Field Scientific Report

Evaluation of the Suitability of New Cassava Genotypes to RTB Users' Needs and Preferences regarding Fufu, at NRCRI in Nigeria

Gender Equitable Positioning, Promotion and Performance, WP5

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Ethics: The activities, which led to the production of this manual, 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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Acronyms, abbreviations and definitions

ANOVA:	Analysis of variance
RTB:	Roots, tubers and bananas
WP:	Work package
BMGF:	Bill & Melinda Gates Foundation
CIRAD:	Centre de coopération internationale en recherche agronomique pour le développement
PMU :	Project Managing Unit
SOP:	Standard operating procedure
Tricot :	Triadic comparisons of technologies (citizen science approach)
CATA :	Check-All-That-Apply
JAR :	Just-About-Right
Complete WP 5 expriment	A set of varieties that are evaluated from planting, to processing with champion processors and consumer testing with 100+ consumers.

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ABSTRACT

This report provides summarized key evidence to be considered for the WP5 Food Product Profile (FPP) for *Fufu* product in Abia state (South East region) and Benue State (North Central region) of Nigeria. The report brings together all the results from the WP5 activities as described in the WP5 guidelines document. The processing operations of the WP5 trials were conducted by the champion processors in two (2) locations and the activities were monitored by the RTBfoods team. The operations were timed and recorded for each activity. The four (4) champion processors in each of the 2 locations were given the same quantity of roots of different clones to peel. The Processing data were recorded at different stages. The consumer testing was carried out using the best preferred clone, intermediate and worst clones with one national and one local variety as checks. The results were drawn from the following activities: agronomic, laboratory, harvest/yield assessment, processing demonstration, product yield assessment and consumer testing results. Eighteen clones of cassava were evaluated for sustainability of new genotypes to RTB users' needs and preferences. The results of the agronomic performance of the clones showed that there was no significant difference between the clones both in Abia and Benue states. The result of the physic-chemical properties obtained from *fufu* products showed that dry matter, starch and amylopectin of the five (5)*fufu* products had no significant difference. The swelling index ranged from 1.74% to 1.83% with TMEB419 and F68P007 having the highest in Abia and Benue. Nwaocha scored highest in both starch and sugar content (64.2% and 4.85%) in Abia while F9P002 scored highest in starch (64.2%), F1053P0010 (4.8%) lowest in sugar content in Benue. In the consumer testing segment, 300 consumers were interviewed in the two (2) locations, Among the 150 consumers interviewed in Abia state, 98 consumers were females and 52 were males while in Benue state 99 consumers were females and 51 were males indicating a significant difference in gender (Chi-square). Results show that many of the consumers were youths. Out of 300 consumers interviewed in Abia and Benue states, 25% (37 and 38 respectively) consume *Fufu* every day. About 49% (85 and 62 consumers) consume several times a week both in Abia and Benue States respectively, 5.3% (8 each) consume once in a week, 10.3% (15 and 16) consume only several times a month, and 3.7% (5 and 6) consume *fufu* once in a month.

Key Words: RTBFoods, Product, *Fufu*, champion processors, agronomic, index, consumers, preferences, clones, dry matter

1 INTRODUCTION

Cassava is one of the most important food crops in Nigeria, and feeds the majority of the country's population, yet, the country has never had enough of it and the prices of derived products such as gari, *fufu*, cassava flour, have always remained upwards (NtiedoEctor, 2021). It also ranks first in terms of output (60million tones) and farm size cropped (7.7million hectares) but 66th in productivity (7.75t/ha) in the world. In Nigeria, about 90% of cassava produce is processed into food, while 70% of the cassava processed is in the form of *gari*, and the other takes the form of *elubo* or *lafun*, *fufu*, or *abacha* (Otunba-Payne, 2020).

Fufu is a traditional Nigerian fermented food product in southern, western and eastern Nigeria and some other parts of West Africa (Rosalessoto *et al*., 2016; Chijioke *et al*., 2020), and usually described as a 'wet paste food product' ranking second after *gari* as a food product from cassava (http://www.cassavabiz.org/).

Ugo et al. (2021) therefore indicated that these complexities involved in the processing of the product (fufu) make it imperative for the need to introduce a multidisciplinary approach for breeding varieties that meet end user needs for fufu. If breeders had laboratory assessments for texture associated traits, whether biochemical, biophysical, or genetic, they could develop new varieties more quickly and effectively (Goddard et al., 2015) with all the characteristics desired by consumers. Farmers select cassava varieties to meet their income, food security, culinary, and agronomic needs, and preserve theircultural identity while sustaining high-yielding local varieties and those introduced by researchers.[5] Cassava roots are processed into value-added products such as lafun, gari/eba, and fufu (Awoyale, 2020).

Akingbala et al. (1991) indicated that the variations in processing methods and differences in physico-chemical properties of cassava varieties alter the texture and organoleptic properties of the cooked fufu. Bechoff et al. (2018) and Asrat et al. (2010) also noted that gender-specific crop trait preferences are rarely considered or prioritised in most breeding programs.

2 CONTEXT

2.1 Product profile

Eighteen (18) clones were used for the study, partitioned in batches for assessment among four purposively selected champion processors. These clones were differentiated with codes to eliminate bias among the processors. Times were allotted for each activity and recorded as questions were asked and answers recorded. The experiment started with the assessment of the raw material and the traits assessed include; root shape, root skin colour, inner root colour, skin texture and ease of peel. The second stage of the experiment for the intermediate product started with peeling, washing, soaking, fermentation, sieving, dewatering, and cooking. The intermediate product mash was also assessed with traits such as colour and texture.

Table 1: Main characteristics to be included in the evaluation for each food Product Profile (identified from other WPs)

Level	Characteristics*
Raw material	#1: Root shape #2: Root skin colour #3: Inner root colour #4: Skin Texture #5:Ease of peeling
Processing	#1: Peeling time #2:Washing time #3: Weight of peeled root #4:Soaking time

Level	Characteristics*
	#5: Fermentation time #6: Sieving time #7: Weight of chaff #8 Cooking time #8:Pounding time #9: Weight of product
Intermediate Product (Mash)	#1: Colour #2: Texture
End Product* (*Fufu*)	#1: Colour #2: Stretchability #3: Smoothness #4: Stickiness

* Quality traits to focus on during WP5 activities (consumer testing, QDA, etc.)

3 METHODOLOGY

3.1 Trial composition clones analysed and locations

The RTBFoods processing experiment was carried out with 4 champion processors for the assessment of Uniform Yield Trial (UYT) using 18 cassava clones with one local and national check in two (2) locations in Nigeria namely; Benue state (North Central zone) and Abia (South east zone). The 18 cassava clones were assessed by the four (4) champion processors at different levels of the experiment. The different level includes; raw material, processing and intermediate/end product. At raw material level, the root shape, root skin colour, inner root colour, skin texture and ease of peeling were assessed. At the processing level, peeling time, weight of peeled root, washing time, soaking time, fermentation time, sieving time, weight of chaff and cooking time were assessed. At the intermediate product level, mash colour and texture were assessed while at the end product level, *fufu* colour, stretchability, smoothness and stickiness were considered.

The quantitative data (guided interviews) were taken along each level of the experiment. Thereafter, Three (3) clones which were a representation of the best, intermediate and worst (TMS13F1053P0010, NR15C1aF9P002, NR15C1AF68P007) respectively were selected alongside the national check (TMEB419) and local checks (Nwaocha for Abia and Ichenke for Benue). These five (5) selected clones were used for consumer testing. The clones were placed as four (4) batches with best, intermediate and worst in each batch. Hence, the complete study include; TMS13F1053P0010, NR15C1aF9P002, NR15C1AF68P007, TMEB419 and Nwaocha/Ichenke. The scores were generated from the pairwising of each trait from the different processors. Each processor ranked and pairwised all the clones according to their observation, both for root and mash (intermediate product) assessment. Then the scores of each trait from each of the processors were summed (appendix 1).

Three hundred (300) Consumers (150 from each zone; disaggregated further into 75 form rural and urban locations each, giving 150 consumers in each State/Region) were invited to test the five (5) eba food products prepared by the champion processors. Also note that some key traits of importance and worst that were highlighted during the processors assessment informed some of the traits (CATA and JAR) for assessment during the consumer interview. The consumer testing was carried out in the two (2) zones. The locations of consumer testing in Abia State were Ubakala (Urban) and Ariam (Rural), while in Benue State the locations were Otukpo (Urban) and OtobiAkpa (Rural).

The use of JAR (Just about Right) and CATA (Check all that Apply) methods were employed. The traits assessed using JAR method were ‘’Smoothness, Colour, Stickiness and Stretchability, while for CATA, traits like sticky, stretchy, dark in colour, lumps, not easy to mould, scatters, easy to cut, too soft, easy to swallow, heavy weight, white, moderately soft, low yield, high starch, smooth, butter/cream colour, too hard, draw little, yellow, fibre particles and watery were assessed.

Table 2: Overview of the trials and genotypes used in 2021/2022 (trial location-Abia/Benue states)

Complete experiment (Complete WP5 activity)[Can coincide with trial location]	Genotypes	Crop program official denomination / Local name	Reasoning for including the variety
	TMS13F1053P0010		*Best clone*
	NR15C1aF9P002		*Intermediate Clone*
	NR15C1AF68P007		*Worst clone*
	TMEB419	*TME 419*	*National check*
	Nwaocha/Ichenke	*Nwaocha/Ichenke*	*Local check*

3.2 Agronomic evaluation (List the parameters evaluated)

Agronomic Parameters Evaluated on the WP5 trials:

-Number at harvest
-Plot type
-Root size
-Root shape
-Rot number
-Root colour
-Root number
-Root weight
-Shoot weight
-Weight in air
-Weight in water

3.3 WP5 Processing evaluation methodology

3.3.1 Flowchart of the processing

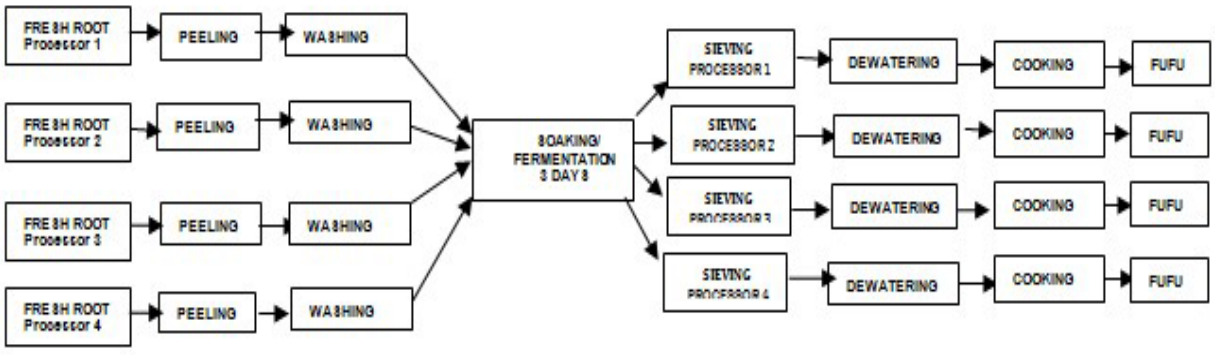

Figure 1: Flow sheet of the experiment making fufu product with 4 champion processors

3.4 Measurements on Raw material harvested

The cassava clones/varieties used in the WP5 trials were carefully chosen to determine the characteristics of the root to get good and bad varieties based on the acceptability of the cassava roots by farmers. These clones/varieties were chosen for uniformity (in terms of quantity for

assessment to avoid bias) and the traits assessed at the raw material level were root shape, root skin colour, inner root colour, root texture and ease of peel.

3.5 Measurements on Intermediate products and/or final products characterization in the laboratory or on the field

The dry matter content was determined using oven dry method according to Adesokan *et al.* (2021) where 5g of homogenized samples was weighed and oven dried at 103^0C for 16hrs. The results were expressed as percentage loss in moisture. The starch and sugar were done using the method of Otegbayo *et al*. (2021) this was done using hydrolysis method. The amylose contents of the flour samples were determined by a colorimetric AACC method. About 100-mg sample was gelatinized in the presence of 95% ethanol (1ml) and 1 N NaOH (9ml) to liberate amylose molecules. Iodine solution (2ml) was added to form an amylose– iodine complex and absorbance was read at 620nm. The amylose contents were calculated by means of a standard curve and expressed as percent of sample dry weight. Amylopectin content was calculated by difference from amylose contents (Udo et al., 2021). The swelling index was measured using the method of Ukpabi and Ndimele (1990). Fifty grams of each sample was put into a 500ml measuring cylinders. Three hundred ml (300ml) of cold water were added and allowed to stand for 4hrs before observing the level of swelling. The swelling index was then calculated as the multiple of the original volume. The crude fibre was done using the AOAC 2020 method.

3.6 Quantitative Descriptive Analysis (QDA) measurements

NRCRI Umudike during the period of the RTBfoods project developed the SOP for processing and preparation of fufu to assist breeders select genotypes with good sensory properties. The institute also developed the SOP for sensory characterization of fufu https://doi.org/10.18167/agritrop/00595. The SOP for profiling the sensory properties of fufu contains descriptors and scale for conducting Quantitative descriptive analysis (QDA) of *fufu* with trained panellists. The SOP was used to characterize sensory texture attributes of the 5 cassava clones for this studys using 12 trained panelists. The result obtained showed there was significant differences ($P<0.05$) among the genotypes for all the sensory texture traits measured. The result also showed that the protocol is also able to discriminate the genotypes with similar sensory texture attributes.

Table 3 Sensory Characterization on Fufu

Clone	Smoothness	Stickiness	Mouldability	Hardness/ softness	Stretchability	Colour	Aroma
Nwaocha	7.055d	4.68d	7.755b	4.4c	5.335b	5.055c	4.5a
F1058P0010	8.11a	6.385a	6.85e	3.7e	5.665a	5.375b	3.88b
F68P007	7.655c	3.5e	8.055a	4.6b	4.9585d	3.775e	3.35d
F9P002	8.05b	4.83c	7.44c	3.9d	5.26c	5.515a	3.52c
TMEB419	7.65c	5.28b	7.11d	4.56a	5.335b	4.105d	3.35d

3.7 Comparison method=Tukey HSD

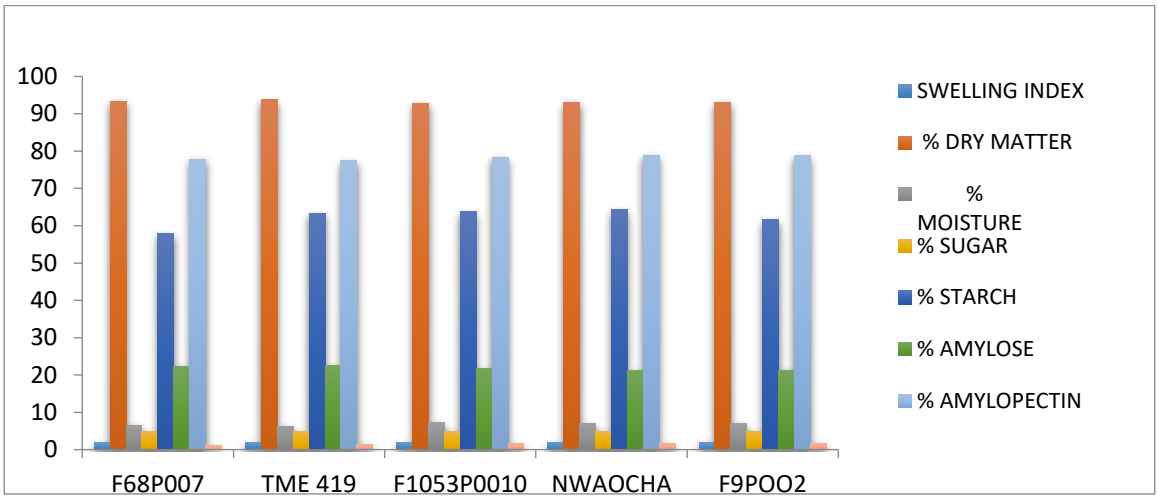

Figure 2 Physico-chemical properties for fufu Abia State

Figures with same letters are not significantly different

Table 4 Physico-chemical properties of Fufu in both locations

Sample Plot No.	Swelling Index	% Dry Matter	% Moisture	% Sugar	% Starch	% Amylose	% Amylopectin	% Crude Fibre
Abia								
F68P007	1.78	93.42	6.58	4.73	57.83	22.19	77.82	1.14
TMEB419	1.834	93.75	6.248	4.73	63.27	22.53	77.47	1.47
F1053P0010	1.793	92.82	7.17	4.77	63.81	21.72	78.28	1.62
NWAOCHA	1.790636	93.10	6.89	4.85	64.28	21.18	78.82	1.64
F9POO2	1.783403	93.06	6.93	4.80	61.65	21.25	78.75	1.67
Benue								
F1053P0010	1.81	90.36	9.64	4.92	67.34	16.4	83.6	0.95
TMEB 419	1.76	92.76	7.24	5.18	71.27	16.77	83.23	1.23
F68P007	1.83	91.71	8.29	4.84	65.96	18.78	81.21	1.15
F9P002	1.79	91	8.96	5.26	72.1	19.83	80.17	1.21
ICHENKE	1.74	90.74	6.26	5.33	64.96	21.54	78.46	1.35

The phyico-chemical property results of the *fufu* mash (Fig) show that the swelling index of the *fufu* mash shows that TMEB419 scored highest. The dry matter of the *fufu* mash ranged from 92.8% (F1053P0010) to 93.7 %(TME419). Starch was highest in Nwaocha (64.277%) and lowest in F68007 (57.831%). Sugar content was also highest in Nwaocha(4.86%). Amylopectin and crude fibre were lowest in F68P007 with 77.82% and 1.135& respectively.

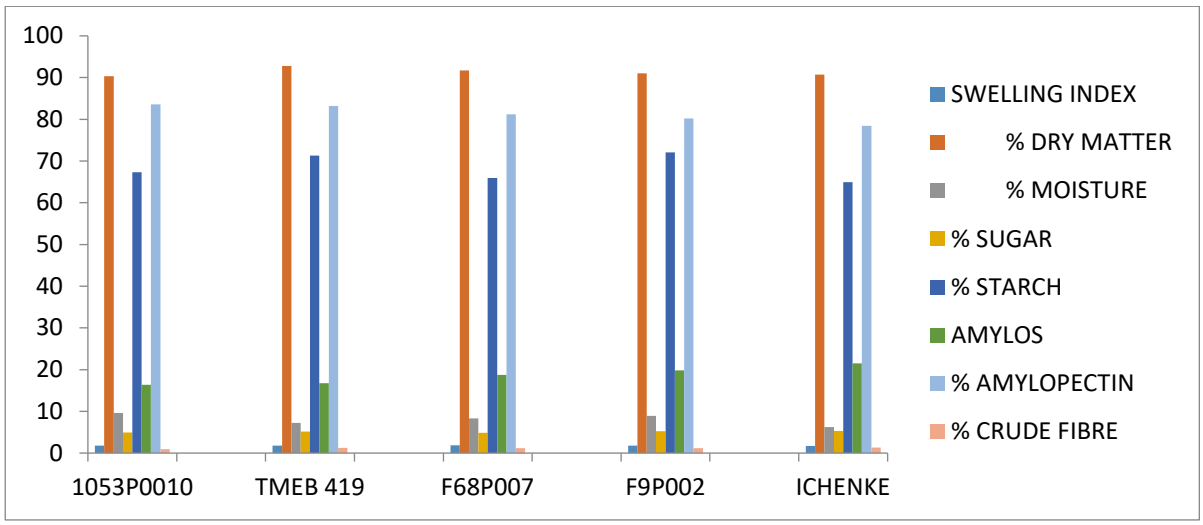

Figure 3: Physico-chemical properties for Fufu Benue State

The physico-chemical properties result of the *fufu* mash in Benue state (Fig. 3), shows that F68P007 scored higher (1.8%) than the other clones for swelling index. The result for dry matter content ranged from 90.3-92.7% with F1053P0010 (90.3%) having the least score and TMEB419 the highest score at 92.7. F9P002 has the highest percent in starch at 72.1%. The result of the Sugar content shows that Ichenke contains high sugar at 5.3%, while F68P007 (4.8%) had the least score. Amylopectin and crude fibre were lowest in Ichenke, F1053P0010 at (78.4%) and (0.9%) respectively.

3.8 Processing evaluation with champion processors

3.8.1 Processing localities

The RTBFoods processing experiment was carried out in Otobi Akpa, Benue State (North central region) and Umudike, Abia state (South east region). A purposive sampling technique was employed in the selection of the localities where the processing experiments were conducted. The processing locations were selected due to their high production intensity of root and tuber crops (cassava, yam, sweet potato and other minor root crop), proximity and collaboration with the Research Institute.

3.8.2 Selecting processors (champion processors)

The champion processors in the two (2) locations were purposively selected based on their wealth of experience in farming. The *fufu* processing activities in the study areas were female dominated only in Abia State where we had one (1) male processor. This was also confirmed by the community and other processors who served as informants. All the four (4) processors in the localities are known for their involvement in the cassava production, processing and marketing of *fufu* products in their area.

3.8.3 Evaluation of the processing with the 'champion processors'

Eighteen (18) cassava clones from the experimental trial were harvested in 3 batches of 6 varieties per batch in each processing location. The four (4) champion processors were invited to assess the clones according to the batches. Each clone was divided into four (4) equal parts and assessment was done (ranking) based on root shape, root skin colour, inner root colour, root texture and ease of peel. Also, the time of peeling, washing, fermentation, sieving and cooking were recorded. The traits

were ranked 5-1, with 5 being the best and 1 being the worst reasons for ranking either best or worst for all the traits were ascertained.

3.8.4 Monitoring times and quantities, product yield and relative amount of drudgery

The processing operations of the WP5 trials were conducted by the champion processors in two (2) locations and the activities were monitored by the RTBFoods team. The operations were timed and recorded for each activity. The four (4) processors in each of the 2 locations were given the same quantity of roots of different clones to peel. The peeling time, washing time, weight of root after peel, soaking/fermentation time, sieving time, weight of dewatered mash, cooking time and *fufu* yield were recorded in that order

Table 5 Timing operations and product yield

Clone	Wgt. of tuber (kg)	Wgt of tuber after peeling (kg)	Peeling time (min)	Washing time (min)	Fermentation time (hrs)	Sieving time (min)	Wgt. of chaff (g)	Wgt. of Fufu mash (kg)
Abia								
F1053(P0010)	5	4	8.5	4.5	72	3.5	146.5	2.7
F68(P0007)	5	4.2	10	2.5	72	2.5	452	2.35
NRISC/AF9(P002)	5	3.9	7	1.5	72	2.5	338.5	2.2
Nwaocha	5	4	9.5	1.5	72	3.5	880.5	1.5
TMEB(419)	5	4.25	9.5	1.5	72	3	538	2.35
Benue								
F1053(P0010)	5	3.95	14.5	2.5	72	16.5	1404	1.4
F68(P0007)	5	3.05	15.5	2.5	72	10	1274	1.65
Ichenke	5	3.45	18.5	2.5	72	12	1316	2
NRISC/AF9(P002)	5	3.9	8.5	2.5	72	11	796.5	2.3
TMEB(419)	5	3.4	11.5	1.5	72	7	1135	2

Results show that for most of the timing operations, there were no significant differences at both locations as well as for the mash yield data. The tuber yield (after peeling) in both locations compared favourably with the local checks but performed better in terms of fufu mash yield (F68(P0007)in Abia and NRISC/AF9(P002) in Benue).

4 CONSUMER TESTING

4.1 Consumer testing design according the number of clones/products to be evaluated

The main aim of the Consumer testing is to understand the consumers' demand for the quality characteristics of *Fufu*. Another aim is to provide a clear and visual mapping of the most liked *Fufu* samples associated with high quality characteristics and high Overall liking scores, and of the least liked *Fufu* samples associated with low quality characteristics and low overall liking scores. Three hundred (300) consumers (150 from each region; 75) were invited to test the 5 *Fufu* products made by the champion processors from varieties with different quality characteristics during the "Processing diagnosis. The consumer testing for *Fufu* products were carried out in the two (2) regions of Nigeria. The locations of consumer testing in Abia State were Ubakala, and Umudike, while in Benue State the locations were Otukpo and Otobi Akpa. The locations were selected due to their proximity to the trial locations.

The use of JAR (Just about Right) and CATA (Check all that Apply) methods were employed. The traits assessed using JAR method were ''Smoothness, Colour, Stickiness and Strechability while for

CATA method, traits like sticky, stretchy, dark in colour, lumps, not easy to mould, scatters, easy to cut, too soft, easy to swallow, heavy weight, white, moderately soft, low yield, high starch, smooth, butter/cream colour, too hard, draw little, yellow, fibre particles, and watery were assessed.

5 RESULTS

From the Table 6, the result the ANOVA and successive multiple comparison showed that in Abia State, there are no significant differences in the number of stands harvested, root weight, weight in air and weight in water among the clones but there is a significant difference between root number of each clone at 0.05 significant level and the shoot weight at 0.01 level of significance. For Benue State, the result of the multiple comparison showed there are no significant differences in the number of stands harvested, root weight, shoo tweight, weight in air and weight in water among the clones but there is a significant difference between root number of each clone at 0.01 significant level.

Table 6 Results of the agronomic performance of the WP5 trails per set of varieties that were used for processing evaluation with champion processors and consumer testing (Abia and Benue)

Genotype	nuhvt	rtnum	rtwgt	shtwgt	wgtair	wgtwt
NR15C1aF68P007	11.3	36.7	17.7	13.1	3736.7	366.7
NR15C1aF9P002	8.7	34.3	13.7	9.0	3790.0	430.0
TMEB419	11.7	29.0	13.7	7.8	3783.3	423.3
TMS13F1053P0010	12.0	46.7	19.1	4.6	3803.3	453.3
Sig.	ns	**	ns	***	ns	ns
Benue						
NR15C1aF68P007	13.7	94.0	30.0	11.0	3383.3	503.3
NR15C1aF9P002	14.3	110.3	40.3	23.3	3736.7	503.3
TMEB419	14.0	70.3	36.9	19.9	3983.3	506.7
TMS13F1053P0010	13.0	88.3	35.8	16.8	3123.3	396.7
Sig.	ns	***	ns	ns	ns	ns

Comparison method=Tukey HSD

5.1 Evaluation of the processing by champion processors: product quality

5.1.1 Pairwise ranking for the fresh root assessment for Abia and Benue States

The result of the pairwise ranking for fresh roots and *fufu mash* in Abia and Benue States are presented in the figures 4 and 5. The result of fresh roots assessment shows that in Abia state F9P002 had the most preferred root shape followed by TMEB419, in Benue; F9P002, F1053P0010 and Nwaocha were the most preferred root shape. For root skin colour the result shows that F1053P0010 is the most preferred followed by F9P002 in Abia, while in Benue, F1053P0010 is the most preferred, followed by F9P002 and Ichenke. F1053P0010 was selected as the most preferred in both locations for root colour followed by Nwaocha (Abia) and TMEB419 (Benue). In Abia, the result for skin texture assessment shows that F9P002 and F1053P0010 were the most preferred, while F1053P0010 is the most preferred in Benue. For ease of peel in Abia, F9P002 and F1053P0010 were the most preferred samples followed by F68P007, while F9P002 is the most preferred sample in Benue followed by F1053P0010.

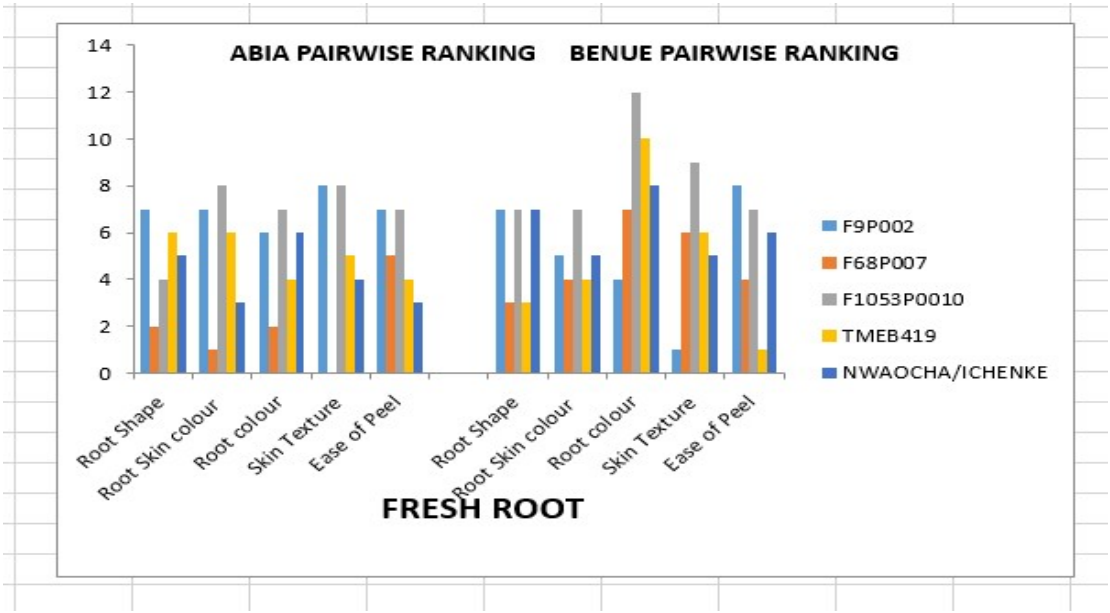

Figure 4: Pairwise ranking of Fresh roots in Abia and Benue states

5.1.2 Pairwise ranking from fufu product with champion processors of a set of 5 samples in Abia and Benue States

Figure 5 shows the results of the pair wise ranking of *fufu* product for Abia and Benue States. The result for *fufu mash*colour shows that F1053P0010 is the most preferred colour in Abia state followed by F68P007 while F1053P0010 and TMEB419 were the most preferred colour in Benue state followed by F9P002. For texture, F1053P0010 is the most preferred sample in Abia and Benue States respectively.

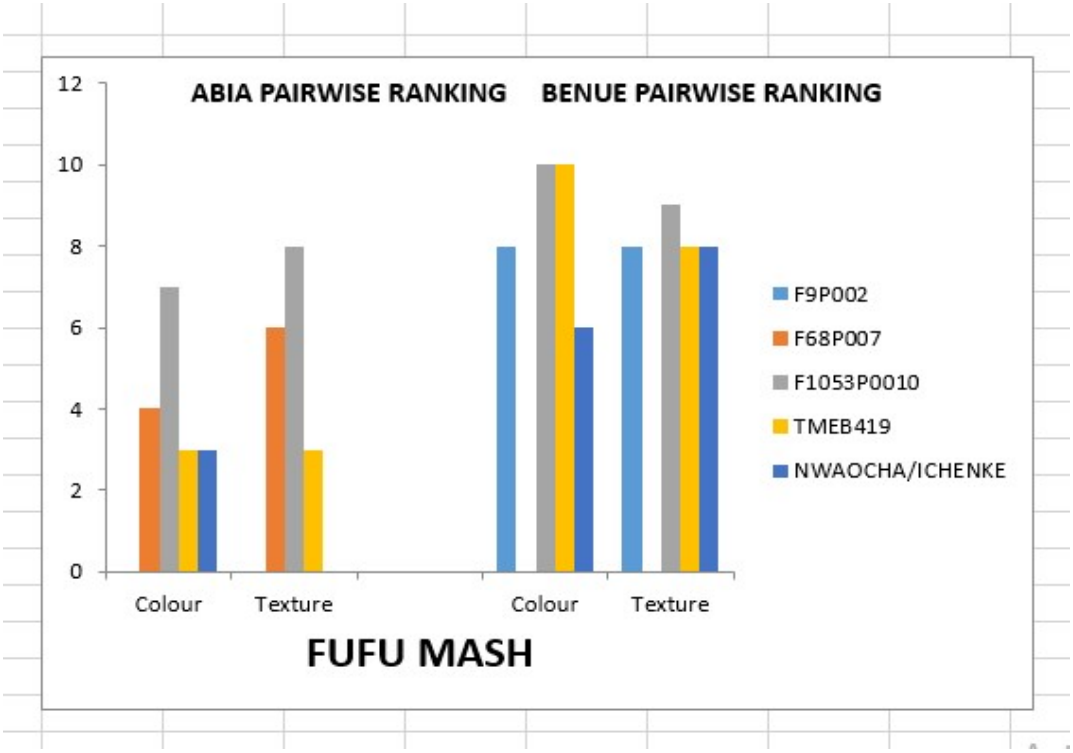

Figure 5: Pairwise ranking of Fresh roots in Abia and Benue States

Clones with higher estimates (higher than 0.00) are preferred more often in paired comparisons than those with lower estimates (Table 7). Results from the five clones that underwent complete experiment (best, intermediate and worst clones) and the local and national checks are highlighted in bold purple colour and bold blue colour respectively, for fresh root and *Fufu* assessment. Ichenke is the land race which served a local check while TMEB419 served as a national check. Significance levels indicate the probability that the estimate is significantly different from *P<0.10; **P<0.05; ***P<0.010. TMEB419 is most preferred both in root (1.22**) and in food products (*fufu* 0.42 significant at 0.10) in Benue State . F68 (POOO7) is preferred in all levels of assessment but is not significant in *fufu* product. 1053(P0010) is also preferred but not significant at any point. In Abia State, TMEB419 is most preferred both in root and food products assessments at 0.05 and 0.10 significant level. F68(POOO7) is preferred in all levels of assessment but is not significant in both root and *fufu* product. Ichenke is also preferred but not significant at any point.

Table 7 Results of Bradley Terry analysis of pairwise ranks for fresh roots and fufu with champion processors in two locations Benue and Abia States on a WP5 trial for two growing seasons (2 year data combined: 2021 and 2022)

Benue State					**Abia State**			
Clones	Fresh Root		*Fufu*		Fresh Root		*Fufu*	
04 (P003)	0.00		0.00		0.00		0.00	
1053(P0010)	**0.29**		**0.51**		**-0.22**		**-0.69**	
1301(POO13)	1.33	**	0.78		0.15		1.39	*
1306(POO15)	1.33		0.28		-1.10		1.61	.
2207(POO07)	1.32	.	0.89		0.00		1.79	*
F116(POO1)	0.78		0.70		0.15		1.10	
F1160(P004)	-1.34	*	0.46		0.69	.	-0.29	
F23(POO3)	0.77		1.03	*	-0.41		1.39	*
F24(POO1)	1.10	*	0.41		-1.10	*	1.39	*
F25(POO1)	1.25	**	1.10	*	-1.10	*	1.10	.
F3(PO17)	-1.91	.	0.95		-0.92		0.22	
F44(POO2)	-2.29	*	1.56	*	-25.58		-25.35	
F68(POOO7)	**0.55**		**0.57**		**-1.10**		**1.10**	
F9(P002)	**-0.82**	**.**	**0.29**		**0.18**		**0.22**	
IBA 00070	-3.25	**	-0.15		0.00		0.00	
Ichenke	**-1.25**		**0.67**		**0.34**		**0.41**	
R22(P001)	-2.20	***	0.56		0.00		-0.29	
TMEB419	**1.22**	****	**0.42**	*	**0.98**	**	**1.34**	*

*P<0.10; **P<0.05; ***P<0.010.

5.2 Consumer testing

5.2.1 Using classical “consumer testing”

Table 8 Overall liking results using ANOVA analysis test (Tuckey) for Abia and Benue States FUFU)

Genotype	Overall	Smoothness	Color	Stickness	Stretchability
F1053P0010	7.56	7.36	7.94	7.23	7.39
F68P007	5.68	7.22	6.41	6.35	6.28
F9P002	6.15	6.91	6.98	6.42	6.65
Local	6.43	6.80	7.24	6.74	7.25

Genotype	Overall	Smoothness	Color	Stickness	Stretchability
TMEB4129	6.23	6.78	7.11	6.41	7.04
Sig.	***	ns	***	**	*
HSD	0.41	ns	0.27	0.60	1.15

**Overall liking was rated on a nine-point scale from 1 = dislike extremely, to 9 = like extremely.*

***Different letters correspond to the Eba samples when they are significantly different. Tukey test (p<0.05).*

In terms of overall liking (Table 8), results show a highly significant difference in overall liking of fufu in the two regions, F1053P0010 performed better than the local check, followed by TMEB4129, F9P002 and F68P007 that compared favorably with the local check. These were also same for colour (1%), stickness (5%) and stretchability (10%). There were no significant differences for smoothness.

5.2.2 Investigating the influence of the Demographic data of the consumers interviewed

Results in Table 9 show demographic differences of the consumers with respect to cluster division for Abia and Benue States. Result shows no significant difference in gender (Chi-square-Table 9). More women respondents were interviewed due to their availability and willingness to participate in the activity. AlAll (100%) the consumers are Nigerians, 150 comprise the Ibo ethnic group, while 150 are Idoma. In both Abia and Benue states, 30.7% consumers were within the age range of 18-25 years old, 19.3%were aged between 26-35, 16% between 36-45, 46-55 (11.3%), while 22.7% consumers were aged above 56years old. Age had a significant influence on the cluster consumer belonged to as well as marital status, occupation, and consumption frequency (Chi-square at p>0.001). Results show that many of the consumers were youth. Youth in Nigeria include citizens of the Federal Republic of Nigeria aged 18–29 years according to the new youth policy. About 14% of the consumers from both locations were students, artisans (7.3%), 14.7% consumers were employed as civil servants, 23.3% were engaged in trade/business, employed (4%), unemployed (2%), while majority (30.7%) were farmers which was significant at 1% level, (Table 8). In terms of marital status, 31% of the consumers were single in the two (2) locations, 61% are married, in both Abia and Benue, 7.3% are widowed.

Table 9 Demographic differences of the consumers with respect to cluster division for Abia and Benue States

Abia State (n=150)					Benue States (n=150)			
Consumers	**Cu**	**Cr**	**Sum**	**Chi-square test (P)**	**Cu**	**Cr**	**Sum**	**Chi-square test (P)**
	75	75	150	**0.339637**	75	75	150	
Female	51	47	98		48	51	99	**0.457705**
Male	24	28	52		27	24	51	
Nigerian	75	75	150		75	75	150	
Idoma	0	0	0	**<0.0001***	75	75	150	**<0.0001***
Igala	0	0	0		0	0	0	
Tiv	0	0	0		0	0	0	
Ibo	75	75	150		75	75	150	

Abia State (n=150)					Benue States (n=150)			
Consumers	**Cu**	**Cr**	**Sum**	**Chi-square test (P)**	**Cu**	**Cr**	**Sum**	**Chi-square test (P)**
Hausa	0	0	0		0	0	0	
Yoruba	0	0	0		0	0	0	
18-25	11	35	46		11	35	46	
26-35	9	20	29		9	20	29	**1.219126**
36-45	11	13	24	**1.219126**	11	13	24	
46-55	13	4	17		13	4	17	
56 and above	31	3	34		31	3	34	
Student	9	12	21		9	12	21	
Artisan	4	7	11		4	7	11	
civi servant	17	5	22	**3.895468**	17	5	22	
trade/business	15	20	35		15	20	35	**9.797345**
employed	5	1	6		5	1	6	
unemployed	0	2	2		2	2	4	
farmer	25	28	53		25	20	39	
Single	16	31	47		15	31	46	
Married	48	43	91		49	43	92	**2.729318**
Widowed	10	1	11	**P-value: 0.000012**	10	1	11	
Every day	6	31	37		7	31	38	
Several times a week	44	41	85		42	40	62	**1.784749**
Once a week	6	2	8	**P-value: 4.978804e**	6	2	8	
Several times a month	14	1	15		15	1	16	
Once a month	5		1		5	1	6	

5.2.3 Consumer attitudes

Out of 300 consumers interviewed in Abia and Benue, 25% (37 and 38 respectively) consume *eba* every day. About 49% (85 and 62) consume *eba* several times a week both in Abia and Benue, while 5.3% (8 persons per location) consume *eba* once in a week in both Abia and Benue. Only 10.3% (15 and 16) consume *eba* only several times a month in both states, and 2.3% (1 and 6) consumers consume *eba* once in a month also in that order.

5.2.4 A Just About Right test (JAR)

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 *fufu* samples. Such "descriptor diagnostic" may help understand why consumers like or dislike this *fufu* sample. Consumers were asked to give their perception of the traits " Colour, Stretchability, Smoothness and

Stickiness of each Product sample, by using a 9-point Hedonic scale (9 = “extremely like” ,8=“like very much”, 7=“moderately”, 6=like slightly“, 5=”neither like, nor dislike” 4= “dislike slightly”, 3= “ dislike moderately”, 2=dislike very much” and 1 = “extremely dislike” respectively). Majority of the consumers in Abia State ranked F1053P0010 as the most preferred *fufu* in colour and stickiness followed by Nwaocha. Majority of the consumers ranked F68P007 as the most preferred trait in smoothness followed by F1053P0010, F1053P0010 and TMEB419 were ranked as the most preferred trait in stretchability followed by Nwaocha among the consumers. In Benue, majority of the consumers selected F1053P0010 as their most preferred *fufu* in colour,smoothness and stickiness, followed by Ichenke; F1053P0010and Ichenke are the most preferred varieties in stretchability, while the least ranked is F68P007.

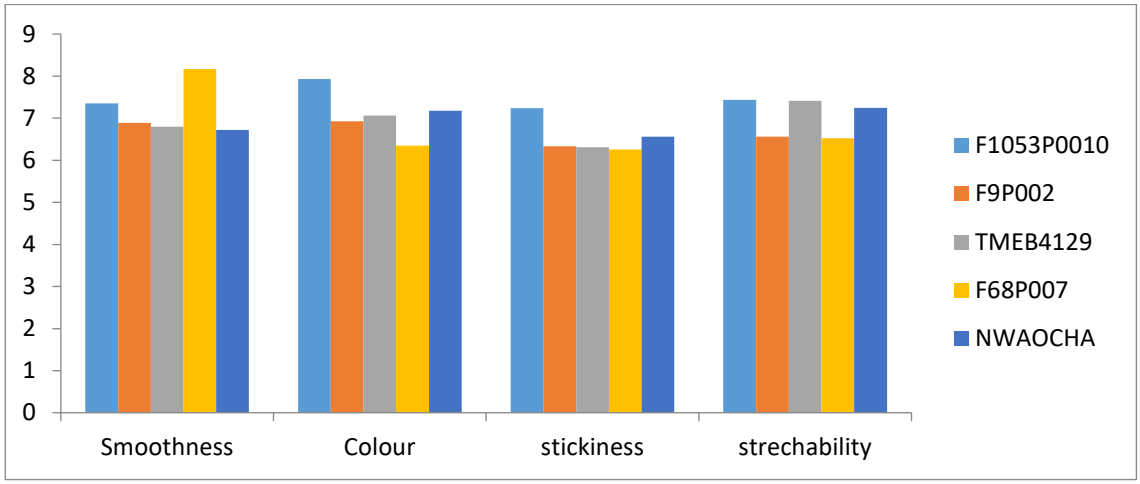

Figure 6: Just about right for traits (fufu) (Abia)

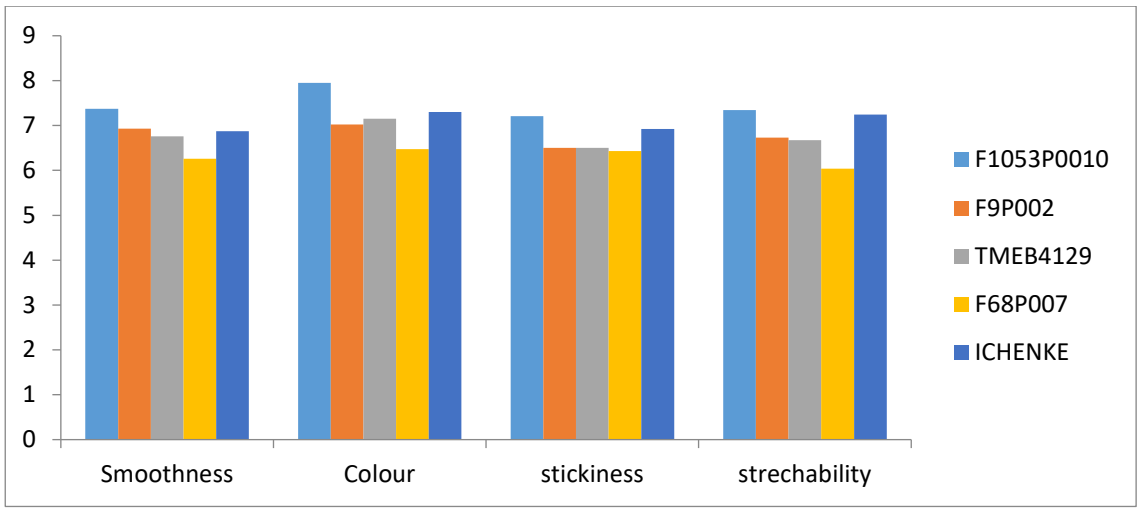

Figure 7: Just about right for traits (fufu) (Benue)

5.2.5 Check all that apply (CATA)

The objective of the CATA test is to show the relationships between hedonic Overall liking scores for each Product sample and the frequencies of citation of each CATA sensory characteristic by all the consumers. After scoring the Overall liking and the perception of some specific sensory characteristics, consumers were invited to choose the most appropriate terms among 23 sensory characteristics that better describe each Product sample. The frequency of citations given by consumers to describe each Product sample were calculated (Table 9). The sensory characteristics most frequently cited by the consumers that were considered the best for describing the products. In Benue, the best characteristics were the following: "Easy to cut, Easy to swallow, Heavy weight,

White, Moderately soft, High starch, Smooth, Draw little" with a frequency of citation range of 200-650 for all the sample products. Also a negative quality characteristic within this range is "Sticky" (402 citations) among the 5 samples).

In Abia, the sensory characteristics most frequently cited by the consumers that were considered the best for describing the products are: "Stretchy, Easy to cut, Easy to swallow, Heavy weight, White, Moderately soft, High starch, Smooth andButter/cream colour" with frequency citation range of 200-650 for all the sample products. Among negative quality characteristics that ranked high is "Sticky (446 citations) among the 5 samples.

Table 10 CATA frequency table

BENUE	F1053 P0010	F9P002	TMEB419	F68P007	ICHENKE	SUM	ABIA F1053P 0010	F9P002	TMEB419	F68P007	NWAOCHA	SUM
Sticky	113	67	83	66	73	402	112	72	86	73	103	446
Stretchy	120	88	86	59	102	455	120	91	92	63	6	372
Dark in colour	7	14	7	4	5	37	7	13	11	4	39	74
Lumps	15	18	28	44	38	143	16	17	27	42	7	109
Not easy to mould	16	8	20	7	6	57	13	10	21	7	5	56
Scatters	0	1	4	18	5	28	0	1	3	18	116	138
Easy to cut	131	128	122	127	120	628	132	127	121	125	97	602
Too soft	11	19	9	23	30	92	12	17	12	25	4	70
Easy to swallow	112	98	108	118	109	545	115	99	112	117	81	524
Heavy weight	78	75	102	77	89	421	74	76	97	75	113	435
White	122	46	105	7	117	397	122	43	107	7	23	302
Moderately soft	115	108	105	89	98	515	113	109	104	90	11	427
Low yield	3	1	1	2	4	11	4	1	1	2	41	49
High starch	80	52	96	60	82	370	75	52	91	60	5	283
Smooth	122	117	107	102	110	558	122	117	108	105	48	500
Butter/cream colour	21	47	33	37	24	162	24	52	31	32	110	249
Too hard	8	19	15	30	12	84	11	18	15	29	11	84
Draw little	29	55	48	53	43	228	29	55	45	51		180
Yellow	0	64	2	100	5	171	2	64	3	106		175
Fibre/dirt/particles	24	22	39	50	43	178	22	21	37	46		126
Watery	0	0	0	0	0	0	10	0	0	1		11
Not rise	7	7	8	4	7	33	1	12	12	7		32

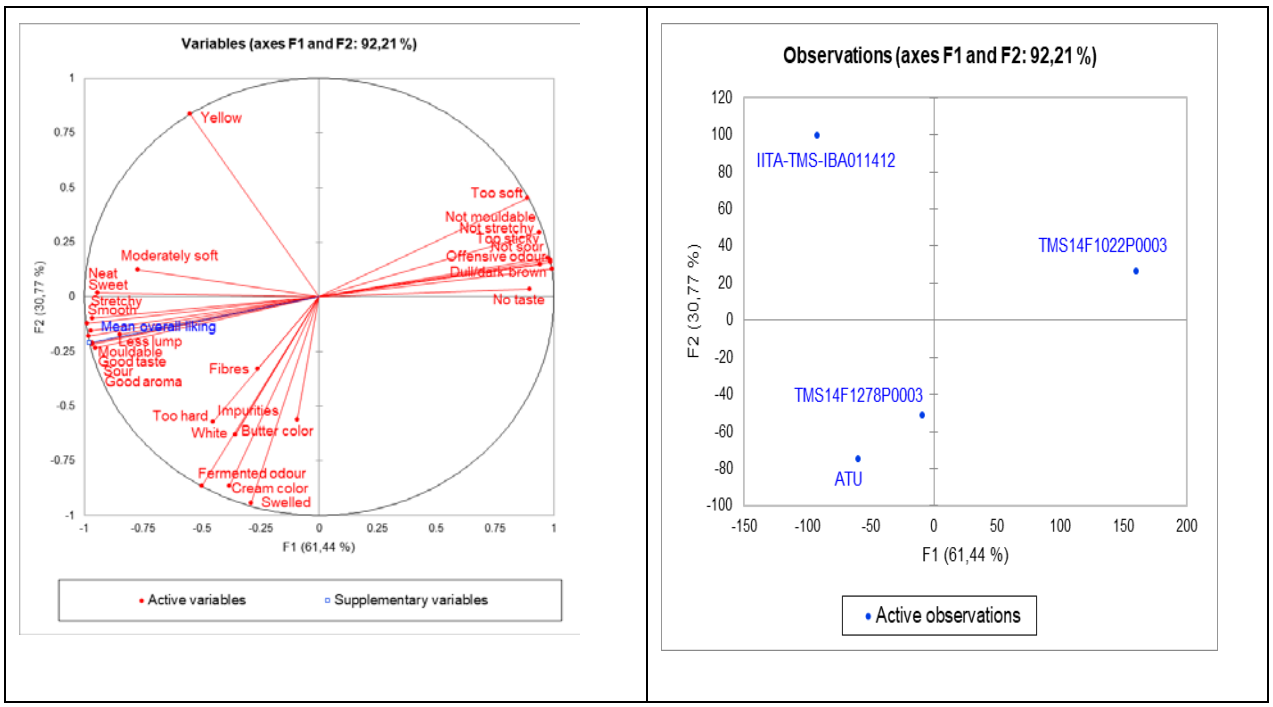

Figure 8: Principle component analysis showing the characteristics and overall liking to identify the main characteristics and emotional descriptors that determine the overall liking

6 DISCUSSION AND CONCLUSION

The study evaluated the Suitability of New Cassava Genotypes to RTB Users' Needs and Preferences regarding *Fufu*, at two regions of Nigeria. Eighteen cassava clones were used for the study among processors, and 5 clones of interest among 300 consumers who participated in the study to access JAR and CATA on all the traits of importance from the processing diagnostics. The sensory characteristics (QDA) for fufu show significant differences in all the traits. Smoothness and mouldability ranked high in terms of importance followed by stickiness, stretchability and colour, while and harness/softness and aroma the least among the traits of interest. This might be because of the importance of *swallowing ability* of this food form in the regions; most consumers swallow fufu and definitely will ranks smoothness and mouldability of this food product high. All the improved clones performed better than the local check in terms of smoothness, and **F68P007 for smoothness and all except F68P007 for stickiness. Chijioke et al. (2020) noted that** major traits influencing gender-specific consumer preferences are related to appearance, texture and smell. Smoothness, not sticky, easy to swallow and drawability of fufu appear to be major traits that drive acceptance by both men and women. In terms of drudgery with respect to processing, there were no significant differences among the clones, but some of the improved clones raked higher than the local check.

The agronomic performance showed a significant variation in the root number in both regions and for shoot weight in Abia State only. Some of the improved clones were also better than the local check in root and fufu mash assessment. This follows **Chijioke et al. (2020)** who indicated that big roots and smooth skin are prioritised for raw material. Some quality characteristics are conditioned largely by variety traits, while others can be modified by adjusting the processing methods. In terms of overall liking, smoothness, colour, stickiness, and stretchability, F1053P0010 ranked the highest in consumer testing. The complexity of producing high-quality fufu makes it imperative to introduce a multidisciplinary approach into breeding programmes.

Ethnic foods like fufu are becoming increasingly popular and also contribute to the food culture They contribute around 19% of foods consumed (at least 4% of which are African and Caribbean foods)(Mintel, 2019; Nielson, 2019). The availability of food for rural dwelling households portends the certainty of their access to adequate for food their own production activities or by procurement from their markets, if they have the means of purchase it (Kindane et al., 2006). Availability, accessibility and utilization in a larger context, embraces the supply, demand and adequacy of food

at all times. Eating more of Fufu, Lafun and Gari products are the most important coping strategies adopted by households to curb the effect of food insecurity (Salau et al., 2019).

The frequency of consumption of fufu is related to the numerous products that have been developed for cassava in different parts of the world and these results in the production and consumption of a wide variety of food products (Okoye et al., 2021; Arua, 2019). Nweke et al. (2002) outlined food products from cassava as gari, fufu (pounded cassava), tapioca, African salad, flour for bakery; feed and starch etc. and are important chains for cassava development in Nigeria. Ezeh et al. (2011) noted that the high demand generated from the major products: gari, fufu, flour to mention but a few, cassava currently plays a vital role in crop combination of most farmers.

For JAR and CATA results show that the improved clones compared favourably with the local checks. The variations in processing methods and differences in physicochemical properties of cassava varieties influence the texture and organoleptic properties of the cooked fufu (Chijioke et al., 2021). Awoyale et al. (2020) showed that consumer-preferred quality traits are the eventual determinants of the adoption decision of commercialized cassava farmers.

7 ARCHIVING RAW DATA (UPLOADING TO CIRAD WEBSITE)

Please arrange the data of each type in excel and upload to the Cirad website and fill the table below. Per category (see table 9 below) try as much as you can to put the data in single excel files using different sheets if necessary.

https://collaboratif.cirad.fr/share/page/site/RTBfoods/documentlibrary#filter=path%7C%2FWP5%7C&page=1[A folder structure on the RTBFoodsdataverse platform has to be created]

Table 11 Overview of WP5 raw data uploaded

N°	Type of raw data	Nr of files and names of the files	Uploaded? (Y/N)
1	Trial agronomic data	a. Regional UYT Agronmic data (Umudike and Otobi) 2021 b. Agronomic data Regional UYT 2021 c. UYT Harvest and Processing Data	n
2	Evaluation with champion processors of roots, intermediate products and final food products	Food Processing and diagnostics data	n
4	Laboratory data physiochemical and functional properties on fresh harvest and final and (if applicable) intermediate products		
5	Laboratory QDA	RTB copy of sensory data using 5 genotypes	n
6	Consumer testing data (classical consumer testing using JAR or Tricot with or without JAR)	Consumer Testing (Abia and Benue)	n

Table 12 Results of the agronomic performance of the WP5 trails in Abia and Benue States

genotype	rep	nu hvt	rt size	rt shape	rot num	rt colour	rt num	rt wgt	shoot wgt	wgt air	wgtwt
Abia											
TMS13F1053P0010	1	13	5	3	0	1	61	27	6.3	3720	510
NR15C1aF68P007	1	8	5	2	0	3	26	15	10	3740	380
NR15C1aF9P002	1	12	5	2	0	1	40	14.2	9.6	3810	450
TMEB419	1	8	5	3	0	1	21	10	5	3460	410
NR15C1aF68P007	2	12	5	3	0	3	41	21.8	16	3910	370
NR15C1aF9P002	2	9	5	3	0	1	46	18.8	11.4	3980	420
TMEB419	2	12	5	2	4	1	19	10.2	9.4	3740	360
TMS13F1053P0010	2	12	5	2	0	1	44	17	4.4	3750	440
NR15C1aF68P007	3	14	5	2	0	3	43	16.4	13.4	3560	350
NR15C1aF9P002	3	5	5	3	0	1	17	8	6	3580	420
TMS13F1053P0010	3	11	5	2	0	2	35	13.4	3.2	3940	410
TMEB419	3	15	5	3	1	1	47	21	9	4150	500
Benue											
NR15C1aF9P002	1	14	7	2	2	2	127	56.8	38.6	3710	550
TMS13F1053P0010	1	14	5	3	0	1	82	36.2	19.8	2880	420
TMEB419	1	12	7	3	12	1	56	25.2	17	3560	320
NR15C1aF68P007	1	14	5	2	0	2	122	33	12.8	3000	480
NR15C1aF9P002	2	14	5	2	0	2	91	29.2	16	2950	380
TMEB419	2	15	7	3	14	1	79	46	20.6	2990	420
TMS13F1053P0010	2	13	5	3	36	1	94	36.8	18.6	3590	440

genotype	rep	nu hvt	rt size	rt shape	rot num	rt colour	rt num	rt wgt	shoot wgt	wgt air	wgtwt
NR15C1aF68P007	2	13	5	2	4	2	85	30.2	11.4	2990	390
NR15C1aF9P002	3	15	7	2	0	2	113	35	15.4	4550	580
NR15C1aF68P007	3	14	5	2	0	2	75	26.8	8.8	4160	640
TMEB419	3	15	7	3	0	1	76	39.4	22.2	5400	780
TMS13F1053P0010	3	12	5	1	0	1	89	34.4	12	2900	330

APPENDIX 1

s/n	Variety/Clone harvested Umudike	Skin colour	Root colour	Skin texture	Ease of peal	Peeling time (min)	Remarks	Grating time	Sieving time (min)	Mash colour	Mash texture	Toasting time	Taste	Aroma	Remarks
1	F2201(P007)	12 (1st)		10 (1st)	9 (1st)	14 (1st)	BEST	3 (1st)	9 (4th)	4(4th)	10(1st)	49(5th)	7(3rd)	7(2nd)	POOR
2	R22(P001)	1 (5th)		4 (5th)	1(5th)	35 (5th)	POOR	4 (2nd)	9 (4th)	5(3rd)	1(5th)	34(2nd)	9(1st)	8(1st)	BETTER
3	IBA 000070	7 (2nd)		5 (3rd)	4 (4th)	29 (3rd)	GOOD	4 (2nd)	7 (1st)	2(5th)	7(3rd)	35(3rd)	5(4th)	5(4th)	GOOD
4	F1053(P0010)	7 (2nd)		5 (3rd)	7 (2nd)	26 (2nd)	BETTER	5 (4th)	8 (3rd)	7(2nd)	10(1st)	41(4th)	4(5th)	6(3rd)	FAIR
5	F25(P001)	3 (3rd)		6 (2nd)	6 (3rd)	33 (4th)	FAIR	5 (4th)	7 (1st)	11(1st)	2(4th)	30(1st)	8(2nd)	4(5th)	BEST
6	F9 (P002)	5 (2nd)		5 (2nd)	6(2nd)	15 (1st)	BETTER	4 (1st)	9 (3rd)	5(2nd)	5(3rd)	18(1st)	5(2nd)	6(1st)	BETTER
7	F1306 (P0015)	9 (1st)		9 (1st)	7(1st)	23 (2nd)	BEST	5 (3rd)	6 (1st)	4 (3rd)	8(1st)	29(3rd)	5 (2nd)	6(1st)	GOOD
8	F44 (P002)	3 (3rd)		3 (4th)	4(4th)	39 (4th)	POOR	4 (1st)	6 (1st)	7(1st)	8(1st)	18(1st)	7 (1st)	6 (1st)	BEST
9	F68 (P007)	1 (4th)		5 (2nd)	5(3rd)	31(3rd)	FAIR	7 (4th)	11(4t)	2(4th)	1(4th)	30(4th)	1(4th)	1(4th)	POOR
10	F116(P001)	4(1st)	3(3rd)	8(1st)	8(1st)	31(2nd)	BEST	4(3rd)	5(1st)	8(1st)	6(2nd)	31(1st)	2(3rd)	3(4th)	Better
11	**TMEB419**	4(1st)	5(2nd)	5(3rd)	4(3rd)	22(1st)	BETTER	3(1st)	7(3rd)	4(2nd)	9(1st)	33(2nd)	2(3rd)	4(3rd)	Good
12	**F1304(p0003)**	4(1st)	7(1st)	6(2nd)	6(2nd)	37(4th)	GOOD	4(3rd)	5(1st)	4(2nd)	0(5th)	65(3rd)	5(2nd)	5(2nd)	Poor
13	**F3P017**	0(4th)	3(3rd)	0(4th)	0(4th)	33(3rd)	POOR	3(1st)	9(4th)	2(4th)	3(4th)	31(1st)	7(1st)	6(1st)	Best
14	**F1301(P0013)**	6(3rd)	6(4th)	4(3rd)	4(4th)	16(1st)	GOOD	5(2nd)	6(2nd)	5(3rd)	6(2nd)	37(2nd)	2(5th)	3(4th)	Good
15	F23 (P003)	3(4th)	3(3rd)	4(3rd)	6(3rd)	32(5th)	FAIR	5(2nd)	6(2nd)	10(1st)	6(2nd)	45(4th)	4(4th)	7(2nd)	Better
16	F24(P001)	0(5th)	0(5th)	4(3rd)	3(5th)	18(2nd)	POOR	6(4th)	6(2nd)	8(2nd)	7(1st)	46(5th)	6(2nd)	3(4th)	Fair
17	F1160 (P0004)	10(2nd)	10(1st)	9(2nd)	7(2nd)	24(4th)	BETTER	7(5th)	5(1st)	2(5th)	6(2nd)	39(3rd)	9(1st)	9(1st)	Best
18	NWAOCHA (local check	11(1st)	10(1st)	11(1st)	13(1st)	20(3rd)	BEST	4(1st)	8(5th)	5(3rd)	5(5th)	29(1st)	5(3rd)	6(3rd)	Poor
	Otobi														
1	F1160 (P004)	5(3rd)	7(2nd)	6(2nd)	8(2nd)	11(3rd)	BETTER	2(1st)	13(1st)	10(2nd)	10(2nd)	85(5th)	11(1st)	9(1st)	BEST
2	1053 (P0010)	12(1st)	12(1st)	11(1st)	10(1st)	14(5th)	BEST	3(3rd)	18(2nd)	11(1st)	11(1st)	57(2nd)	10(2n)	8(2nd)	BETTER
3	04 (P003)	5(3rd)	5(4th)	6(3rd)	8(2nd)	9(1st)	GOOD	2(1st)	29(5th)	6(3rd)	6(3rd)	58(3rd)	3(3rd)	7(3rd)	GOOD
4	F9 (P002)	8(2nd)	6(3rd)	5(4th)	1(5th)	11(3rd)	FAIR	4(4th)	24(3rd)	3(4th)	1(5th)	53(1st)	3(3rd)	3(4th)	FAIR
5	R22 (P001)	2(5th)	0(5th)	2(5th)	5(4th)	10(2nd)	POOR	4(4th)	25()4th	0(5th)	2(4th)	70(4th)	3(3rd)	3(4th)	POOR
6	F24 (POO 1)	2(5th)	2(5th)	4(4th)	2(4th)	19(4th)	POOR	4(3rd)	19(4th)	5(3rd)	8(2nd)	80(4th)	8(2nd)	8(3rd)	GOOD
7	F25 (POO 1)	7(2nd)	8(3rd)	8(2nd)	5(3rd)	19(4th)	GOOD	3(2nd)	21(5th)	4(4th)	3(4th)	73(3rd)	5(4th)	2(5th)	FAIR
8	1301 (POO 13)	10(1st)	12(1st)	11(1st)	12(1st)	9(1st)	BEST	2(1st)	9(1st)	11(1st)	11(1st)	63(1st)	7(3rd)	10(1st)	BEST
9	F23 (POO 3)	5(4th)	3(4th)	2(5th)	2(4th)	14(2nd)	FAIR	4(3rd)	17(3rd)	0(5th)	0(5th)	71(2nd)	1(5th)	3(4th)	POOR
10	TMEB 419	6(3rd)	9(2nd)	7(3rd)	9(2nd)	16(3rd)	BETTER	4(3rd)	11(2ndt)	10(2nd)	8(2nd)	84(5th)	9(1st)	9(2nd)	BETTER
11	1306 (POO 15)	8(2nd)	6(3rd)	11(1st)	9(1st)	11(1st)	BEST	6(4th)	15(1st)	4(3rd)	5(3rd)	45(3rd)	5(4th)	4(4th)	FAIR
12	2207(POO07)	9(1st)	8(2nd)	10(2nd)	7(2nd)	14(2nd)	BETTER	4(2nd)	20(3rd)	7(2nd)	7(2nd)	47(5th)	6(2nd)	6(3rd)	BETTER
13	F68 (POOO7)	4(4th)	1(5th)	4(4th)	5(3rd)	11(1st)	POOR	5(3rd)	26(5th)	3(5th)	3(4th)	41(2nd)	6(2nd)	7(2nd)	GOOD
14	F116 (POO1	1(5th)	5(4th)	6(3rd)	5(3rd)	11(1st)	GOOD	6(4th)	24(4th)	4(3rd)	3(4th)	46(4th)	3(5th)	1(5th)	POOR
15	Wonono	8(2nd)	12(1st)	0(5th)	4(5th)	17(5th)	FAIR	3(1st)	16(2nd)	12(1st)	12(1st)	40(1st)	12(1st)	8(1st)	BEST
16	F44 (POO2)	1(4th)	0(4th)	0(4th)	0(4th)	9(1st)	POOR	3(1st)	11(1st)	3(3rd)	3(3rd)	50(3rd)	3(3rd)	3(3rd)	GOOD
17	F3(PO17)	4(2nd)	3(3rd)	4(3rd)	2(3rd)	11(2nd)	GOOD	4(2nd)	15(3rd)	0(4th)	0(4th)	38(1st)	1(4th)	0(4th)	POOR
18	IBA 00070	4(2nd)	5(2nd)	6(2nd)	5(2nd)	14(3rd)	BETTER	4(2nd)	17(4th)	6(2nd)	6(2nd)	44(2nd)	7(1st)	7(1st)	BETTER
19	Ichenke	9(1st)	9(1st)	8(1st)	9(1st)	15(4th)	BEST	4(2nd)	12(2nd)	9(1st)	9(1st)	51(4th)	7(1st)	7(1st)	BEST

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