Training / Support mission on Instrumental Textural Characterization of Boiled and pounded yam by penetrometry and Pounded Yam by Kieffer Dough Extensibility

Cirad-Guadeloupe, France

07/03/2024 – 27/03/2024, Guadeloupe, France

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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 training/support mission was carried out to train Cirad-Guadeloupe on conducting a new SOP for the measurement of extensibility of pounded yam by the Kieffer dough extensibility (KDGE) and lubricated squeezing flow procedures (LSF) and using already existent SOP for boiled yam characterisation by penetrometer. Moreover, a part of CIRAD-Guadeloupe collection was characterised (D. Alata genotypes) in order to evaluated potential use of these genotypes for pounded yam production.

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

Key Words: Boiled yam, Pounded yam, Kieffer dough extensibility, 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 boiled and pounded yam textural characteristics. The SOP will ensure that partners use the same procedure across their various labs for evaluating the texture of boiled yam.

1.2 Specific objectives

To train the IITA partner in the setting up of the texture analyser for the measurement of texture of boiled and pounded yam.

Characterise different D. Alata genotypes of Cirad-Guadeloupe collection by means of extensibility of pounded yam, hardness of boiled yam and dry matter of fresh yam.

1.3 Organizing committee

Santiago ARUFE, Romain DOMINGO, Oluwatoyin AYETIGBO. Cirad Montpellier (France)

2 TRAINING/SUPPORT MISSION IMPLEMENTATION

Visited researchers :

- Sandrine ANDYPAIN, Olivier HUBERT. Qualisud, Cirad Guadeloupe (France)
- Dominique RINALDO (INRAE Guadeloup)
- Komivi DOSSA (AGAP, Cirad Guadeloupe)

2.1 Agenda

2.1.1 DAY 1 of the mission

Arriving in Guadeloupe and planning of different meetings:

- 8.30 a.m Meeting with Mme Rinaldo at INRAE to pick up the texturometer.
- 11 a.m Meeting with Komivi and colleagues from AGAP to visit the Roujol station, have lunch together and discuss next week's schedule.
- Afternoon: pick up the first genotypes.

2.1.2 DAY 2 of the mission

- Preparation of 250 samples for dry matter determination.
- Development of a template to calculate the addition of water after cooking. After several discussions with Toyin and Romain, we've concluded that it's better to adjust the water by taking into account the water absorbed by the yam during steaming, and this can be done easily with a single weighing just after cooking (if we know the fresh matter of the fresh yam). Until now, the template shared with the partners presented a model obtained by Laurent Adinsi with the 10 genotypes in Benin, which enabled the quantity of water to be estimated as a function of the initial dry matter but, like any

model, it works in a general way (in this case assuming that all the genotypes absorb the same quantity of water during cooking, which we now know is not entirely true). The risk associated with its use is that the amount of water to be added may be wrong in some cases, but this risk is eliminated with this proposed calculation.

2.1.3 DAY 3 and 4 – 9 of the mission

- We have evaluated the 4 remaining genotypes from the first batch of 10 genotypes. We therefore have MS, NIRS, extensibility and penetrometry data for 4 parents (one is missing to be included in the next batch) and 6 hydrids (3 2024s and 3 2023s).
- We prepared the MS for the next 10 genotypes (250 samples prepared in the afternoon).
- Tomorrow: finalisation of the determination of the DM of the 10 genotypes (from 11 to 20) and measurement of the corresponding texture.
- We're starting to get used to working in the laboratory here, which wasn't easy at first because the equipment is scattered all over the campus (the 105°C oven 50 m away in another building, the -80°C freezer 25 m away). We are more co-ordinated and we optimise our time better, but the average of 5 genotypes/day seems very difficult to increase. Measuring DM is still the most time-consuming stage. For this method to be considered medium throughput, we absolutely must develop and validate a NIRS MS calibration to be able to move forward more quickly.
- Komivi will be coming tomorrow afternoon to take a look to the experimentation and Mme Rinaldo on Friday morning.
- The Neufchâteau freeze-dryer has broken down. We contacted Komivi and they offered us theirs, but it has a very small capacity. As discussed by telephone, we are thinking of taking the frozen samples to Montpellier. However, dry ice is classified as dangerous for air transport and there's a risk that we won't be able to take it through the airport or that we'll have to do a lot of paperwork.

2.1.4 DAY 5 of the mission

- We have evaluated the first 6 genotypes of the second batch of 10 genotypes, including 1 with a particular colour. We have now characterised 16 genotypes.
- We received a visit from Komivi, who brought us the next 15 genotypes, including the parent that had yet to be characterised (14M), Florido and a few hybrids. However, this batch of 15 still lacks the 2023 hybrids that we will receive early next week. In discussions with him, we learned that the Boutou genotype is very bad for boiling at harvest, but becomes good with storage. We're going to try to bring tubers of this genotype to Montpellier for monitoring over a few months (texture + physicochemistry). We also talked about evaluating Grosse Caille (*D. Rotundata*), which didn't grow this year at AGAP but which a colleague can supply from his garden. The same goes for yellow yam.
- We have received confirmation of our request to the Regional Director to come and work on Saturdays. The Regional Director agreed, while respecting safety regulations.
- Tomorrow: visit from Mme Rinaldo, characterisation of the 4 remaining genotypes (for which we already know the dry matter) and preparation of the dry matter for measuring on Saturday.
- Transporting the samples to Montpellier: we're going to bring them frozen with ice in coolers. We'll buy the coolers on the last weekend of the mission, once we know exactly how many samples we have.

2.1.5 DAY 6 and 7 of the mission

- We finished the evaluation of the second batch of 10 genotypes (Friday) and started the 3rd batch (dry matter Friday afternoon, 6 genotypes in texture Saturday). We now have 26 genotypes characterised, including TiViolet, which is very interesting because of its purple colour (like A9, Toufi Tetea and Rossette) but which also stands out from the others because it is 3 times more extensible than the best of the others (but still less than the *D. Rotundata*). So we've finished characterising the parents (5) and we still have 3 hybrids left. I've had time today to analyse this in depth and with potential duplicates in the list we're at 68, if we take out the duplicates and the varieties that haven't grown, I think we'll be around 60.
- Tomorrow we'll finish the remaining 4 to finish the top 30 + we'll do the dry matter for the next 10. One of tomorrow's genotypes (Belep) is very high in dry matter (34%) and is likely to be the first to have to correct the water content of the mash by adding water after mashing (all the previous ones have dry matter smaller than 30 after cooking, so no need to add water).

2.1.6 DAY 8 of the mission

- We have finished evaluating the third batch of 10 genotypes. We now have 30 genotypes characterised.
- We picked up some new genotypes at Roujol this lunchtime and we have 15 more to characterise over the next 2 days (we should be at 42 by Wednesday evening if all goes well).
- We took advantage of the return trip to Roujol to talk to Komivi. We agreed that one of his technicians would come and work at our place on Wednesday to acquire NIRS spectra for transferring the models.
- We realised that Komivi knew a lot about the different genotypes. A simple conversation with him gave us some interesting information. So we're planning to see him next Monday afternoon to discuss things in more depth and get more information about his choice of genotypes, history, target properties, the reasons for the parents, and so on.
- We're entering the home straight to finish the mission with a minimum of 50 genotypes; it's going to be very difficult to reach 60.

2.1.7 DAY 9 of the mission

- We have started evaluating the fourth batch of 10 genotypes. We currently have 38 genotypes characterised.
- Today's news: the Noulelcaé variety is also purple, HYB 30, 5 and 6 are cream-coloured and have very poor looting and extensibility. The Beté Beté variety formed a ball during pillage, but its extensibility is very poor, which gives us an indication that the malleability index (ability to form a ball) from Emmanuel and Ezekiel's thesis is not correlated with extensibility.
- Tomorrow a technician from AGAP will come to the laboratory to acquire the spectra and transfer the models. We've been lucky because tomorrow we'll be analysing samples (4) with very contrasting dry matter levels. We're waiting for him to arrive with 10 more genotypes as requested. We will therefore prepare the DM samples for the following day.

2.1.8 DAY 10 of the mission

- We have finished evaluating the fourth batch of 10 genotypes. We now have 42 genotypes characterised.
- Today's news: the Sea 190 variety is good for pounding but has poor extensibility (34% DM fresh, so water is added after cooking). On the other hand, the Malankon variety also has 34% DM and is not good for pounding.
- We went to pick up some new varieties. AGAP supplied us with 6 more (they don't have any more) so the final dataset will be made up of 48 genotypes (a few hybrids are missing) which we'll finalise, in principle, tomorrow.
- I took the opportunity to collect tubers from the genotypes with the largest size to study the tuber effect. We'll be doing this study on the varieties Tropicale, Desirable (both genotypes transferred to CI) and A24. 3 tubers for Tropicale and Desirable and 2 for A24 (which with the average already done will make 3). It's very limited but it's the working material we have. We therefore decided to carry out the study only on the quality of pounded yam, because with just one tuber we don't have enough to do both pounding and boiling, and for boiling we can rely on the data from Jolaine Ayax's master's degree.

2.1.9 DAY 11 of the mission

- We have completed the evaluation of all the genotypes supplied by our colleagues in the DEFI team, a total of 48 genotypes, all D. Alata.
- Today's news :
    - we worked all day with Levy Laurent, DEFI technician, who took the spectra of 5 genotypes (127 spectra) fresh.
    - The Roujol and A24 varieties are good for pounding (but not extensible), both with high MS values. Quick conclusion after the evaluation of 48 genotypes: all the good pounding genotypes had high dry matter (over 32% fresh) but not all the genotypes with DM >32% are good for pounding.
- Meeting confirmed with Olivier, Bastien and Sandrine on Monday 11am to give them feedback on the results of our mission, answer questions on the application of the protocols (they were trained at the start of last week) and give them a presentation on yam activities in Guadeloupe (current and future projects).
- Tomorrow we will be evaluating 8 tubers (3 Desirable, 3 Tropical and 2 A24) to study the tuber effect on the properties of pounded yam.

2.1.10 DAY 12 of the mission

- We have completed the evaluation of 3 tubers of the Desirable genotype and 3 tubers of the Tropical genotype for the study of intra-genotype/inter-tuber variability. The A24 genotype was not studied because the plant material (2 tubers, 1 of which was in poor condition) was mistakenly sent to AGAP in bags of leftovers. So for this study we have 2 varieties studied with 3 tubers + an average of the tubers for each from the study of the collection.
- We bought coolers to transport the samples to Montpellier.
- Monday: we drop off the texturometer to Mme Rinaldo at 8 am, meeting with Qualisud colleagues at 11am and with Komivi and his team in the afternoon.
- On Tuesday, we'll pick up the samples in the morning and leave for the airport in the afternoon.

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 penetrometry and pounded yam by KDGE procedures.

3.2 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.
- Statistical evaluation of textural data.

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