

Training / Support mission on Instrumental Textural Characterization of Boiled yam by Ottawa Extrusion, and Pounded Yam by Kieffer Dough Extensibility, at NRCRI, Nigeria

08/01/2024 – 12/01/2024, Umudike, Nigeria,

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This report has been written in the framework of the RTB Breeding project, Quality-component (under CIRAD coordination), as a continuation of work initiated under the RTBfoods project.

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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.

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This document has been reviewed by

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21/01/2025

Final validation by

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21/01/2025

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ABSTRACT

The training mission was carried out to train NRCRI team on the standard operating procedure (SOP) for the textural characterization of boiled yam by the Ottawa extrusion method tentatively developed in IITA. The previous methods to characterize texture of boiled yam under standard protocols by penetration method have been shown to be discriminant but not always repeatable due to the variation in locale-specific texture and the physiological parts of yam, vis-à-vis proximal, central and distal parts. Texture profile analysis (TPA) have also yielded repeatable measurements between replicates but not always discriminant texture among yam genotypes. Extrusion was performed using 8-blade grid on an Ottawa cell on a texture analyser to measure textural properties of 9 yam genotypes, represented by instrumental parameters such as maximum force, end force, linear distance and area under curve. Sensory evaluation was performed to score the firmness of boiled yam from the genotypes.

The second objective of the mission was to train the NRCRI team on conducting a new SOP for the measurement of extensibility of pounded yam by the Kieffer dough extensibility (KDGE) procedure. Previous procedures by lubricated squeeze flow (LSF) and uniaxial extensibility (UAE) have not been consistently representative of extensibility of pounded yam, and have not been usable for some *D. alata* genotypes especially those with sticky or fracturing texture, respectively. Also, the pounded yam preparation procedure was revised by considering the adjustment of dry matter by addition of water during pounding.

The partners were trained on how to prepare the samples for evaluation, carry out the textural procedures, analysis of the data, and precautionary measures needed to ensure accurate conduct of the procedures.

Key Words: Boiled yam, Extrusion, Ottawa cell, Pounded yam, Kieffer dough extensibility, Sensory evaluation, Yam

1 GENERAL OVERVIEW

1.1 Interest of this training/support mission in RTB Breeding-Quality framework

- The mission was to equip the partners with skills for conducting the revised standard operating procedure for determining Ottawa extrusion texture of boiled yam using the Ottawa cell. The SOP will ensure that partners use the same procedure across their various labs for evaluating the texture of boiled yam.
- The second mission was to equip the partners with the skills to conduct the new procedures to prepare pounded yam by adjusting the dry matter during pounding, how to determine extensibility of the pounded yam using the Kieffer dough extensibility SOP, and data analysis. This will ensure that partners are able to produce pounded yam under standard conditions and measure extensibility of the pounded yam across the various partner labs.
- This mission will assist to achieve the RTB Breeding Quality deliverables with respect to texture of boiled and pounded yam product profiles.

1.2 Specific objectives

1. To train the NRCRI team in the setting up of the texture analyser for the measurement of texture of boiled yam by Ottawa extrusion procedure.
2. To train the NRCRI team in the setting up of the texture analyser for the measurement of extensibility of pounded yam by Kieffer dough extensibility procedure.

1.3 Organizing committee

- Ugo Chijioke, Biosciences laboratory manager, National Roots Crops Research Institute, (NRCRI), Umudike, Nigeria

1.4 List of participants or trained/supported staff

Workshop/Training Title: Training / Support mission on Instrumental Textural Characterization of Boiled yam by Ottawa Extrusion and pounded Yam by Kieffer Dough Extensibility

Place: NRCRI, Umudike, NIGERIA

Dates: 08/01/2024 – 12/01/2024

Workshop/Training Responsible Person: Ayetigbo OLUWATOYIN, Texture Focal Point, RTB Breeding Project, CIRAD, oluwatoyin.ayetigbo@cirad.fr

Research Project Supervised by: Dominique DUFOUR, Food Technologist, CIRAD, dominique.dufour@cirad.fr

You have been invited to take part in this training/workshop and accepted to join with full knowledge of its objectives, agenda and content. The potential risks related to this training have been openly communicated by trainers.

For reporting purposes, you will be asked to provide contact information. Sessions and discussions could be recorded; some pictures will be taken by the organizers. Data storage and management of information will be secured according to the specific rules of RTB Breeding project, to limit traceability and prevent use of personal data by external entities.

If you do not wish your picture or email address to be used by RTB Breeding project, it has to be mentioned in the table below. Participants who wish to express any particular or personal issue or concern are free to ask the responsible person whose contact is written above or the organizers, and to withdraw at any time.

Date: 08/08/2024

NRCRI TEAM

#	NAME First name	Gender (F/M)	Position	Education Background (ex: Biochemistry) -	Institute COUNTRY +	WP	Email Contact	Consent to Picture use (YES/NO)
1	Ugo Chijioke	F	Biosciences laboratory manager	Food Science	NRCRI, Umudike, NIGERIA	2	ugochijioke4@gmail.com	YES
2	Okoronkwo Justice	M	Principal laboratory technologist	Applied chemistry	NRCRI, Umudike, NIGERIA	2	justice_okoronkwo@yahoo.com	YES
3	Udoka Precious	F	laboratory technologist	Food chemistry	NRCRI, Umudike, NIGERIA	2	preudoka@yahoo.com	YES
4	Abah Simon Peter	M	Senior research Officer (breeding)	Plant breeding	NRCRI, Umudike, NIGERIA	3	abahsp@gmail.com	YES
5	Aniede Emmanuel	M	Ad-hoc staff	Food science and technology	NRCRI, Umudike, NIGERIA	2	aniedeammanuelbc@gmail.com	YES

1.5 Preliminary experience / level of staff trained

UGO Chijioke is the manager of the Biosciences laboratory at NRCRI, Umudike, Nigeria, where she manages the coordination of research and laboratory activities associated with food sciences. She is familiar with the principles of texture analysis and has been instrumental in the management of texture and biophysical data in NRCRI.

OKORONKWO Justice is the principal laboratory technologist primarily responsible for the collection of the textural data in NRCRI, Umudike, and is skilled in the use of the texture analysis. He has been instrumental in the collection of textural data of fufu and boiled yam in the RTBfoods and RTB Breeding projects.

UDOKA Precious is a laboratory technician who assist in the collection of data or in conduct of experiments in NRCRI, Umudike. She is trained and sufficiently skilled in the use of the texture analyser.

ABAH Simon peter is a plant breeder at NRCRI and works in the breeding and running of breeding programs, especially for yams. He is not quite familiar with the use of the texture analyzer, and is instrumental in the provision of yam accessions in NRCRI.

ANIEDE Emmanuel is a Bachelors student studying Food science and technology at Michael Opara University of Agriculture, Umudike, Nigeria. He is not particularly skilled in the use of the texture analyzer and requires training.

2 TRAINING/SUPPORT MISSION IMPLEMENTATION

2.1 Agenda

Training on Ottawa extrusion texture of boiled yam and Kieffer dough extensibility (KDGE) texture of pounded yam (NRCRI team)

8 January 2024 (Day 1)	9 January 2024 (Day 2)	10 January 2024 (Day 3)	11 January 2024 (Day 4)	12 January 2024 (Day 5)
<ul style="list-style-type: none"> • Arrival and introduction to the biosciences food quality team and facility. • Setting up and calibration of the texture analyzer in the lab. • Presentation of the theoretical principles of the new SOP for the preparation of boiled yam and the texture analysis of boiled yam by Ottawa extrusion method. • Collection and documentation of nine yam genotypes from the yam storage barn at NRCRI. • Discussion with team and work plan breakdown. • Dry matter analysis of the fresh and boiled yam. • Replicate datasets collected (genotype <i>TDr1500100</i>, <i>TDr1500042</i>, <i>TDr1437005</i>, <i>TDr1439027</i>) for Ottawa extrusion and sensory texture of boiled yam. 	<ul style="list-style-type: none"> • Calibration of texture analyzer. • Replicates measurement of Ottawa extrusion and sensory texture of genotypes <i>TDa1511008</i>, <i>TDaOweigbo</i>, <i>TDrOju lyawo</i>, <i>TDa1510119</i> and <i>TDa1520050</i>. 	<ul style="list-style-type: none"> • Calibration of texture analyzer. • Presentation of the theoretical principles of the new SOP for the preparation of pounded yam by water addition to adjust dry matter, and the Kieffer dough extensibility texture of pounded yam. • Discussion with team and work plan breakdown. • Dry matter analysis of the fresh, boiled, and pounded yam. • Measurements of first replicate of Kieffer dough extensibility of yam genotypes <i>TDr1500100</i>, <i>TDr1439027</i>, <i>TDr1437005</i>, <i>TDr1500042</i>, <i>TDaOweigbo</i>, <i>TDrOju lyawo</i>, <i>TDa1520050</i>. <i>Genotypes</i> 	<ul style="list-style-type: none"> • Actual dry matter of the nine yam genotypes was determined to determine the amount of water to be added to adjust dry matter of pounded yam during pounding. Drying was done at 105°C for 16-18h. 	<ul style="list-style-type: none"> • Calibration of texture analyzer. • Measurements of second replicate of Kieffer dough extensibility of yam genotypes <i>TDr1500100</i>, <i>TDr1439027</i>, <i>TDr1437005</i>, <i>TDr1500042</i>, <i>TDaOweigbo</i>, <i>TDrOju lyawo</i>, <i>TDa1520050</i>, <i>TDa1510119</i>. <i>Genotypes</i> <i>TDa1511008</i> and <i>TDa1510119</i> were analyzed in CIRAD Montpellier due to shortage of mission period. • Dry matter of pounded yam determined in order to confirm adjustment of dry matter. • Collection of final mass of samples for dry matter calculation was sent to me by the team due to end of mission. • Collation of data, running of macro, and statistics of texture data.

		<i>TDa1511008 and TDa1510119 were analyzed in CIRAD Montpellier due to shortage of mission period.</i>		
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Training on Ottawa extrusion texture of boiled yam (NRCRI team)

8-9 January 2024

DAY 1- 8 January 2024

Who: Ugo Chijioke, Okoronkwo Justice, Udoka Precious, Abah Simon, Aniede Emmanuel

Where: NRCRI Biosciences laboratory.

What:

- Arrival and introduction to the biosciences food quality team facility led by Ugo Chijioke and assisted by Okoronkwo Justice.
- The texture analyzer in the lab was set up and calibrated for texture measurement after fitting with the Ottawa cell.
- Presentation of the theoretical principles of the new SOP for the preparation of boiled yam and the texture analysis of boiled yam by Ottawa extrusion method. The method is considered to be conceptually discriminant and repeatable, and better compared to the penetration and TPA methods. The procedure produces valuable textural information for texture of boiled yam by providing parameters such as Hardness (Maximum force), Area under curve, linear distance, End force, etc. A tentative SOP has already been developed at IITA, but this was reviewed by changing parameters such as sample size and geometry, and steaming time to 23 minutes. Measurement of texture was to be taken at approximately 45 °C.
- Collection and documentation of nine yam genotypes consisting of five *D. rotundata* and four *D. alata* yams from the yam storage barn at NRCRI.
- Discussion with team and work plan breakdown. A member of the team handled dry matter determination, another handled the steaming of boiled yams and another handled the texture measurement.
- Dry matter analysis of the fresh and boiled yam.
- Replicate datasets collected (genotype *TDr1500100*, *TDr1500042*, *TDr1437005*, *TDr1439027*) for Ottawa extrusion and sensory texture of boiled yam.

Specific Methods & Tools Used:

- Discussions and demonstration of procedures.
- Tentative SOP on textural characterization of boiled yam by Ottawa extrusion.
- Review skills of trainees with the Texture analyzer (TA-XT Plus, Stable Micro Systems Ltd., Surrey, UK) and with Exponent Software Interface.

Challenges Faced:

- There was need to change the steaming time, geometry of the boiled yam samples and texture analyzer settings compared to that developed by IITA.

Output(s) -Result(s):

- Trainees understood the new sample preparation procedures
- Trainees understood the procedures to set-up, calibrate, and use the texture analyzer and conduct the extrusion textural procedure with minimal supervision.
- The replicate data for instrumental and sensory texture of genotypes *TDr1500100*, *TDr1500042*, *TDr1437005*, *TDr1439027* was obtained, as well as dry matter data of fresh and boiled yam.

DAY 2- 9 January 2024

Who: Okoronkwo Justice, Udoka Precious, Abah Simon, Aniede Emmanuel

Where: NRCRI Biosciences laboratory.

What:

- Calibration of texture analyzer.
- Replicates measurement of Ottawa extrusion and sensory texture of genotypes *TDa1511008*, *TDa Oweigbo*, *TDrOju lyawo*, *TDa1510119* and *TDa1520050*.

Specific Methods & Tools Used:

- Discussions and demonstration of procedures.
- Tentative SOP on textural characterization of boiled yam by Ottawa extrusion.

Challenges Faced:

- None

Output(s) -Result(s):

- The replicate data for extrusion texture of genotypes *TDa1511008*, *TDa Oweigbo*, *TDrOju lyawo*, *TDa1510119* and *TDa1520050* was obtained, as well as dry matter data of fresh and boiled yam, and sensory data.

DAY 3- 10 January 2024

Who: Okoronkwo Justice, Udoka Precious, Abah Simon, Aniede Emmanuel

Where: NRCRI Biosciences laboratory.

What:

- Calibration of texture analyzer.
- Presentation of the theoretical principles of the new SOP for the preparation of pounded yam by water addition to adjust dry matter, and the Kieffer dough extensibility texture of pounded yam. It was necessary to adjust dry matter of pounded yam since consumers of pounded yam perform this process traditionally, and this need to be considered in the development of the instrumental texture SOP.
- Discussion with team and work plan breakdown. Three groups performed different tasks from sample preparation, and steaming and pounding, and texture analysis.
- Dry matter analysis of the fresh, boiled, and pounded yam.
- Measurements of first replicate of Kieffer dough extensibility of yam genotypes *TDr1500100*, *TDr1439027*, *TDr1437005*, *TDr1500042*, *TDaOweigbo*, *TDrOju lyawo*, and *TDa1520050*. Genotypes *TDa1511008* and *TDa1510119* were analyzed later in CIRAD Montpellier due to shortage of mission period.

Specific Methods & Tools Used:

- Discussions and demonstration of procedures.
- Tentative SOP on preparation of pounded yam and Kieffer dough extensibility of pounded yam.

Challenges Faced:

- None

Output(s) -Result(s):

- The first replicate data for extrusion texture of genotypes *TDr1500100*, *TDr1439027*, *TDr1437005*, *TDr1500042*, *TDaOweigbo*, *TDrOju Iyawo*, and *TDa1520050* was obtained, as well as dry matter data of fresh, boiled, and pounded yam.

DAY 4- 11 January 2024

Who: Okoronkwo Justice, Udoka Precious, Abah Simon, Aniede Emmanuel

Where: NRCRI Biosciences laboratory.

What:

- Dry matter of all the genotypes was determined in order to be able to calculate the amount of water to be added during pounding for the second replicate sets of data.

Specific Methods & Tools Used:

- Discussions and demonstration of procedures.
- Tentative SOP on preparation of pounded yam and Kieffer dough extensibility of pounded yam.

Challenges Faced:

- None

Output(s) -Result(s):

- Dry matter of all the genotypes in preparation for next day's activities.

DAY 5- 12 January 2024

Who: Okoronkwo Justice, Udoka Precious, Abah Simon, Aniede Emmanuel

Where: NRCRI Biosciences laboratory.

What:

- Calibration of texture analyzer.
- Measurements of second replicate of Kieffer dough extensibility for yam genotypes *TDr1500100*, *TDr1439027*, *TDr1437005*, *TDr1500042*, *TDaOweigbo*, *TDrOju Iyawo*, *TDa1520050*, *TDa1511008* and *TDa1510119*. Genotypes *TDa1511008* and *TDa1510119* were analyzed later in CIRAD Montpellier due to shortage of mission period.
- Dry matter of pounded yam determined in order to confirm if the adjustment of dry matter was accurate.
- Collection of final mass of samples for dry matter calculation was sent to me by the team afterwards, due to end of mission.
- Collation of data, running of macro, and statistics of texture data. Macros developed calculated instrumental textural parameters such as extensogram peak force, extensibility, and extensogram area.

Specific Methods & Tools Used:

- Discussions and demonstration of procedures.
- Tentative SOP on preparation of pounded yam and Kieffer dough extensibility of pounded yam.
- Trainees had hands-on practice of the procedures.

Challenges Faced:

- None

Output(s) -Result(s):

- The second replicate data for extrusion texture of genotypes *TDr1500100*, *TDr1439027*, *TDr1437005*, *TDr1500042*, *TDaOweigbo*, *TDrOju Iyawo*, and *TDa1520050* was obtained, as well as dry matter data of fresh, boiled, and pounded yam.

List of material/documents shared with trainees

(to be attached to this Report)

- A mailed copy of the tentative SOPs for Ottawa extrusion of boiled yam and Kieffer dough extensibility of pounded yam. We could not share the document until it is validated and fully published.

3 TRAINING / SUPPORT MISSION OUTPUTS & FEEDBACKS

3.1 Specific outputs of the training/support mission

- Trainees understood the new SOPs for sample preparation and textural evaluation of boiled yam by Ottawa extrusion and pounded yam by Kieffer dough extensibility procedures and had hands-on practice.
- Trainees understood the procedures to set-up, calibrate, and use the texture analyzer to conduct extrusion and extensibility tests by Ottawa cell and KDGE rig, respectively with minimal supervision.
- Two sets of replicate texture data of nine genotypes were obtained for boiled yam by Ottawa extrusion and pounded yam by KDGE. Also, dry matter data of fresh, boiled, and pounded yam were collected.
- Partners understood how to use macro for texture parameters calculation.

3.2 Challenges faced & paths for improvement (if relevant)

- Adjustment of pounded yam dry matter by addition of water during pounding may sometimes result in sticky doughs been produced. Therefore, the calculation of water added must be correctly performed, taking care to avoid cooling of the pounded yam during pounding. Warm water addition was found to enhance dough consistency and avoid rapid cooling.
- The SOPs used for the training purposes have been finalised but remains to be published, and this is being done at the moment, and are likely to be ready for validation and publication shortly.

3.3 Feedbacks from trainees / General remarks from support team

- Trainees were satisfied with the training on above average scale.
- Request for occasional support in cleaning textural data, statistics and macro development.
- Request for copies of final SOPs after publication.

3.4 Next steps

- Finalizing the pending SOPs for publication.
- Sensory evaluation for key texture parameters of boiled yam (such as mealiness, firmness, crumbliness), and for pounded yam (such as mouldability, stretchability, and smoothness) should be performed in future.
- Statistical evaluation of textural data.

4 APPENDICES

List of documents attached to the report

1. Data sheets for Ottawa extrusion and KDGE texture of boiled and pounded yam	Yes
2. SOP (pending copies)	Yes
3. Pictures consent	Yes

4.1 Annex 1: Group picture(s)



Sample preparation team and sensory evaluation panelists at NRCRI, Umudike, Nigeria



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