NIRS Measurement on Milled and Un-milled Gari

High-Throughput Phenotyping Protocols (HTPP), WP3

Ibadan, Nigeria, October 2020

Emmanuel Oladeji ALAMU, International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria

Michael ADESOKAN, IITA, Ibadan, Nigeria

Karima MEGHAR, Centre de coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Montpellier, France (Validator)

Fabrice DAVRIEUX, CIRAD, Saint-Pierre, France-Réunion (Validator)

www.rtbfoods.cirad.fr

This report has been written in the framework of RTBfoods project.

Ethics: The activities, which led to the production of this document, were assessed and approved by the CIRAD Ethics Committee (H2020 ethics self-assessment procedure). When relevant, samples were prepared according to good hygiene and manufacturing practices. When external participants were involved in an activity, they were priorly informed about the objective of the activity and explained that their participation was entirely voluntary, that they could stop the interview at any point and that their responses would be anonymous and securely stored by the research team for research purposes. Written consent (signature) was systematically sought from sensory panelists and from consumers participating in activities.

Image cover page © LAJOUS P. for RTBfoods.

RTBfoods

WP3: High-Throughput Phenotyping Protocols (HTPP)

SOP: NIRS Measurement on Milled and Un-milled Gari

Date: 09/10/2020	Release: 1

Written by: Emmanuel Oladeji ALAMU and Michael ADESOKAN

For information on this SOP please contact:

- MAZIYA-DIXON, Busie; b.maziya-dixon@cgiar.org.
- ALAMU, Emmanuel Oladeji; oalamu@cgiar.org
- ADESOKAN, Michael ; m.adesokan@cgiar.org

This document has been reviewed by:

Karima MEGHAR (CIRAD)	27/10/2020
Fabrice DAVRIEUX (CIRAD)	29/10/2020

Final validation by:

Fabrice DAVRIEUX (CIRAD)	02/11/2020

CONTENTS

Table of contents

ABSTRACT

Gari is a creamy white granular flour produced from fermented and gelatinized cassava mash. Application of Near-infrared spectroscopic techniques in analyzing the chemical and functional properties of gari depends on the collection of quality spectral data. This SOP was developed to collect the spectra of gari using the NIRS equipment. Particle sizes of gari vary depending on the size of the sieve used during production. Therefore, the SOP covered the presentation of gari sample "as is" and as "milled gari" to obtain the uniform particle size. Spectral data of gari were collected in three replications, and each measurement involves taking fresh samples into the sampling ring cup. The SOP also included the materials required, repeatability test and the critical points for the measurement.

Keywords: Cassava roots, Gari, functional property, Spectra, NIRS

1   SCOPE AND APPLICATION

Gari is a starch rich high energy and staple product derived from cassava (Manihot esculenta Cranz). It is regarded as a convenient product as it is stored and marketed in a ready-to-eat form and may be prepared with hot or cold water; this depends on the intended form in which it is to be consumed. Gari is the most common form in which cassava is sold and consumed in Nigeria and other African countries. Gari is obtained from cassava roots after several successive steps: peeling, washing, grating, pressing/fermenting, sieving, and cooking/drying (Escobar et al., 2018). This protocol is developed for the analysis of gari; a granulated cassava product using the Near-Infrared Reflectance Spectrometer.

2   REAGENTS

No reagent uses

3   APPARATUS

Material	Image
Electric power Blending machine This is used to for pulverizing the gari samples prior NIRS analysis.	
Near Infrared Reflectance Spectrophotometer (NIRS) XDS Rapid Content Analyzer Serial No: 3013-0857 Wavelength range of 400- 2495 nm	

4 PROCEDURE

Gari samples are presented for analysis "as is" (un-milled) or as milled using a laboratory mill. An electric milling machine is used to pulverize the gari to a fine and uniform particle (< 0.1 microns). Homogenized milled or un-milled samples are filled into samples cups and placed unto the sample compartment of the NIRS machine. Triplicate scans of each sample are taken during measurements. The samples ring cell are properly cleaned using dry soft tissue after each analysis.

Figure 1: Work Flow for milled gari measurement using NIRS

5   EXPRESSION OF RESULTS

Results are expressed on dry weight basis of the unit of measurement e.g. % (w/w)

6   CRITICAL POINTS OR NOTE ON THE PROCEDURE

➢ The Tabletop Near Infrared Spectrophotometer must be switch on 30 minutes before taking spectra reading. Also, the diagnostics test of the equipment must be successfully completed.

➢ Minimum of triplicate spectra (different sampling from the sample sample) must be collected for each sample

➢ The repeatability test must be carried out by taking at least ten readings on the blended sample. Absorbances values repeatability is an indication of the stability and performance of the Near Infrared Spectrophotometer. The mean (x) and standard deviation of the absorbances for the average spectra are estimated for each wavelength, and the root mean square error (RMS) was calculated using the equation below :

$$\mathrm{RMS(i)} = \sqrt{\frac{\sum_{j}^{p}(X_{ij} - \overline{X_{j}})^2}{p}}$$

Where:

$\overline{X_j}$ average of absorbance of wavelength j

p number of wavelengths (j variate from 1 to p).

X_{ij} is an absorbance value of spectra i for wavelength j.

➢ The root means square error (RMSE) for 10 repetitive spectra of the milled gari sample ranged from 3060 – 14603 µabs and an average of 6888 µabs. Also, RMSE for Un-milled gari had a range of 25189-19102 µabs and average values of 83640 µabs, respectively. The considerable difference in the average RMSE shows that spectral data collection is better from milled gari than unmilled gari (this is because of non-uniform particle size)
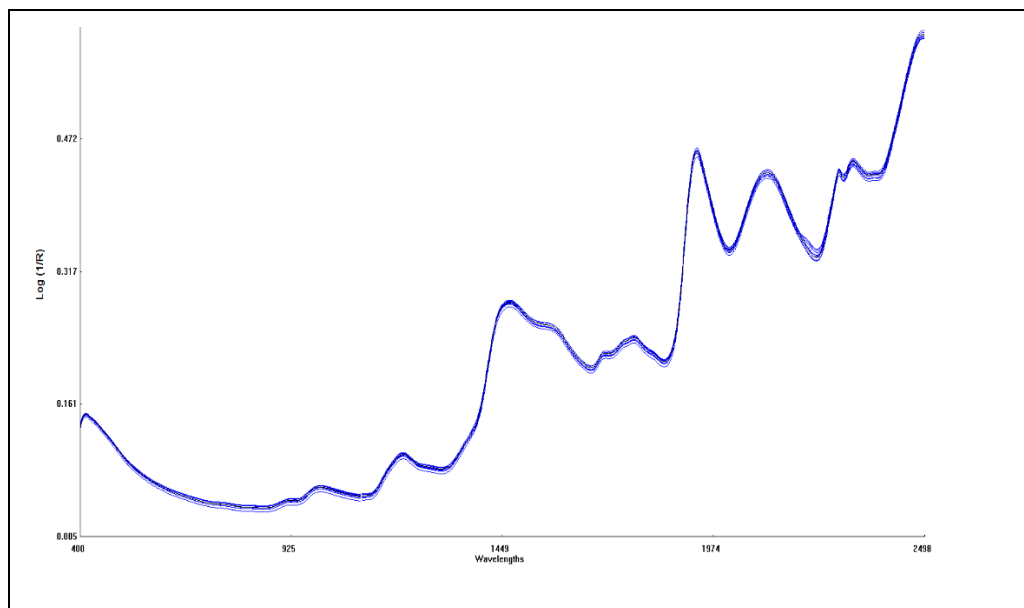
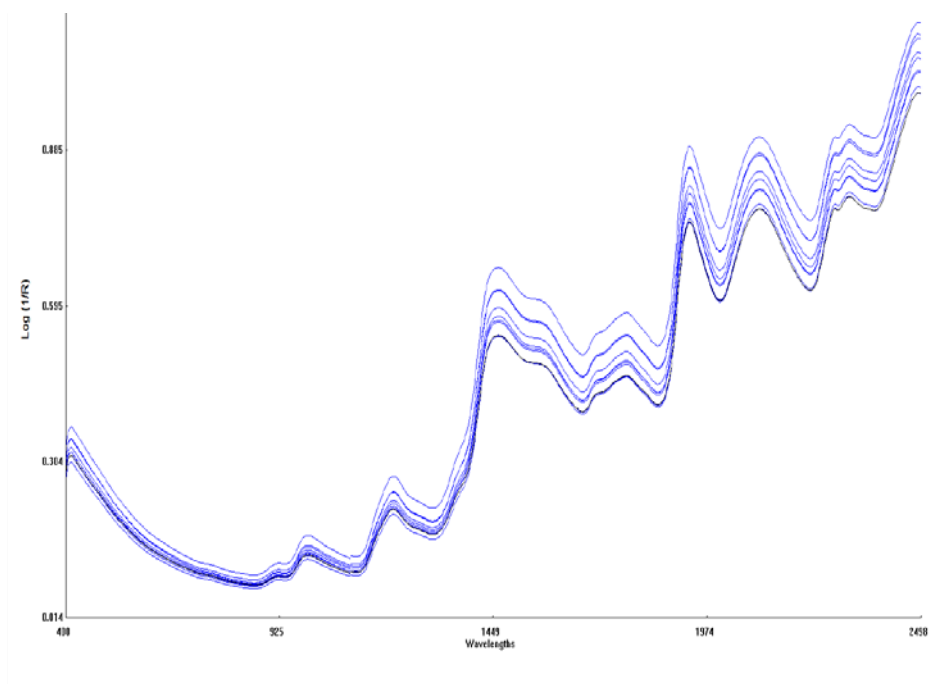Figure 2: Spectra of 10 replications of milled gari using the NIRS

Figure 3: Spectra of 10 replications Un-milled gari using the NIRS

Institute:	Cirad – UMR QualiSud
Address:	C/O Cathy Méjean, TA-B95/15 - 73 rue Jean-François Breton - 34398 Montpellier Cedex 5 - France
Tel:	+33 4 67 61 44 31
Email:	rtbfoodspmu@cirad.fr
Website:	https://rtbfoods.cirad.fr/