantitative data at each preparation step was systematically entered in data sheets.

3 RESULTS

3.1 Raw material characteristics

3.1.1 Weight

The average weight of sweetpotato roots ranged from 211 g (Otandibata) to 337 g (NASPOT 8) in Kamwenge as shown in **Figure 2A**.

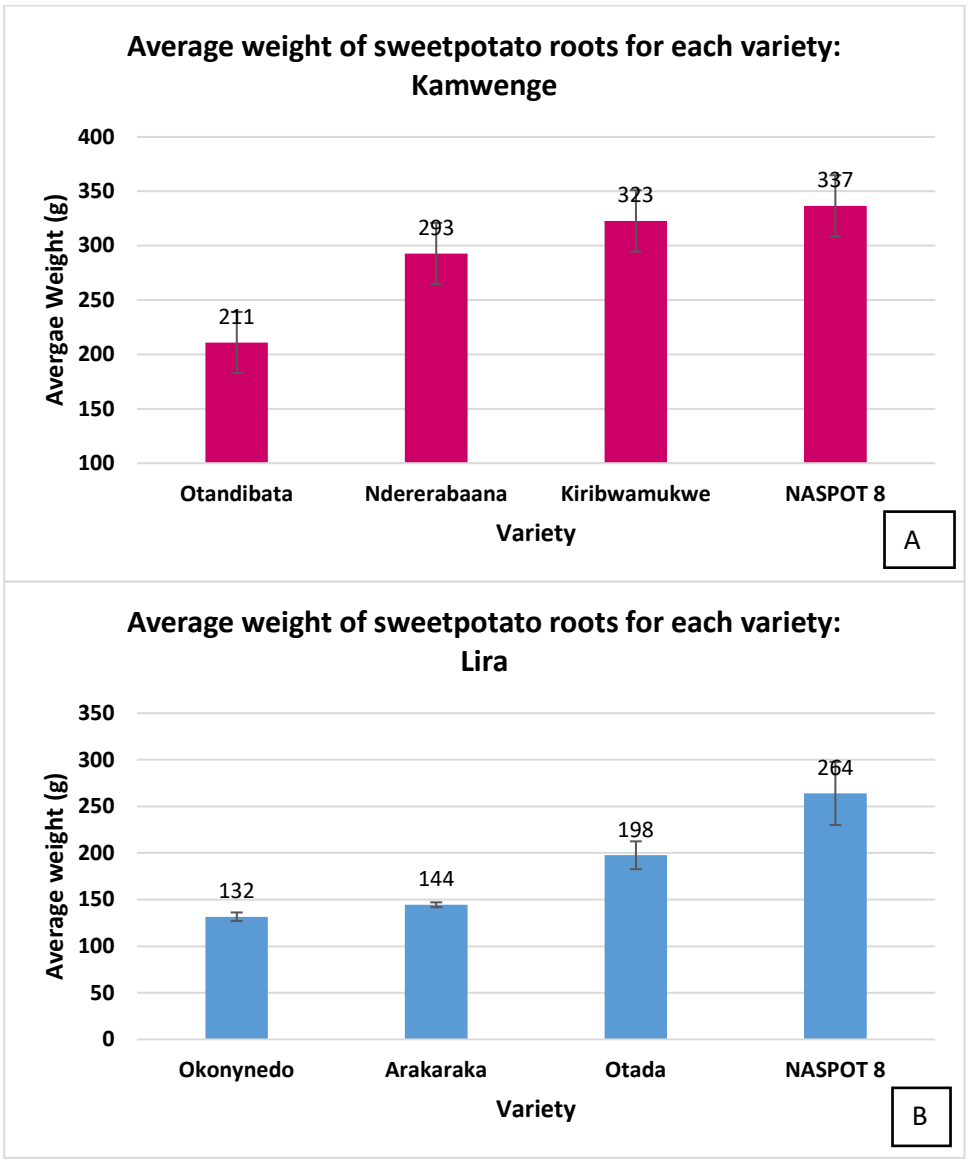


Figure 2 Weight average (g) of sweetpotato root for each variety under study in Kamwenge (A) and Lira (B)

Figure 2B shows the average weight of sweetpotato roots for varieties under study in Lira. It varied from 132 g (Okony nedo) to 264 g (NASPOT 8). In both locations, NASPOT 8 had the highest average weight per root. In addition, the sweetpotato varieties from Kamwenge had a higher average weight per root than those from Lira.

3.1.2 Dry matter content

Dry matter content of raw and boiled sweetpotato varieties from Lira are shown in **Figure 3**. The dry matter of raw sweetpotato varied from 35.6% (Araka raka) to 40.6% (Okony nedo). When boiled, dry

matter content ranged from 35.4% (Okony nedo) to 42.7% (Otada). The dry matter of boiled Otada roots was significantly different from that of other varieties. It is also worth noting that dry matter increased after cooking for all varieties except Okony nedo.

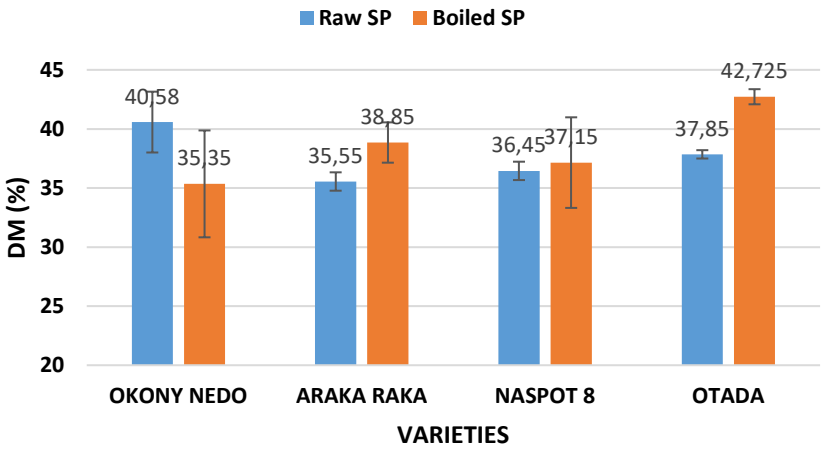


Figure 3 Dry matter content of raw and boiled sweetpotato varieties

3.1.3 Qualitative information collected on the raw material

General characteristics (good and poor quality) of raw sweetpotato by location are summarised in **Table 1.** In Lira, the most preferred raw sweetpotato characteristics were smooth skin, big size roots, White flesh colour and heavy in the hands. On the contrary, rough skin, too much sap, soft and watery roots were identified as least preferred characteristics.

Table 1 *Characteristics of raw sweetpotato in Lira and Kamwenge*

Location	Good quality	Poor quality
Lira	smooth skin (7) big size (4) white flesh colour (4) heavy in the hands (3) sweet taste (3) hard root (2) not watery (2) red skin colour (2) good smell (1) moderate thick skin (1) not rotten (1) not sappy (1) purple skin color (1) purple skin colour (1) yellow flesh colour (1)	rough skin (4) sappy (2) soft (2) watery (2) cream peel colour (1) has fibres (1) not sweet (1) rotten (1)

Location	Good quality	Poor quality
Kamwenge	Sappy (4) nice skin color: red, spotless (3) Hard root (3) Firm peel (3) Mealy (3) Nice shape: smooth and straight (2) Sizeable: moderate-big size (2) Deep orange flesh color (1) Crunchy (1) Non-fibrous (1) Medicinal (1) Sweet taste (1) Smooth skin (1)	Bad skin color: pale, non-uniform, black spots (3) Fibrous (3) Loose outer skin (2) Bad flesh color: white, black spots (2) Not mealy (2) No sap (2) Watery (2) Not sweet (2) Small (1) Soft (1) Too dry (1) Bitter (1) Rough skin (1)

In Kamwenge, the most important characteristics of raw sweetpotato were sappy, nice skin color, hard root, firm peel and mealy. Nice skin color was defined as a homogenous red skin color, free of spots which often indicates disease or rot. On the other hand, fibrous sweetpotatoes with a bad skin color were thought of as roots that would give poor quality sweetpotato. Processors considered sweetpotatoes with skin, which is pale or non-uniform in color, or with black spots as having bad skin color. This is in direct contrast to the definition of a nice skin color.

3.2 Product profiling

3.2.1 Unit operations of product profile process

The two methods used to prepare sweetpotato in Lira and Kamwenge are shown in **Figure 4.** In Lira, the direct boiling method is preferred where the peeled sweetpotato roots are partially submerged in water in a saucepan, covered with another saucepan and boiled directly. In Kamwenge, steaming is more common (**Figure 5**). The peeled sweetpotato roots are wrapped in banana leaves and placed in a saucepan containing water, banana stalks and banana leaf midribs at the base. The wrapped sweetpotato roots are not in direct contact with the water.

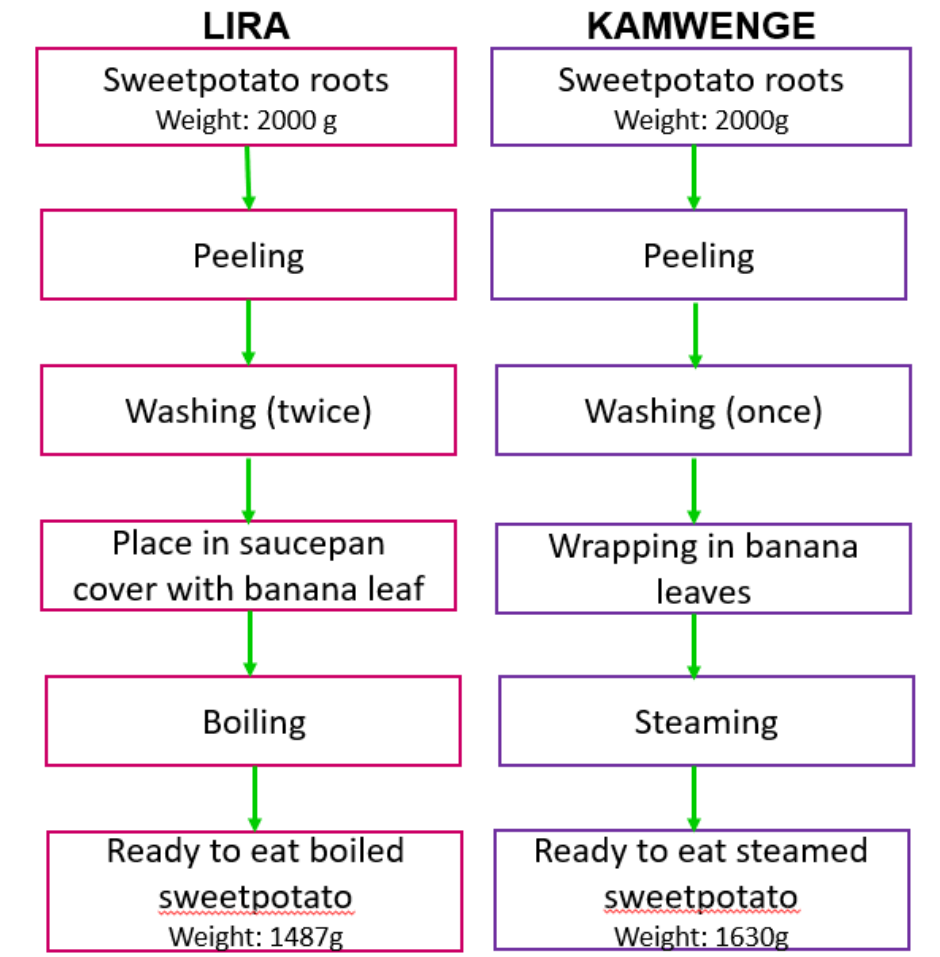


Figure 4 Flow diagram of boiled sweetpotato process in Lira and Kamwenge

Processors in Lira emphasised that washing was done twice to remove soil and sap. If not washed well, residual sap in the final product would lower the quality in terms of appearance (black marks) and taste (sappy/astringent taste). Therefore, washing was done until all sap was removed that is, when not sticky in the hands).

Peeling

Washing

Wrapping

Steaming

Steamed sweetpotato

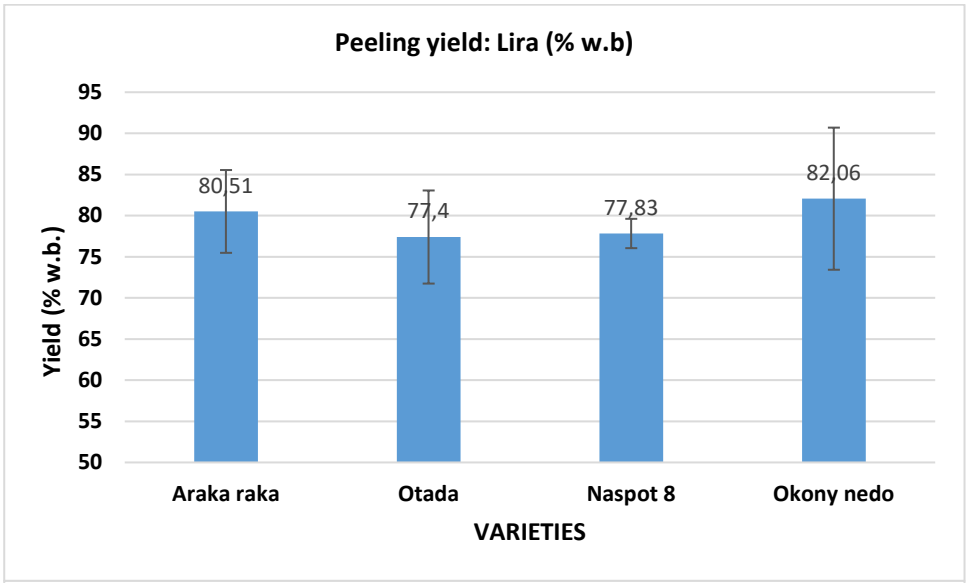
Figure 5 Steamed sweetpotato process - Kamwenge

3.2.2 Unit operations characterization

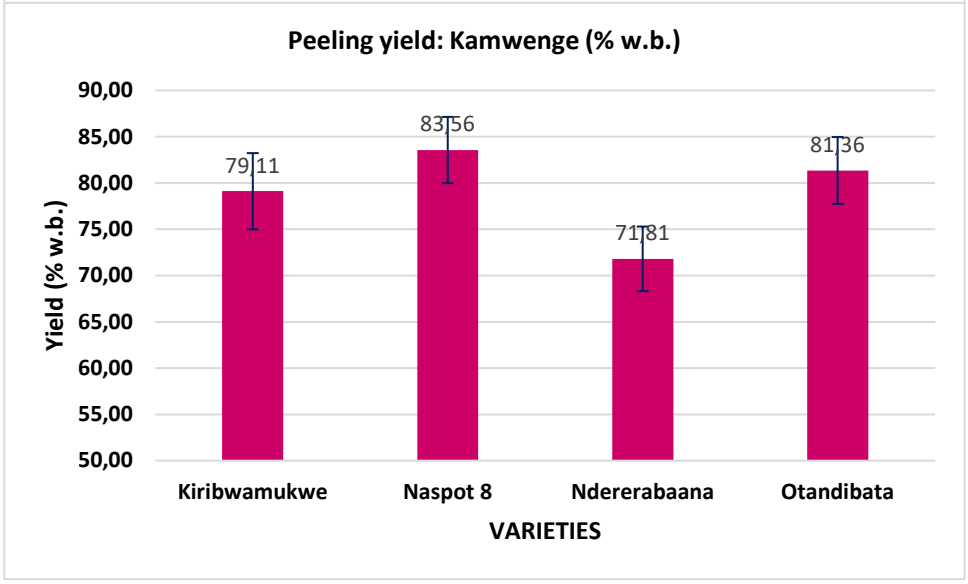
Peeling

Peeling yield

In Lira, the peeling yield varied from 77.4 % to 82.06 % (**Figure 6A**). Okony nedo had the highest while Otada had the lowest yield. There were no significant differences in yield among the four varieties. In Kamwenge, it ranged from 72 % for Ndererabaana to 84 % for NASPOT 8 (**Figure 6B**). NASPOT 8 and Otandibata had significantly higher peeling yield than Ndererabaana. In relation to ease of peeling, there was polarity between processors with 50% of them rating NASPOT 8 as 'easy to peel'. Otandibata was deemed 'not easy to peel' by 75% of the processors.



A



B

Figure 6 Peeling yield of sweetpotato varieties in Lira (A) and Kamwenge (B)

Peeling productivity

Peeling productivity in Lira is shown in **Figure 7A**. It varied from 12.02 kg/hr/processor to 14.53 kg/hr/processor. NASPOT 8 had the highest while Araka raka had the lowest productivity. However, these differences were not significant. This could be linked to root size/weight where NASPOT 8 had the highest average root weight while Araka raka was among the lowest (Figure 2).

In Kamwenge, as shown in **Figure 7B**, peeling productivity ranged from 10.14 kg/hr/processor (Otandibata) to 15.84 kg/hr/processor (Kiribwamukwe). This follows the variation in peeling time since the duration of peeling Kiribwamukwe was significantly shorter than Otandibata and NASPOT 8. This observation indicates that Kiribwamukwe was perhaps easy to peel. Indeed 3 of the four processors (75%) said that this variety was easy to peel while 75% said that Otandibata was not easy to peel. More so, Kiribwamukwe also had a high average root weight whereas Otandibata had the lowest and thus the observed high productivity.

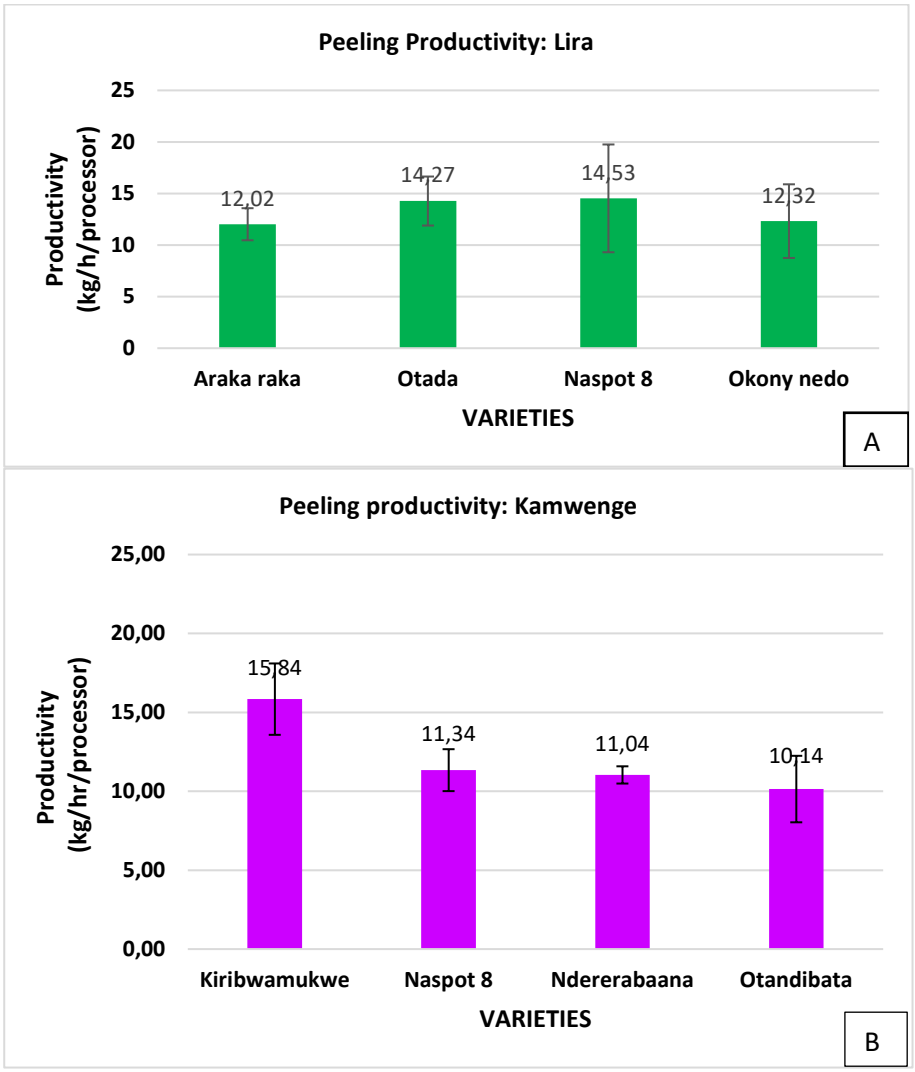


Figure 7 Peeling productivity of sweetpotato varieties in Lira (A) and Kamwenge (B)

According to these findings, varieties with high average root weight (big size) such as NASPOT 8 (Lira) and Kiribwamukwe (Kamwenge) also had a high peeling productivity. However, on the contrary, varieties such as NASPOT 8 (Kamwenge), despite their high average weight (and big size) were deemed difficult to peel because of having a soft peel and many 'eyes' and, this could have contributed to their relatively lower peeling productivity.

Boiling

Boiling yield

The boiling yield of sweetpotato varieties in Lira varied from 74.8 % to 82.1 % (**Figure 8A**). In Kamwenge, as shown in **Figure 8B**, boiling yield ranged from 72.9 % (Ndererabaana) to 82.0 % (Kiribwamukwe). The trends of peeling yield and boiling yield were similar in both locations however the varietal differences were not significant.

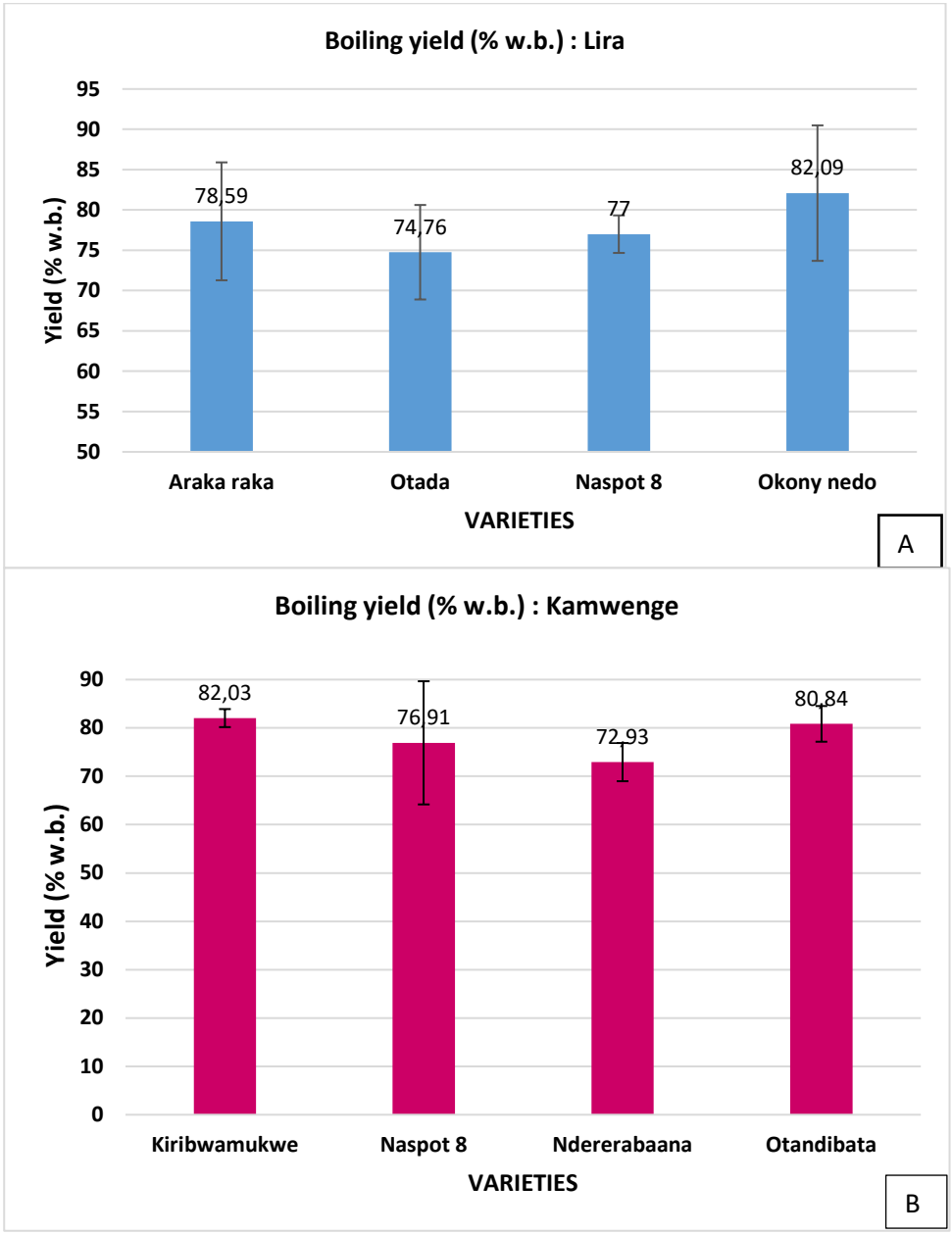


Figure 8 Boiling yield of sweetpotato varieties in Lira (A) and Kamwenge (B)

Boiling Productivity

Productivity of the boiling operation is shown in **Figure 9**. Boiling productivity varied from 1.79 kg/hour/processor to 2.54 kg/hour/processor in Lira. Araka raka had the highest while NASPOT 8 had the lowest productivity however the varietal differences were not significant. In Kamwenge, boiling productivity ranged from 1.38 kg/hour/processor for Ndererabaana to 1.66 kg/hour/processor for Otandibata. It took Otandibata a shorter time to get cooked probably because it was soft as indicated by most processors.

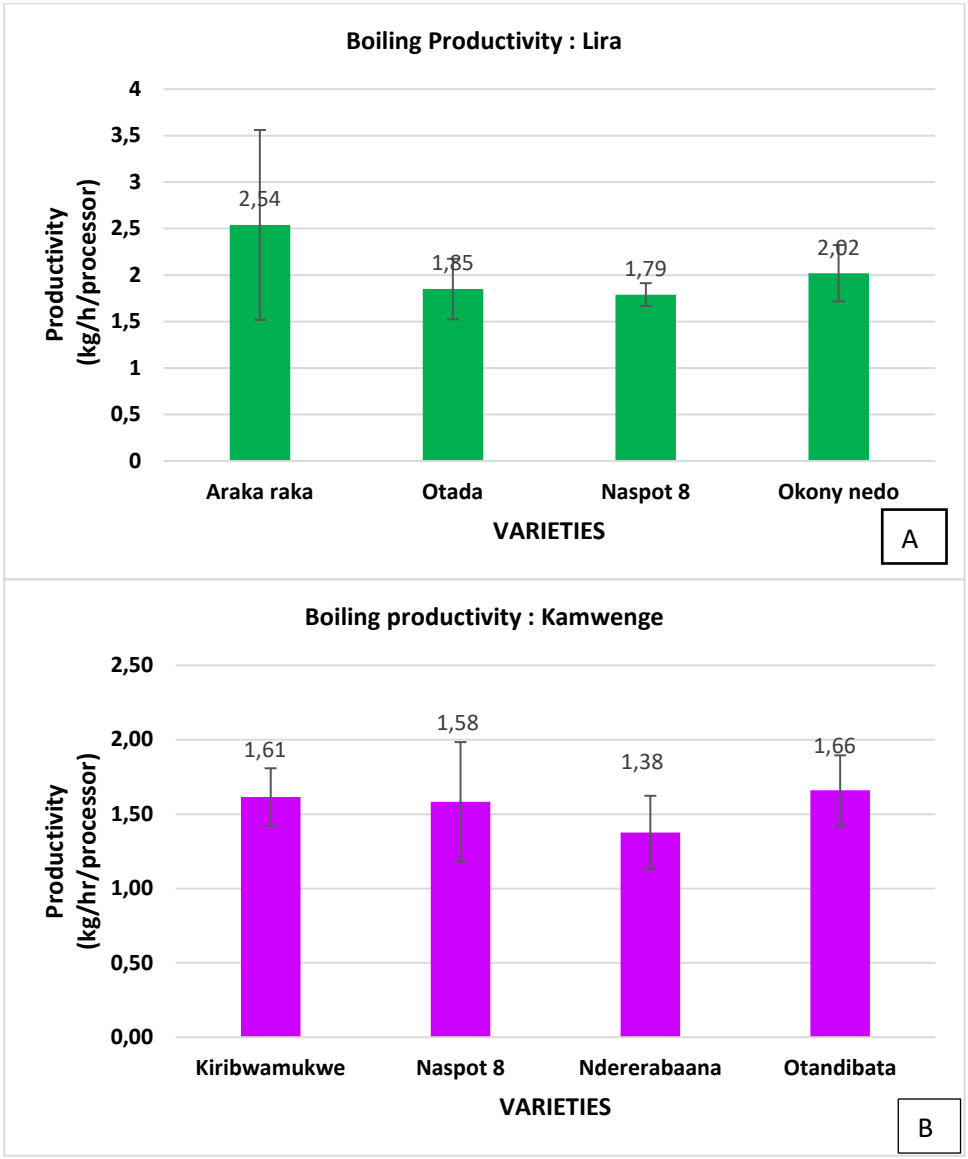


Figure 9 Boiling productivity of sweetpotato varieties in Lira (A) and Kamwenge (B)

3.3 End-product processors appreciation

3.3.1 End-products descriptors

According to **Table 2**, regarding appearance, processors in Lira indicated that sweetpotatoes that were yellow or white in colour and had no sap were preferred to those with sap. Preferred textural characteristics were mealy, soft, not watery and smooth sweetpotato while fibrous, watery and very soft were undesirable. Naturally, sweetness was also a desired characteristic of boiled sweetpotato. Processors also liked a good sweetpotato smell but not an off-odour or no smell.

Table 2 Boiled sweetpotato high quality and poor-quality characteristics in Lira and Kamwenge

Appearance/Colour		**Textural**		**Taste**		**Flavour/Odour**	
High quality	Poor quality	High quality	Poor quality	High quality	Poor quality	High quality	Poor quality
LIRA							
• No sap (10) • yellow colour (7) • white colour (3) • white spots (2) • orange colour (1)	• sappy (4) • black spots (1) • cracked surface (1) • white colour (1)	• Mealy (15) • Soft (6) • not watery (5) • smooth (5) • firm (4) • smooth surface (4) • no fibres (3) • thick (2)	• has fibres (9) • watery (6) • very soft (2)	• sweet taste (12)	• not sweet (5)	• good smell (10)	• no smell (1) • off-odour (fermented) (1)
KAMWENGE							
• Nice color: yellow, white, whitish on the inside (4) • Shiny surface (1) • Smooth surface (1)	• Pale color (3) • Non-uniform color (2) • Not white (1)	• Mealy (4) • Firm (4) • Starchy (3) • Not fibrous (2) • Dry (1) • Sticky (1) • Not watery (1) • Slow rate of breakdown (1)	• Fibrous (4) • Soft (4) • Watery (4) • Not mealy (2) • Fast rate of breakdown (1)	• Sweet (3)	• Not sweet (4)	• Good SP aroma (2)	• Off odour (1)

In Kamwenge, the processors stressed the importance of color in evaluating quality of boiled sweetpotato (**Figure 10**). Sweetpotato that was white or yellow in color with a whitish centre was preferred to that of a pale or non-uniform color. This is in line with the characteristics and preferences of raw sweetpotato. The processors in Kamwenge were also keen on the textural attributes of the product. Mealiness, firmness and starchy texture were associated with a good product while fibrousness, being watery and softness were considered poor quality. The most important taste and flavour/odour characteristics were the same as those observed in Lira. Overall, the characteristics considered important were similar in both areas.

Steamed NASPOT 8 Steamed Ndererabaana Steamed Otandibata

Figure 10 Steamed sweetpotato varieties - Kamwenge

3.3.2 Preferred and least preferred sweetpotato varieties

Table 3 Varietal preference of boiled sweetpotato in Lira and Kamwenge

Region	Variety	Rank
Lira	Otada	1
	Okony nedo	2
	NASPOT 8	3
	Araka raka	3
Kamwenge	NASPOT 8	1
	Kiribwamukwe	2
	Otandibata	3
	Ndererabaana	4

In Lira, Otada was the most preferred sweetpotato variety followed by Okony nedo and NASPOT 8 and Araka raka jointly ranked third (Table 3). However, all the varieties demonstrated similar and overall good quality characteristics in terms of appearance, flavour, texture and taste.

The results indicate that Otada and Okony nedo, as raw material, have the higher dry matter content (37.85% and 40.58%, respectively). At the end of the cooking operation we can observe that the dry matter content of Otada increase (42.72 %) while the dry matter of Okony nedo decrease (35.35%). These large variations in behaviour seem to contrast with the small variations observed in the two other less appreciated varieties. It can be hypothesized that the matrix (cell wall) of each of these sweetpotato varieties react differently to the cooking process, thus providing different textures of the finished product, and different appreciations. To be linked with WP2.

In Kamwenge, NASPOT 8 was the most preferred sweetpotato variety, followed by Kiribwamukwe. Ndererabaana was the least preferred sweetpotato (Table 3). Ndererabaana, unlike NASPOT 8 was soft, neither mealy nor sweet, had an off-odour and bad appearance.

There were some notable similarities and differences in variety preference before (raw material) and after cooking (end-product) in Kamwenge. Most processors (75%) selected NASPOT 8 as the variety with best raw material and product characteristics. However, only 1 processor (25%) identified Ndererabaana as the worst raw material yet 75 % of the processors selected it as the worst product. This indicates that raw material characteristic are perhaps not reliable indicators of poor-quality product. Therefore, breeders should consider characteristics of boiled roots when developing selection criteria in order to meet consumer needs.

4 CONCLUSION

Morphological and sensory characteristics are of utmost importance in the quality of sweetpotato before, during and after cooking. While morphological characteristics such as size, skin color, and root texture are overriding factors before cooking (raw material), sensory characteristics including firmness, mealiness, color (hue, intensity and distribution), sweetness, and nice flavor are predominant quality determinants during (processing) and after cooking (end-product). Breeders may need to use a comprehensive selection criterion that considers these both morphological and sensory characteristics in order to appropriately satisfy consumer needs.

The congruence between variety ranking according to raw material and end-product characteristics, especially with regards to poor quality sweetpotato in Kamwenge demonstrates that product quality cannot be reliably concluded from the quality of raw materials. Therefore, development of selection criteria should include traits linked to cooked product characteristics for effective breeding.

5 APPENDICES

5.1 Appendix 1: Summary table of quantitative data

Variety/ Location	**Raw material characteristics**		**Processing quantitative data**				
			Peeling unit operation	**Boiling unit operation**			**End products**
Lira	Weight (g)	Dry matter (%)	Yield (%)	Productivity (kg/h/op)	Boiling time (min)	Yield (%)	Dry matter (%)
Araka raka	144	35.55	80.51	12.02	42.35	78.59	38.85
Otada	198	37.85	77.40	14.27	43.44	74.76	42.72
NASPOT 8	264	36.45	77.83	14.53	52.56	77.00	37.15
Okony nedo	132	40.58	82.06	12.31	48.75	82.09	35.35
Kamwenge							
Kiribwamukwe	323		79.11	15.84	64.67	82.03	
NASPOT 8	337		83.56	11.34	62.33	76.91	
Ndererabaana	293		71.81	11.04	67.33	72.93	
Otandibata	211		81.36	10.14	61.33	80.84	

5.2 Appendix 2: Overview of quality traits of raw potato, potato processing and boiled potato

LIRA									
Name of varieties	**Raw product**				**On the cooked**				
	Agronomical characteristics	**Technological characteristics at each step of the process**			**Sensory characteristics**				
		Peeling	***Washing***	***Example***	**When you look at**	**Texture when you touch**	**When you smell**	**Taste (In mouth)**	**Texture when you chew After-taste**
OKONY NEDO (545)	• Smooth skin • Firm root	• Moderate sap • Easy to peel • Yellow flesh colour • Smooth skin • Firm root	• No sap • Smooth flesh surface		• Yellow colour • Not watery • No fibres • Has white spots inside – a sign of mealiness • Surface is smooth • No sap	• Not watery • Soft • Medium thick • No sap • Firm • Floury in the hands (mealy)	• Good smell	• Sweet taste • No sap	• Soft • Floury (mealy)
ARAKA RAKA (760)	• Smooth skin • White flesh colour • Hard/firm root	• Easy to peel • Moderate sap • Thick flesh • White flesh colour • Smooth skin • Smooth flesh surface	• No sap • Smooth flesh surface	•	• White colour • Smooth surface • No visible sap • Has whitish spots inside – sign of mealiness	• No sap • Firm • Floury between fingers (mealy)	• Good smell	• Sweet taste	• Thick • Not watery • Floury (mealy) • Dry in the mouth (makes me thirsty)

LIRA									
Name of varieties	**Raw product**				**On the cooked**				
	Agronomical characteristics	**Technological characteristics at each step of the process**			**Sensory characteristics**				
		Peeling	***Washing***	***Example***	**When you look at**	**Texture when you touch**	**When you smell**	**Taste (In mouth)**	**Texture when you chew After-taste**
NASPOT 8 (699)	• Hard root • Sweet taste • Yellow flesh colour • Big size	• Moderate sap • Easy to peel • Orange flesh colour • Thin skin	• No sap • Smooth flesh surface	•	• Attractive yellow colour • Orange colour • Looks like egg yolk	• Not watery • Smooth • Soft • No sap • No fibres • Floury in the hands (mealy)	• Good smell	• Sweet taste	• Smooth • Soft • Firm • Floury (mealy)
OTADA (178)	• Smooth skin • Big size • White flesh colour • Moderate thick skin • Purple skin color	• Easy to peel • Moderate sap • Easy to peel • Heavy in the hands • Thick flesh • Not watery • Smooth skin • Pale yellow flesh colour	• No sap • Smooth flesh surface	•	• Smooth surface • Yellow colour • White marks/spots – sign of mealiness • No fibres	• Not watery • Soft • Medium thick • No sap • Firm • Floury in the hands (mealy)	• Good smell	• Sweet taste	• Smooth • Dry • Soft • Floury (mealy) like an egg yolk

KAMWENGE									
Name of varieties	**Raw product**				**On the cooked**				
	Agronomical characteristics	**Technological characteristics at each step of the process**			**Sensory characteristics**				
		Peeling	***Washing***	***Example***	**When you look at**	**Texture when you touch**	**When you smell**	**Taste (In mouth)**	**Texture when you chew**
KIRIBAMUKWE (537)	• White color • Soft peel • Not firm	• Easy to peel • Firm peel • Hard to peel • Soft peel	• Not firm • Not sappy • Color change	• 'Easy to peel; The peel was firm and could be removed easily; Peeled root was firm and dry implying good quality' • 'leaves a second layer of skin…Peels very easily, i.e. knife moves fast, so it's not a good variety or root'	• Nice color (white, yellow, white powder-like inside) • Fibrous • Watery • Non-uniform color	• Firm • Starchy • Mealy • Dry • Watery • Soft • Fibrous	• Nice sweetpotato smell	• Not sweet • Sweet	• Sticky • Low rate of breakdown • Mealy • Soft • Dry • Fast rate of breakdown • Watery

KAMWENGE									
Name of varieties	**Raw product**				**On the cooked**				
	Agronomical characteristics	**Technological characteristics at each step of the process**			**Sensory characteristics**				
		Peeling	***Washing***	***Example***	**When you look at**	**Texture when you touch**	**When you smell**	**Taste (In mouth)**	**Texture when you chew**
NASPOT 8 (246)	• Big size • Red skin • Firm root • Orange color • Yellow color • Hard peel • Soft peel	• Easy to peel • Hard to peel • Not firm	• Not sappy • Color change •	• 'The peel was soft – seems the SP was still young/not mature, not easy to peel because a lot of flesh is carried with the peel, has many eyes which are difficult to remove when peeling' • 'The knife doesn't move easily; Knife doesn't make a loud sound when peeling; Takes longer to peel and this good; Second layer of the skin doesn't move off; A yellow and orange color of the flesh is more appealing'	• Nice color (white, yellow) • Dry • Shiny skin	• Firm • Mealy • Not firm • Not mealy	• Nice sweetpotato smell	• Sweet	• Starchy • Mealy • Slow rate of breakdown • Not watery • Not fibrous • Smooth texture

KAMWENGE									
Name of varieties	**Raw product**				**On the cooked**				
	Agronomical characteristics	**Technological characteristics at each step of the process**			**Sensory characteristics**				
		Peeling	***Washing***	***Example***	**When you look at**	**Texture when you touch**	**When you smell**	**Taste (In mouth)**	**Texture when you chew**
NDERERABANA (387)	• White color • Black spots (diseased/rotten) • Fibrous • Hard peel • Soft peel • Small size	• Easy to peel • Sappy	• Sappy • No color change • Not slippery	• 'Has threads on the surface, has some black spots, Has a good white colour' • 'SP was difficult to peel – like that of cassava. Not able to peel properly to separate the flesh from the peel and not able to control the knife movement – knife slides; Peel was soft; has sap'	• Smooth skin • Fibrous • Pale color • Not white • Non-uniform	• Mealy • Soft • Not mealy • Watery • Fibrous	• Nice sweetpotato smell • Off odour	• Not sweet	• Soft • Not mealy • Fast rate of breakdown

KAMWENGE									
Name of varieties	**Raw product**				**On the cooked**				
	Agronomical characteristics	**Technological characteristics at each step of the process**			**Sensory characteristics**				
		Peeling	***Washing***	***Example***	**When you look at**	**Texture when you touch**	**When you smell**	**Taste (In mouth)**	**Texture when you chew**
OTANDIBATA (912)	• White color • Soft peel • Soft • Pale color	• Easy to peel • Hard to peel • Firm peel • Soft peel	• Slippery • No color change • Color change	• 'Easy to peel; The peel was firm and could be removed easily; Peeled root was firm and dry implying good quality' • Looks nice (white colour) but has eyes, Little brown discolouration (maybe disease or oxidation?'	• White color • Yellow color • Pale color • Not white • Fibrous •	• Firm • Sticky • Mealy • Soft • Fibrous • Watery	• Nice sweetpotato smell • No sweetpotato smell	• Sweet • Tasteless • Not sweet	• Mealy • Firm • Not mealy • Fibrous • Fast rate of breakdown

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