Report on the Calibration and validation of NIRS calibration models developed for determination of selected end-user traits of fresh cassava roots

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Overview:

Calibration models were developed for dry matter and starch content in fresh cassava roots using three sampling protocols namely, blending, grating and chopping. Blended samples had better coefficient of determination in calibration when compared with other modes of sample presentation

Sampling and measurement protocols

Materials:

A total of 72 fresh cassava roots, comprising of 18 genotypes from IKENNE and UBIAJA locations with two replications per location. Three (large, medium and small size roots) of each root were washed, air-dried, peeled, and again washed and dried with soft paper. The roots were cut into smaller sizes using stainless steel knife and then blended using Laboratory Warren blender. Blended samples were divided into two portions, a portion was scanned on the tabletop Near Infrared Spectrometer (XDS Rapid Content Analyzer; XM 1100 Series) with a wavelength range of 400 nm to 2498 nm. Standard method of analysis was used to analyze the samples in the laboratory for dry matter content. 144 spectra data were collected on the NIRS using the Win ISI software and spectra data were stored on the database.

Spectra Collections:

A total of 72 samples were scanned on the NIRS machine using the ISI Scan software. Each of the sample set was scanned two (2) times with wavelength range of 400 to 2498 nm, registering the absorbance values log (I/R) at 0.5 nm intervals for each sample using a NIRS monochromator (model FOSS XDS, solid module) and a coarse cell cup. Blended samples were homogenized and fill into the sample cup for spectra collections. 114 spectra data were generated during period 2 and spectra data were subjected to various pre-treatments to eliminate noise and outliers.

Table 1: Calibration statistics of Blended Fresh Cassava roots

Constituent	N	Mean	SD	Est. Min	Est. Max	SEC	RSQ	SECV	1-VR
DM	125.00	32.761	4.544	19.128	46.393	1.140	0.937	1.314	0.916

SEC: standard error of calibration; **SECV**: Standard error of cross validation; **RSQ**: coefficient of determination in calibration

Table 2: Validation statistics of Blended Fresh Cassava roots for dry matter

Constituent	N	Mean	SD	SEP	R^2pred	BIAS	SLOPE
DM	72	33.13	4.03	1.503	0.875	-0.457	0.954

SEP: standard error of prediction, **SD**: standard deviation

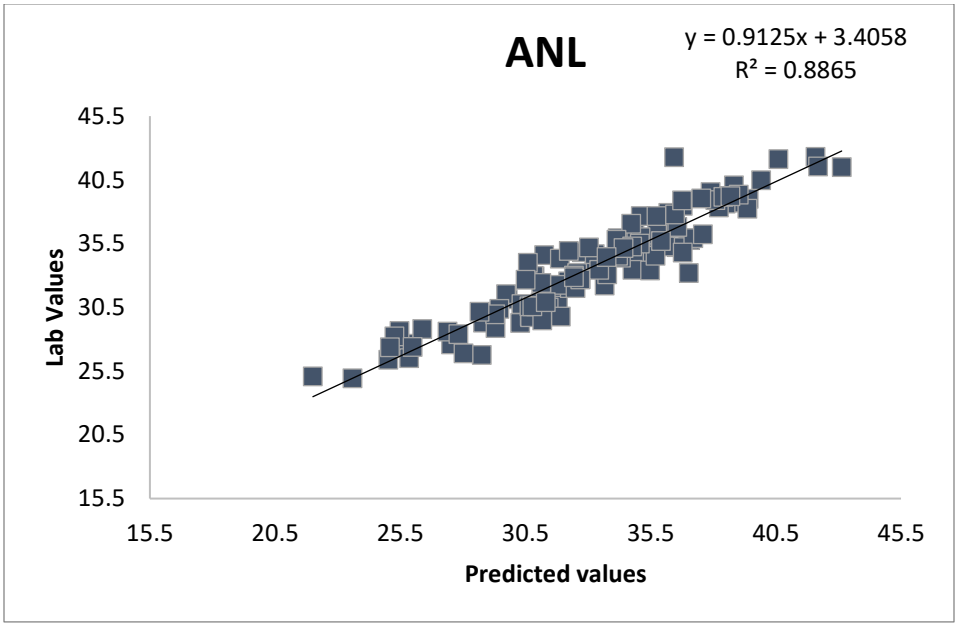

Figure: Validation curve for dry matter content of fresh cassava roots

Conclusion:

Dry matter content is an important quality trait of interest in fresh cassava roots, which informed several decisions taken in many breeding programmes. Limitation with time taken during wet analysis has been eliminated by the adoption of Near Infrared Spectrometers for the determination of these traits. This study shows that dry matter content can be accurately predicted during screening stages of breeding using the near infrared spectroscopy. However, the prediction performance of starch content is not yet acceptable due to poor coefficient of determination in calibration. Therefore, prediction model for starch is expected to be improved upon.