Training & Support Mission on Instrumental Textural Characterization of Extensibility of Pounded Yam by Uniaxial Extension and Bi-extensional Viscosity at CNRA & UNA, Côte d'Ivoire

27/03/2023 – 07/04/2023

Centre National de Recherche Agronomique (CNRA), Bouake, Côte d'Ivoire

Université Nangui-Abrogoua (UNA), Côte d'Ivoire

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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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ABSTRACT

The instrumental measurement of extensibility texture (which represents sensory stretchability) may be considered as an important procedure for measuring the quality parameter in selecting yam genotypes for pounded yam.

Nineteen alata and rotundata varieties of yams from several Ivorien populations were collected in CNRA Bouake station to determine the baseline characteristics of the yams regarding the pounded yam extensibility. The uniaxial extensibility (UAE) and the bi-extensional viscosity (BEV) of pounded yam was determined by standard operating procedures (SOP) after the pounded yam was prepared following a standard method.

The training mission was conducted to train the Centre National de Recherche Agronimique (CNRA) and Université Nangui-Abrogoua (UNA) teams to set up and measure extensibility of pounded yam instrumentally using the texture analyser and standard procedures; uniaxial extensibility and lubricated squeezing flow (LSF).

Some Statistical evaluations were presented to show the accuracy, repeatability, and discriminant power of the procedures.

Context: Support training on new SOPs to determine the instrumental extensibility texture of pounded yam

Content: Instrumental extensibility texture of pounded yam

Objectives:

- To train the partners in the setting up of the texture analyser and determination of extensibility of pounded yam by different protocols
- To evaluate the accuracy, repeatability, and discriminability of extensibility texture protocols used to measure instrumental extensibility parameters
- To familiarize trainees on techniques for conducting other textural measurement protocols (such as extrusion, penetration, and Texture Profile Analysis, TPA).

Key Words: extensibility, PCA, discriminant analysis, pounded yam, texture analysis, LSF

1 GENERAL OVERVIEW

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

- The training is to equip the partners with skills for the preparation of pounded yam and determination of extensibility of pounded yam following standard protocols with focus on determining a baseline for stretchability characteristics of pounded yam product profile for the upcoming harvests of yams in 2023 and 2024. Stretchability is a key textural trait characteristic of pounded yam.
- Training to equip the partners with skills to statistically evaluate textural parameters with a focus on discriminating between genotypes of yams based on the textural characteristics of pounded yam.

1.2 Specific objectives

1. To train partner in the setting up of the texture analyser and determination of extensibility of pounded yam.
2. To evaluate the accuracy, repeatability, and discriminability of extensibility textural protocols used to measure instrumental extensibility parameters.

1.3 Organizing committee

- Kouakou Amani Michel, Regional Director, Centre National de Recherche Agronimique (CNRA), Cote d'Ivoire.
- Dibi Konan E. Brice, Breeder/Agronomist Centre National de Recherche Agronimique (CNRA), Bouake, Cote d'Ivoire.
- Mbeguie Mbeguie Didier, Researcher, CIRAD, France.
- Ehounou Adou Emmannuel, Breeder, Centre National de Recherche Agronimique (CNRA), Bouake, Cote d'Ivoire.
- Diby N'nan Sylvie A., Researcher/Lectrurer, Université Nangui-Abrogoua (UNA).

1.4 Support team

#	NAME First name	Gender (F/M)	External OR Position / Responsibilities	Background –Expertise	Institute / Company + COUNTRY	Email Contact	Consent to Picture use (YES/NO)
1	AYETIGBO Oluwatoyin	M	Focal Point, Texture	Food Science & Physical measurements	CIRAD, FRANCE	oluwatoyin.ayetigbo@cirad.fr	YES

1.5 List of participants or trained/supported staff

#	NAME First name	Gender (F/M)	Position	Education - Background	Institute + COUNTRY	WP	Phone Contact or Email	Consent to Picture use (YES/NO)
1	Kouakou Amani Michel	M	Regional Director	Breeder	CNRA, Cote d'Ivoire	2	0102021111	YES
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10	Gou'e Emmanuel	M	AT/PRT		CNRA, Cote d'Ivoire	2	0141323311	YES

11	Gnahe Hermann Dekpaho	M	Enseignant-Chercheur	Food Science	UNA, Abidjan	2	0747174375, hgnahe@gmail.com	YES
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14	Odjesika Madeleine	F	Stagiaire		CNRA, Cote d'Ivoire	2	0779846887, madeleinesika49@gmail.com	YES
15	Kouame Guy-Marc	M	Technicien, AT/PRT		CNRA, Cote d'Ivoire	2	0787720662, guymarcthibaut@gmail.com	YES
16	Diby N'nan Sylvie A.	F	Enseignant-Chercheur		UNA, Abidjan	2	0778213925, nnandiby@gmail.com	YES
17	Antonin Kouassi	M	Enseignant-Chercheur		UNA, Abidjan	2	0505726121, antoninkouassi@live.fr	YES
18	Mbeguie Mbeguie Didier	M	Chercheur		CIRAD, France	2	0788187368, mbeguie@cirad.fr	YES
19	N'goran Anne Luciana	F	Stagiaire		CNRA, Cote d'Ivoire	2	0787293153, ngoranluciana@gmail.com	YES

1.6 Preliminary experience / level of staff trained

Essis Brice Sidoine is a researcher at the research institute. He has limited knowledge on texture measurement procedures.

Hala Kinampinan is a researcher at the research institute. He has little knowledge on texture measurement procedures.

Kouame Kouassi Thiegba is a researcher at the research institute. He has little knowledge on texture measurement procedures.

Kouabenan Fabrice is the key technician in the laboratory of the research institute. He handles the use of the texture analyser, and is familiar with texture analyses. He assists the key focal point on texture at CNRA, Bouake.

Ehounou Adou Emmannuel is the key focal point on texture at CNRA, Bouake. He supervises the technician in the lab and assists with the texture analyses. He is familiar with texture measurements.

N'goran Akissi Rolande is a technician with the yam barn. She assists with selection of yam genotypes and sample preparation in the lab. She has little knowledge in texture measurements in the lab.

Gou'e Emmanuel is a technician supporting the yam breeding. He has little knowledge on texture measurement procedures.

Gnahe Hermann Dekpaho is a researcher and lecturer with the UNA. He is a Food scientist with particular interests in texture measurement and analyses. He has some knowledge on the use of the texture analyser.

Zamble' Tchambi is a technician supporting the yam breeding. He has little knowledge on texture measurement procedures.

Yapi Yapi Eric is a researcher with CNRA. He manages the handling of the texture analyser at CNRA station, Abidjan. He has considerable know-how on the measurement of texture.

Odjesika Madeleine is an intern understudying at CNRA, Bouake. She assists in yam genotype collection and sample preparation, but has limited knowledge on texture analyses.

Kouame Guy-Marc is a technician at the CNRA, Bouake station. He assists in the yam selection and breeding. He has limited knowledge on texture analyses.

Diby N'nan Sylvie A. is a researcher and lecturer with the UNA. She is a Food scientist with particular interests in biochemical analyses. She has some knowledge on the use of the texture analyser.

Antonin Kouassi is a researcher and lecturer with the UNA. He is a Food scientist with particular interests in food quality. He has considerable knowledge on handling and use of the texture analyser. He is well familiar with texture and sensory analyses.

Mbeguie Mbeguie Didier is a researcher with CIRAD, France. He is responsible for RTB WP coordination in Cote D'Ivoire. He is with particular interests in physical and biochemical analyses. He has sufficient knowledge on handling and use of the texture analyser. He is familiar with texture analyses.

N'goran Anne Luciana is an intern understudying at CNRA, Bouake. She assists in sample preparation, but has limited knowledge on texture analyses.

2 TRAINING/SUPPORT MISSION IMPLEMENTATION

2.1 Support mission agenda

27 March (Day 1)	28 March (Day 2)	29 March (Day 3)	30 March (Day 4)
• Arrival and introduction to the directorate, management and staff of CNRA and UNA • Familiarisation with the lab protocol materials, and equipment in the lab • Presentation of the theoretical aspects of the UAE and LSF SOPs and distribution of SOP copies to the trainees • Collection and documentation of yam genotypes from the yam storage barn • Discussion with team and work plan breakdown • Reviewing the setting up and calibration of the texture analyser, and test run of texture analyser • First set of practical measurements of UAE and LSF by trainer and trainees using a yam genotype as trial example • Brief example of demonstration of calculations and statistical analyses of data	• Collection and documentation of yam genotypes *CNRAigr17/00965, CNRAiga19/00121* from the yam storage barn • Discussion with team and work plan breakdown • Calibration and setting up of texture analyser • Measurements of UAE and LSF texture parameters • Collection and storage of data	• Collection and documentation of yam genotypes *C20, TDa15/20008, N'zaDjiDjiNou* from the yam storage barn • Discussion with team and work plan breakdown • Calibration and setting up of texture analyser • Measurements of UAE and LSF texture parameters • Collection and storage of data	• Collection and documentation of yam genotypes *TDr14/39027* and *Toulekangbo* from the yam storage barn • Discussion with team and work plan breakdown • Calibration and setting up of texture analyser • Measurements of UAE and LSF texture parameters • Collection and storage of data

31 March (Day 5)	3 April (Day 6)	4 April (Day 7)	5 April (Day 8)
• Collection and documentation of yam genotypes *Krengle* and *CNRAiga19/00021* from the yam storage barn • Discussion with team and work plan breakdown • Calibration and setting up of texture analyser • Measurements of UAE and LSF texture parameters • Collection and storage of data	• Collection and documentation of yam genotypes *CNRAiga15/00020*, *TDa15/15032* and *TDr14/43002* from the yam storage barn • Discussion with team and work plan breakdown • Calibration and setting up of texture analyser • Measurements of UAE and LSF texture parameters Collection and storage of data	• Collection and documentation of yam genotypes *TDr14/37005*, *TDa15/10080*, *TDa15/11008* and from the yam storage barn • Discussion with team and work plan breakdown • Calibration and setting up of texture analyser • Measurements of UAE and LSF texture parameters • Collection and storage of data	• Collection and documentation of yam genotypes *CIVCDr 233, TDr14/14005, TDa15/20050* and from the yam storage barn • Discussion with team and work plan breakdown • Calibration and setting up of texture analyser • Measurements of UAE and LSF texture parameters • Collection and storage of data

6 April (Day 9)	7 April (Day 10)
• Calculations of UAE and LSF textural parameters and statistical analysis of data to estimate the repeatability and discriminance between the yam genotypes based on the textural parameters of pounded yam • Hands-on examples by trainees • Demonstration of extrusion texture, penetration and TPA for trainees • Closure of training sessions	• Collection of tubers of yam genotypes *C18* and 18 other genotypes for laboratory evaluation of physicochemical quality (starch, pectins, amylose, RVA, gelatinization, microstructure)

2.2 Daily progress of support mission agenda

DAY 1, 27 March

Who: Kouaku, Boni, Dibi, Sidoine, Hala, Kouame, Fabrice, Ehounou, N'goran, Gou'e, Gnahe, Guy-Marc, Yapi Yapi, Odjesika, N'nan Sylvie, Gou'e Emmanuel, Antonin, Didier, Luciana

Where: Laboratoire SAH

What:

- Arrival at CNRA, Bouake, and introduction to the directorate, management and staff of CNRA and UNA
- Familiarisation with the lab protocol and equipment in the lab
- Review of the theoretical aspects of the UAE and LSF SOPs by PowerPoint presentation, and distribution of SOP copies to the trainees. Explanation of procedures, precautions to be respected, advantages and disadvantages attributed to each procedures.
- Collection and documentation of yam genotypes from the yam storage barn
- Discussion with the whole team and work plan breakdown into sample preparation and sample measurement teams
- Reviewing the setting up and calibration of the texture analyser, and test run of texture analyser
- First set of measurements of UAE and BEV parameters by trainer and trainees, using a random yam genotype as trial example
- Brief example of demonstration of calculations and statistical analyses of data using first generated data

Specific Methods & Tools Used:

- Discussions on procedures
- Demonstration of procedures
- Distribution of copies of validated SOPs
- Review of expertise of trainees with the Texture analyser (TA-XT Plus, Stable Micro Systems Ltd., Surrey, UK) and with Exponent Software Interface

Challenges Faced:

- Much of the technical staff were not familiar with the use of the texture analyser, except a few technicians who have previously interacted with the texture analyser.
- It was observed that *alata* yam genotypes were more difficult to prepare into pounded yam and difficult to handle (especially by not forming dough sheets or being too sticky) than *rotundata* yam genotypes that presented better ease of handling during sample preparation and texture analyses.
- Language, but this was resolved by translation by some staff members

Output(s) – Result(s):

- Trainees understood sample preparation procedures using SOP
- Trainees understood the two textural procedures and could conduct them with minimal supervision
- Trainees understood the procedures to set-up, calibrate and measure using the texture analyser
- Trainees understood how to extract raw data generated from trial experimentation

DAY 2, 28 March

Who: Didier, N'nan Sylvie, Antonin, Gnahe Hermann, Eric Yapi, Fabrice, N'goran Akissi

Where: Laboratoire SAH

What:

- Collection of yam genotypes CNRAigr17/00965 and CNRAiga19/00121 from the yam storage barn
- Setting up and calibration of the texture analyser
- Sample preparation team prepared the pounded yam samples, while the sample measurement team took the textural measurements
- First set of actual samples (CNRAigr17/00965 and CNRAiga19/00121) were used for measurements of UAE and BEV parameters by trainer and trainees
- The first actual data of samples (CNRAigr17/00965 and CNRAiga19/00121) were generated for UAE and BEV.

Specific Methods & Tools Used:

- Using the validated SOP on UAE & LSF
- Texture analyser (TA-XT Plus, Stable Micro Systems Ltd., Surrey, UK) with Exponent Software Interface
- Participation of technical staff members in practical measurements

Challenges Faced:

- It was observed that *alata* yam genotype CNRAiga19/00121 could not form a dough sheet due to its high mealy/fracturable nature. The *rotundata* genotype CNRAigr17/00965 formed dough sheet easily
- Due to the high temperature variation between the outside environment and lab temperatures, regulation of temperature within the lab space was achieved by stoppage of air conditioning unit which could influence texture considerably.

Output(s) – Result(s):

- UAE and BEV raw data for genotypes CNRAigr17/00965 and CNRAiga19/00121 was obtained
- The repeatability of the measurements of the UAE & BEV was analysed from replication (duplicates) of the data

DAY 3, 29 March

Who: Emmanuel Adou, Odjesika Madeleine, N'goran Akissi Rolande, Gnahe Hermann, Eric Yapi, Kouassi Jean Paul, Kouame Guy Marc, Zamble' Tchambi, Goue Emmanuel, Kouabenan Fabrice, Kouassi Hermann Antonin, Didier, Diby N'nan Sylvie

Where: Laboratoire SAH

What:

- Collection of yam genotypes C20, TDa15/20008, and N'za Djidjinou from the yam storage barn
- Setting up and calibration of the texture analyser
- Sample preparation team prepared the pounded yam samples, while the sample measurement team took the textural measurements
- Samples (C20, TDa15/20008, and N'za Djidjinou) were used for measurements of UAE and BEV parameters by trainees
- Data of samples (C20, TDa15/20008, and N'za Djidjinou) were generated for UAE and BEV.

Specific Methods & Tools Used:

- Using the validated SOP on UAE & LSF
- Texture analyser (TA-XT Plus, Stable Micro Systems Ltd., Surrey, UK) with Exponent Software Interface
- Participation of technical staff members in practical measurements

Challenges Faced:

- It was observed that *alata* yam genotype TDa15/20008 could not form a dough sheet due to its high mealy/fracturable nature, but *alata* genotype N'za Djidjinou managed to form a dough sheet for UAE measurements. The *rotundata* genotype C20 formed dough sheet easily.

Output(s) – Result(s):

- UAE raw data for genotypes C20 and N'za Djidjinou was obtained, while BEV raw data for genotypes TDa15/20008, C20 and N'za Djidjinou were also obtained
- The repeatability of the measurements of the UAE & BEV was analysed from replication (duplicates) of the data

DAY 4, 30 March

Who: Adou Emmanuel, Gnahe Hermann, Odjesika Madeleine, Yapi Yapi Eric, Kouassi Hermann Antonin, Kouabenan Fabrice, Kouame Guy Marc, Diby N'nan Sylvie, N'goran Akissi Rolande, Didier

Where: Laboratoire SAH

What:

- Collection of yam genotypes TDr 14/39027 and Toulekangbo from the yam storage barn
- Setting up and calibration of the texture analyser
- Sample preparation team prepared the pounded yam samples, while the sample measurement team took the textural measurements
- Samples (TDr 14/39027 and Toulekangbo) were used for measurements of UAE and BEV parameters by trainees
- Data of samples (TDr 14/39027 and Toulekangbo) were generated for UAE and BEV.

Specific Methods & Tools Used:

- Using the validated SOP on UAE & LSF
- Texture analyser (TA-XT Plus, Stable Micro Systems Ltd., Surrey, UK) with Exponent Software Interface
- Participation of technical staff members in practical measurements

Challenges Faced:

- It was observed that *alata* yam genotype Toulekangbo could not form a dough sheet due to its high mealy/fracturable nature, but the *rotundata* genotype TDr 14/39027 formed dough sheet easily.

Output(s) – Result(s):

- UAE raw data for genotype TDr 14/39027 was obtained, while BEV raw data for genotypes TDr 14/39027 and Toulekangbo were also obtained

- The repeatability of the measurements of the UAE & BEV was analysed from replication (duplicates) of the data

DAY 5, 31 March

Who: Didier, Yapi Yapi Eric, Diby N'nan Sylvie, Kouassi Hermann Antonin, Emmanuel Adou, Zamble' Tchambi, Odjesika Madeleine, N'goran Akissi Rolande, Goue Emmanuel, Kouabenan Fabrice, Kouame Guy-Marc

Where: Laboratoire SAH

What:

- Collection of yam genotypes Krengle and CNRAiga19/00021 from the yam storage barn
- Setting up and calibration of the texture analyser
- Sample preparation team prepared the pounded yam samples, while the sample measurement team took the textural measurements
- Samples (Krengle and CNRAiga19/00021) were used for measurements of UAE and BEV parameters by trainees
- Data of samples (Krengle and CNRAiga19/00021) were generated for UAE and BEV.

Specific Methods & Tools Used:

- Using the validated SOP on UAE & LSF
- Texture analyser (TA-XT Plus, Stable Micro Systems Ltd., Surrey, UK) with Exponent Software Interface
- Participation of technical staff members in practical measurements

Challenges Faced:

- It was observed that *alata* yam genotype CNRAiga19/00021 could not form a dough sheet due to its high mealy/fracturable nature, but the *rotundata* genotype Krengle formed dough sheet easily.

Output(s) – Result(s):

- UAE raw data for genotype Krengle was obtained, while BEV raw data for genotypes Krengle and CNRAiga19/00021 were also obtained
- The repeatability of the measurements of the UAE & BEV was analysed from replication (duplicates) of the data

DAY 6, 3 April

Who: Emmanuel Adou, Kouassi Hermann Antonin, N'Goran Anne Luciana, Kouame Guy-Marc, Kouabenan Fabrice, Goue Emmanuel, Zamble' Tchambi, N'goran Akissi Rolande, Odjesika Madeleine,

Where: Laboratoire SAH

What:

- Collection of yam genotypes CNRAiga15/00020, TDa15/15032, and TDr14/43002 from the yam storage barn
- Setting up and calibration of the texture analyser
- Sample preparation team prepared the pounded yam samples, while the sample measurement team took the textural measurements

- Samples (CNRAiga15/00020, TDa15/15032, and TDr14/43002) were used for measurements of UAE and BEV parameters by trainees
- Data of samples (CNRAiga15/00020, TDa15/15032, and TDr14/43002) were generated for UAE and BEV.

Specific Methods & Tools Used:

- Using the validated SOP on UAE & LSF
- Texture analyser (TA-XT Plus, Stable Micro Systems Ltd., Surrey, UK) with Exponent Software Interface
- Participation of technical staff members in practical measurements

Challenges Faced:

- It was observed that *alata* yam genotype CNRAiga15/00020 could not form a dough sheet due to its high mealy/fracturable nature, *alata* genotype TDa15/15032 formed a dough sheet with slight difficulty, and the *rotundata* genotype TDr14/43002 formed dough sheet easily.
- The genotype TDr14/43002 had small sized tubers, and could not be replicated. Therefore, a cooking replication was not done.

Output(s) – Result(s):

- UAE raw data for genotypes TDa15/15032 and TDr14/43002 were obtained, while BEV raw data for genotypes CNRAiga15/00020, TDa15/15032, and TDr14/43002 were also obtained
- The repeatability of the measurements of the UAE & BEV was analysed from replication (duplicates) of the data

DAY 7, 4 April

Who: Emmanuel Adou, Kouassi Hermann Antonin, N'Goran Anne Luciana, Kouame Guy-Marc, Kouabenan Fabrice, Goue Emmanuel, Zamble' Tchambi, N'goran Akissi Rolande, Odjesika Madeleine,

Where: Laboratoire SAH

What:

- Collection of yam genotypes TDr14/37005, TDa15/10080 and TDa15/11008 from the yam storage barn
- Setting up and calibration of the texture analyser
- Sample preparation team prepared the pounded yam samples, while the sample measurement team took the textural measurements
- Samples (TDr14/37005, TDa15/10080 and TDa15/11008) were used for measurements of UAE and BEV parameters by trainees
- Data of samples (TDr14/37005, TDa15/10080 and TDa15/11008) were generated for UAE and BEV.

Specific Methods & Tools Used:

- Using the validated SOP on UAE & LSF
- Texture analyser (TA-XT Plus, Stable Micro Systems Ltd., Surrey, UK) with Exponent Software Interface
- Participation of technical staff members in practical measurements

Challenges Faced:

- It was observed that *alata* yam genotype TDa15/10080 could not form a dough sheet due to its high mealy/fracturable nature, the *rotundata* genotype TDr14/37005 formed dough sheet but with difficulty due to its sticky nature, and the *alata* genotype TDa15/11008 formed a dough sheet with slight difficulty.

Output(s) – Result(s):

- UAE raw data for genotypes TDr14/37005 and TDa15/11008 were obtained, while BEV raw data for genotypes TDr14/37005, TDa15/10080 and TDa15/11008 were also obtained
- The repeatability of the measurements of the UAE & BEV was analysed from replication (duplicates) of the data

DAY 8, 5 April

Who: N'Goran Anne Luciana, Emmanuel Adou, Gnahe Hermann Dekpaho, Kouassi Hermann Antonin, Yapi Yapi Eric, Kouame Guy-Marc, Odjesika Madeleine, N'goran Akissi Rolande, Essis Brice, Kouabenan Fabrice

Where: Laboratoire SAH

What:

- Collection of yam genotypes CIVCDr 233, TDr14/14005 and TDa15/20050 from the yam storage barn
- Setting up and calibration of the texture analyser
- Sample preparation team prepared the pounded yam samples, while the sample measurement team took the textural measurements
- Samples (CIVCDr 233, TDr14/14005 and TDa15/20050) were used for measurements of UAE and BEV parameters by trainees
- Data of samples (CIVCDr 233, TDr14/14005 and TDa15/20050) were generated for UAE and BEV.

Specific Methods & Tools Used:

- Using the validated SOP on UAE & LSF
- Texture analyser (TA-XT Plus, Stable Micro Systems Ltd., Surrey, UK) with Exponent Software Interface
- Participation of technical staff members in practical measurements

Challenges Faced:

- It was observed that *alata* yam genotype TDa15/20050 formed a dough sheet with some difficulty, while the *rotundata* genotypes CIVCDr 233 and TDr14/14005 formed dough sheet easily.
- The yam tuber sizes for genotype TDr14/14005 was small, and could not be replicated. Therefore, no cooking replication was done.

Output(s) – Result(s):

- UAEand BEV raw data for genotypes CIVCDr 233, TDr14/14005 and TDa15/20050 were obtained
- The repeatability of the measurements of the UAE & BEV was analysed from replication (duplicates) of the data

DAY 9, 6 April

Who: Emmanuel Adou, Kouassi Hermann Antonin, Anne Luciana, Kouame Guy-Marc, Kouabenan Fabrice, Goue Emmanuel, Zamble' Tchambi, Gnahe Hermann Dekpaho, N'goran Akissi Rolande, Odjesika Madeleine

Where: Laboratoire SAH

What:

- As an addendum, training on conducting extrusion, texture profile analysis (TPA) and penetrometry measurements were embarked briefly.
- Detailed training on extraction of UAE and BEV data from Exponent software
- Detailed training on statistical analyses of UAE and BEV data using all the data collected throughout the training. Such statistics include the calculation of descriptives, Principal components analysis, Hierarchical clustering, one- and two-way ANOVA, discriminant analysis, and bivariate correlation.

Specific Methods & Tools Used:

- Using the JMP software for statistics
- PowerPoint presentation
- Ensuring participation of all trainees in practical demonstration of statistical methods

Challenges Faced:

- The UAE data is relatively easier to extract and analyse. However, the BEV was more laborious and difficult to calculate by many trainees. The key focal technicians on Bouake understood the calculations well.

Output(s) – Result(s):

- UAE and BEV data can be extracted and analysed by technical focal trainees concerned with textural data collection.
- Trainees could conduct extrusion, texture profile analysis (TPA) and penetrometry measurements

DAY 10, 7 April

Who: Emmanuel Adou, Gnahe Hermann Dekpaho, N'goran Akissi Rolande, Zamble' Tchambi, Kouabenan Fabrice, Kouame Guy-Marc, Goue Emmanuel, Yapi Yapi Eric, Anne Luciana

Where: Laboratoire SAH & Yam barn

What:

- Collection of 19 yam genotypes (eighteen genotypes studied and one genotype C18) from the yam barn for transport to Montpelier, France. The samples will be analysed for the physicochemical properties (swelling power and solubility, amylose, pectins, and RVA) to determine what biophysical property influences the stretchability of pounded yam from the Ivorian genotypes.

Specific Methods & Tools Used:

- Collection of yam genotypes and packaging in net bags for shipment to Montpelier

Challenges Faced:

- Careful packaging and storage to avoid bruising of the collected yam specimens

Output(s) – Result(s):

- It is expected to determine the physicochemical properties of the starch isolated and the flour from the collected yam specimens, and to unravel which of the properties significantly influence the texture (especially stretchability) of pounded yam made from the Ivorian yam genotypes.

2.3 List of material/documents shared with trainees

- Validated SOP for the Instrumental Determination of Extensibility of Pounded yam (https://doi.org/10.18167/agritrop/00684).
- Validated SOP for determination of Bi-extensional viscosity (BEV) of Pounded yam by Lubricated Squeezing Flow (LSF) method (https://doi.org/10.18167/agritrop/00686).
- Validated SOP for textural characterization of pounded yam (https://doi.org/10.18167/agritrop/00613)
- JMP software was shared to the key focal trainees

2.4 General approach - methods applied

- PowerPoint presentations on the SOPs
- Open discussion and demonstrations with trainees.
- Hands-on practical activities by each trainee

3 TRAINING/SUPPORT MISSION OUTPUTS & FEEDBACKS

3.1 Specific outputs of the training/support mission

- Trainees understood and were able to conduct hands-on demonstration of sample preparation, conducting the SOPs, the measurements of the textural parameters, as well as calculations related to the SOPs.
- Textural data on instrumental measurement of extensibility of pounded yam was generated and statistically analysed, and found to be accurate, repeatable and discriminant between genotypes. The data generated may be useful for correlation with sensory data on stretchability of pounded yam, and the protocols may be useful for screening large populations of yam genotypes preferred by consumers for making pounded yam of good quality.
- Demonstration of the KDGE protocol for determination of extensibility of fufu to the trainees
- The mission afforded the opportunity to collect a reasonable number of fresh yam genotypes for biophysical analysis in Montpelier.

3.2 Challenges faced & paths for improvement

- Among the two protocols trained in the mission, the uniaxial extensibility protocol (UAE (https://doi.org/10.18167/agritrop/00684) is limited in analysing genotypes that produce pounded yam of sticky/adhesive and mealy texture. The method could only be applicable to genotypes that produce pounded yam that is cohesive and non-sticky, and that can be excellently or fairly

rolled into dough sheets. Some genotypes are not cohesive enough to be rolled into a homogeneous dough sheet. This disadvantage is not applicable to the LSF protocol for which we could obtain data points for all the genotypes analysed regardless of the textural nature. There was also no significant relationship between the UAE textural parameters and the LSF parameters. This limitation proves that the UAE and the LSF are unrelated. In the near future, a new SOP to determine the extensibility of pounded yam (and other pasty FPPs) will be developed by the focal point texture team in Montpelier using a Kieffer dough gluten extensibility (KDGE) system. It is believed that this system will be applicable to all genotypes of pounded yam and should reliably correlate with the sensory stretchability of pounded yam.

- Absence of sensory textural evaluation data on the genotypes studied. The CNRA + UNA team need to be trained in standard sensory panel evaluation and consumer tests for establishing threshold of key quality traits of pounded yam. It is important for the focal point on sensory texture evaluation to conduct training sessions to train and select panellists for sensory evaluation, and threshold determination.

3.3 Feedbacks from trainees / General remarks from support team

- Request for further statistical training in cleaning textural data and statistical analyses and further support in preparation of the SOP on determination of extensibility of pounded yam by KDGE system.
- Request for sensory evaluation training and threshold evaluation by consumer test.

3.4 Next steps

- Sensory analyses of the stretchability of pounded yam should be conducted for the same genotypes in order to correlate them with the instrumental textural parameters (uniaxial extensibility and bi-extensional viscosity) measured during the training.
- A new, more robust SOP on determination of extensibility of pounded yam by KDGE protocol which may guarantee a good link between instrumental extensibility and sensory stretchability is expected to be developed.
- The physicochemical properties that influence the textural behaviour of pounded yam need to be studied for the specimens studied during the training.

4 APPENDICES

List of documents attached to the report

1. Review of data on pounded yam instrumental extensibility texture by uniaxial extensibility (UAE) and lubricated squeezing flow (LSF) at CNRA, Cote d'Ivoire (Appendix 1)	**Yes**
2. Pictures	**Yes**

4.1 Annex 1: Group picture

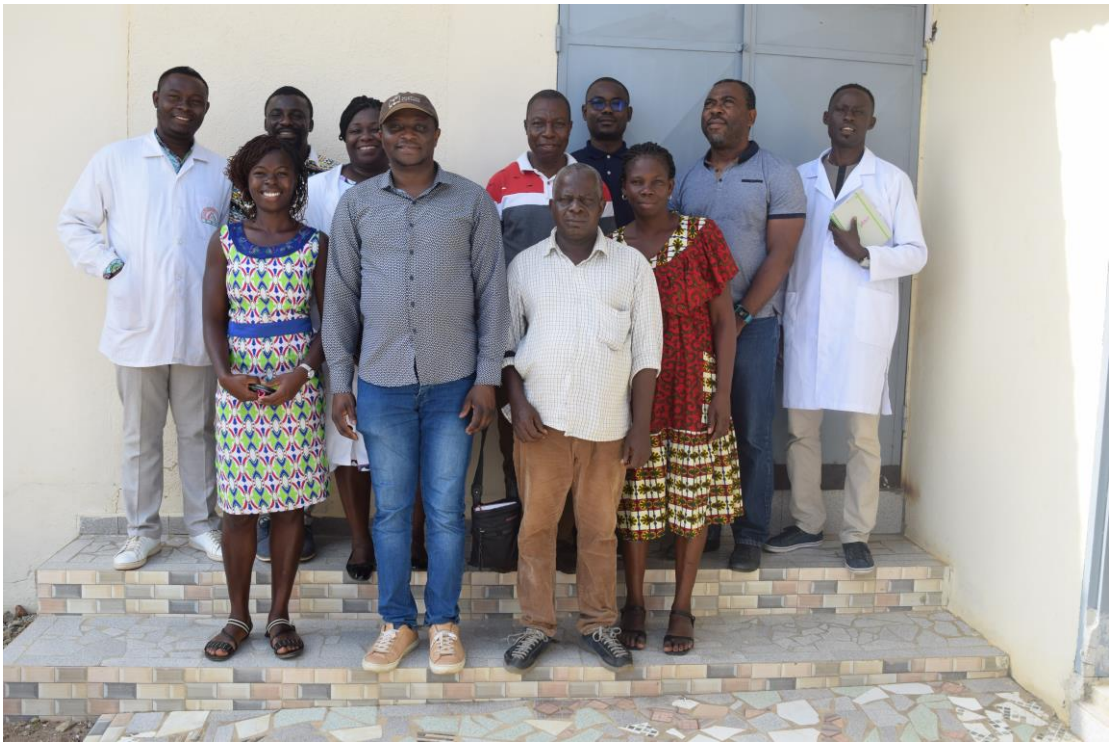


Photo credit: CNRA

4.2 Annex 2: Review of data on pounded yam instrumental extensibility texture by uniaxial extensibility (UAE) and lubricated squeezing flow (LSF) at CNRA, Cote d'Ivoire

Genotypes:

A total of 19 yam varieties (8 varieties of *D. rotundata* and 11 varieties of *D. alata*) for pounded yam were determined.

				Difficulty of using method	
s/n	**Genotype**	***D. rotundata***	***D. alata***	**UAE**	**LSF**
1	CNRAigr17/00965	***		Yes	Yes
2	C20	***		Yes	Yes
3	TDr14/39027	***		Yes	Yes
4	Krengle	***		Yes (slight difficulty)	Yes
5	TDr14/43002	***		Yes	Yes
6	TDr14/37005	***		Yes (sticky, difficulty to form dough sheet)	Yes
7	CIVCDr 233	***		Yes	Yes
8	TDr14/14005	***		Yes	Yes
9	CNRAiga19/00121		***	No (not forming dough sheet)	Yes
10	TDa15/20008		***	No (not forming dough sheet)	Yes
11	No. 69 N'za DjiDjiNou		***	Yes (with difficulty)	Yes
12	No. 33 Toulekangbo		***	No (not forming dough sheet)	Yes
13	CNRAiga19/00021		***	No (not forming dough sheet)	Yes
14	CNRAiga15/00020		***	No (not forming dough sheet)	Yes
15	TDa15/15032		***	Yes (with difficulty)	Yes
16	TDa15/10080		***	No (not forming dough sheet)	Yes
17	TDa15/11008		***	Yes (with some difficulty)	Yes
18	TDa15/20050		***	Yes (with difficulty)	Yes
19	C18		***	No (not forming dough sheet)	Yes

Procedure:

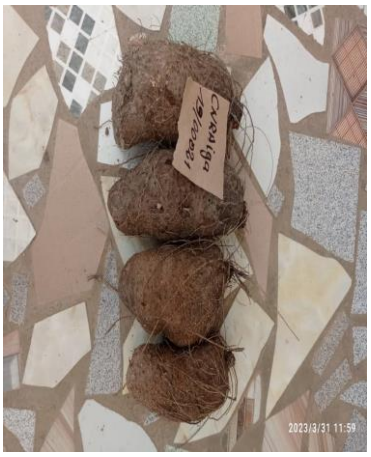
The instrumental measurement of extensibility (which represents sensory stretchability), may be considered as an important procedure for measuring quality parameter in selecting yam genotypes for pounded yam. Nineteen genotypes of yams from several Ivorian populations in CNRA Bouake were collected to observe baseline characteristics of the yams regarding their pounded yam extensibility texture. The uniaxial extensibility (UAE) of pounded yam was determined by the standard procedure (https://doi.org/10.18167/agritrop/00684), and the bi-extensional viscosity (BEV) of pounded yam was determined following the lubricated squeezing flow (LSF) standard procedure (https://doi.org/10.18167/agritrop/00686). The pounded yam were first prepared following standard procedure (https://doi.org/10.18167/agritrop/00613). Two preparations or cooking replicates per genotype was considered. About 2-8 measurements per cooking replicate was collected depending on the difficulty of the UAE procedure, while 7-8 measurements were collected per cooking replicate for the BEV measurements.


CNRAiga
17/00965


TDa 15/2008


N°69
N'ZA DTI DJI NOU


N°33
Tmlekangbô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CNRAiga
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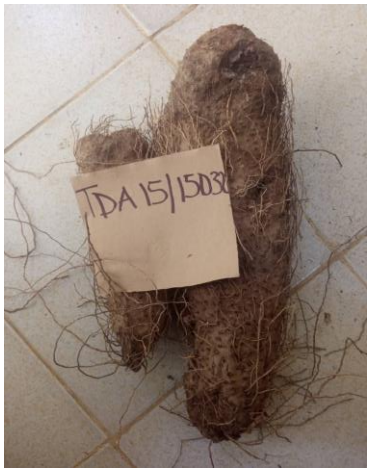
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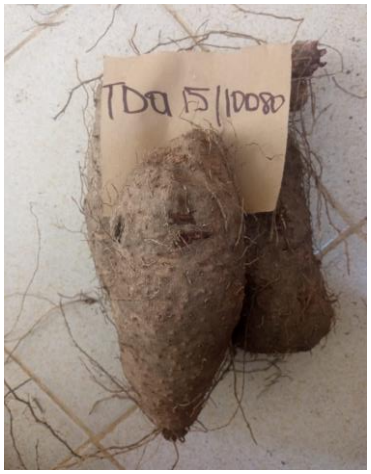
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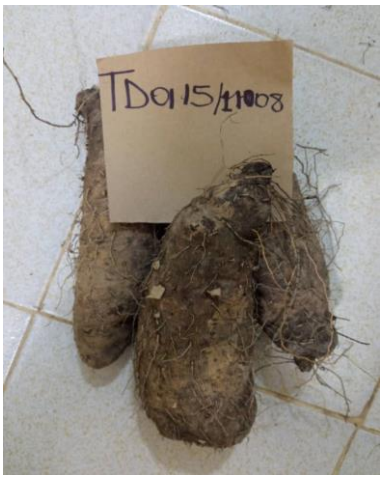
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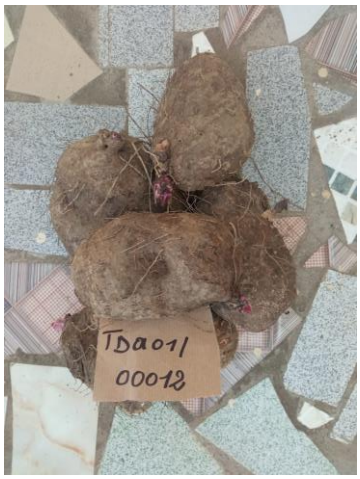
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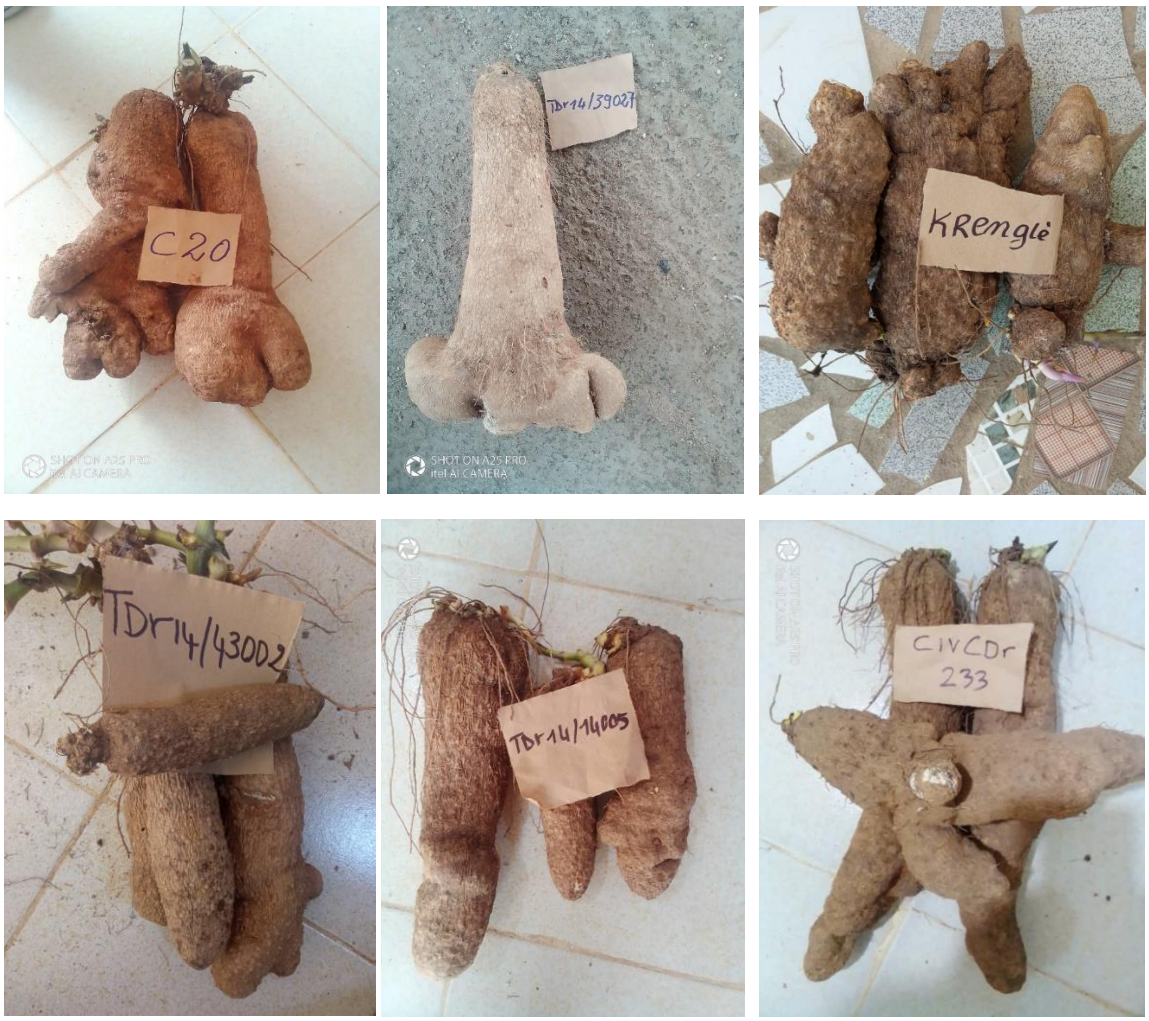
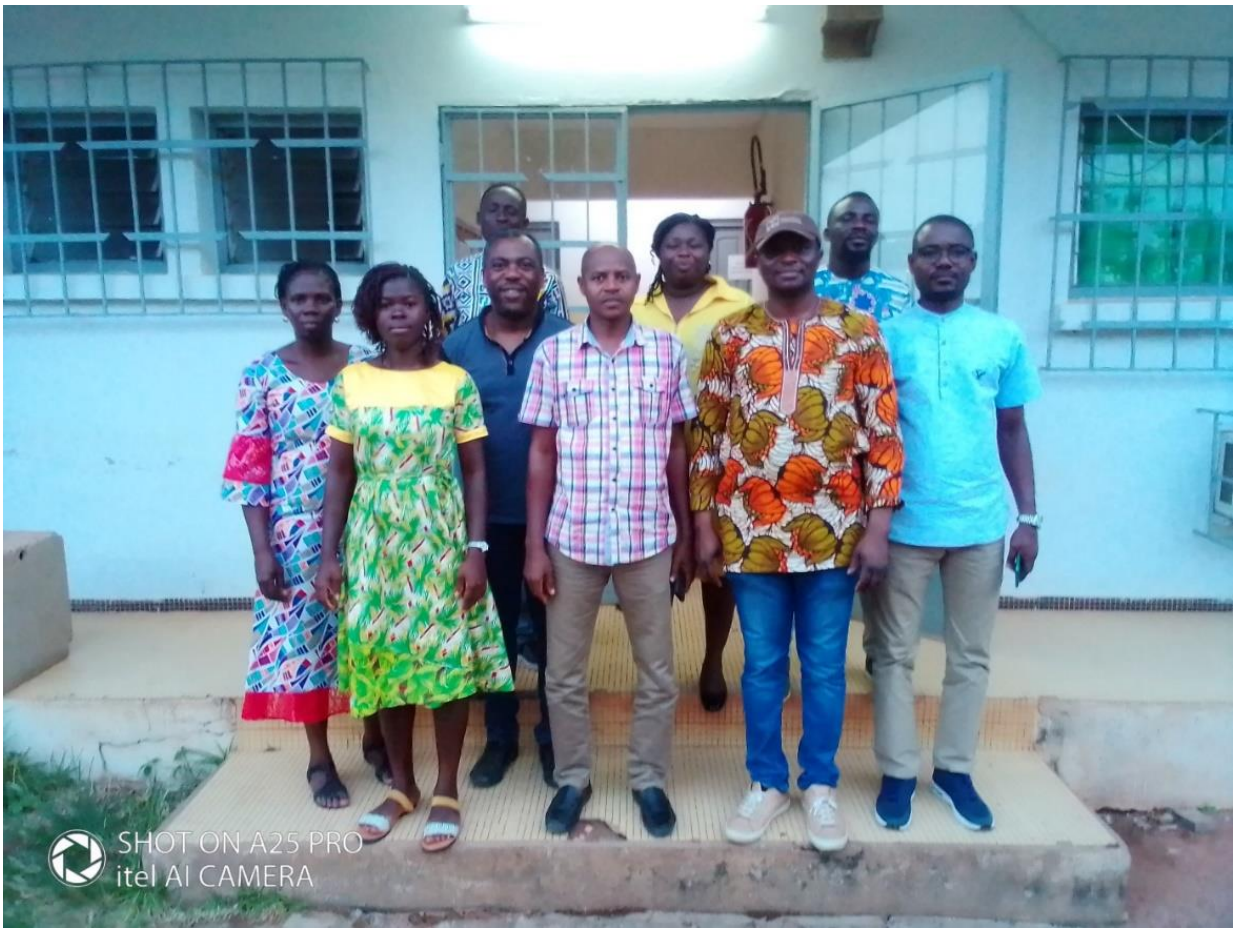
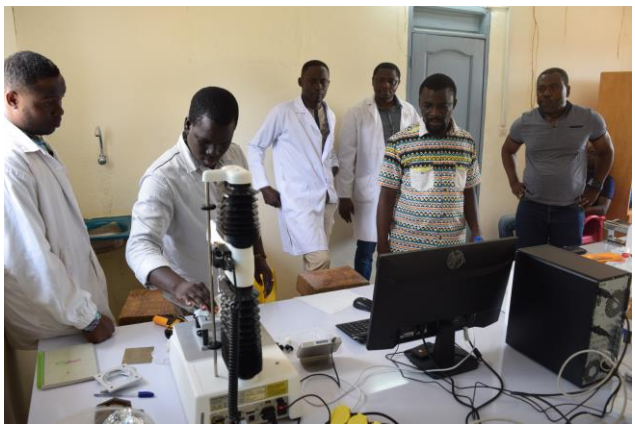


Examples of yams used in the preparation and evaluation of extensibility of pounded yam

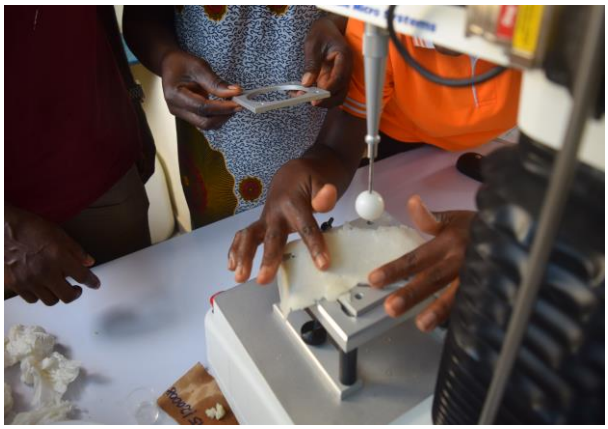
4.3 Annex 3: Photographs of training on instrumental extensibility texture of pounded yam at CNRA, Cote d'Ivoire



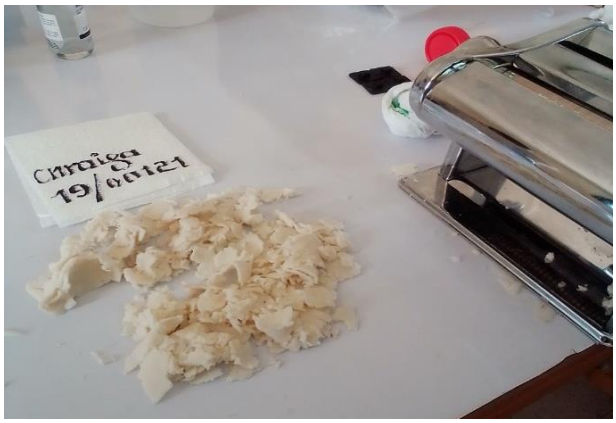
The focal points of CNRA & UNA, with CP/PRT and CIRAD facilitator



Training session on LSF

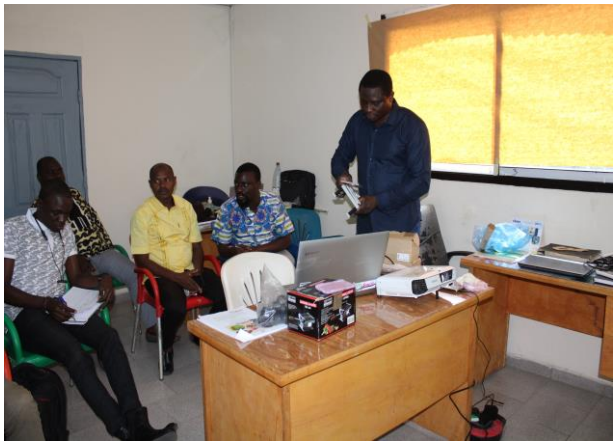


Training session on UAE

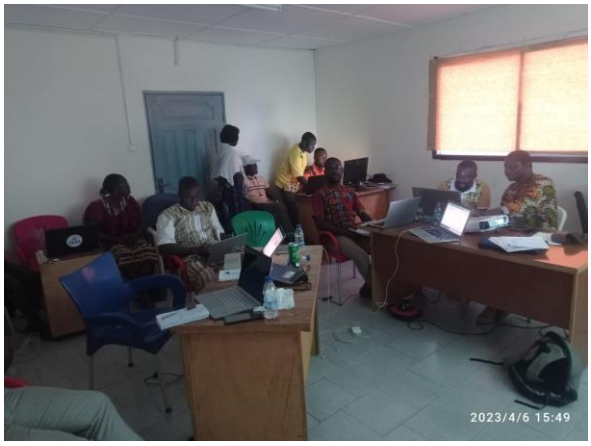


A mealy *alata* genotype not forming dough sheet for UAE test

Training participants in the lab



Theoretical class on setting up for measurements



Training session on statistical analyses