NIRS Prediction of Neutral Detergent Fiber Digestibility of Tropical Forages

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INTRODUCTION

Near Infrared Reflectance Spectroscopy (NIRS) is a method to obtain rapidly information on chemical plant compounds. It is environmentally friendly as it avoids the use of chemical reagents for analysis. Neutral Detergent Fiber Digestibility (NDFD) is used to estimate energy content of feedstuffs and thus also as an important criterion in forage breeding.

OBJECTIVE

The aim of this work was to develop a NIRS calibration equation for NDFD of tropical forages as a tool in diet formulation to increase productivity on farm.

MATERIAL AND METHODS

Forages: The study was conducted using 238 forage samples (154 grasses and 84 legumes, of which 42 were herbaceous and 42 shrubs).

Fig. 1 Tropical forages collective for calibration

Reference Analysis:

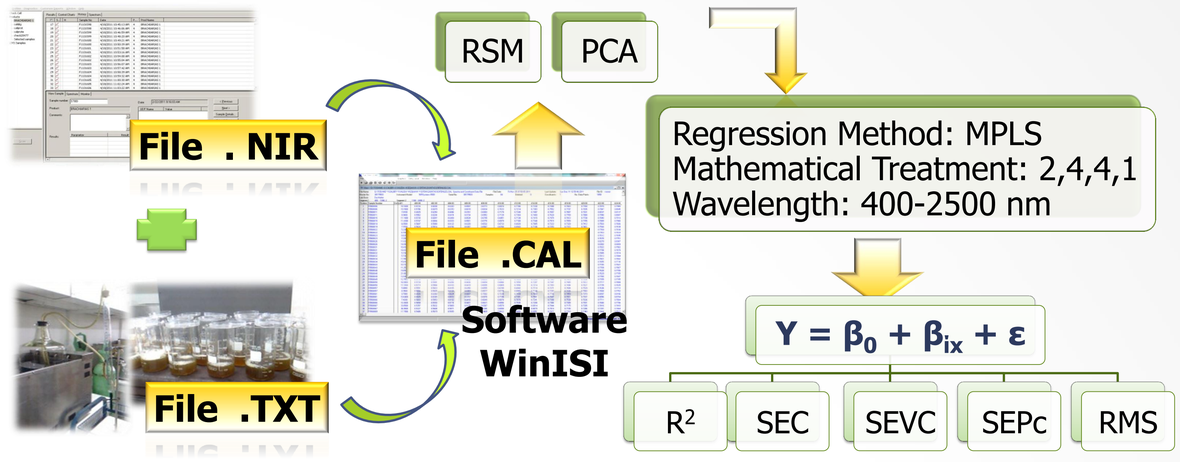
Digestibility of Neutral Detergent Fiber (NDFD) was determined running one replicate each in two separate runs, using approximately 0.5 g of sample in a 100 ml centrifuge tube for the digestion (Tilley & Terry 1963), followed by the evaluation of NDF in the residue. The NDFD values as a percentage of NDF in the sample were calculated as [1 – (g of residual NDF after fermentation/g NDF of original sample)] × 100.

Obtaining Spectra: The ground samples were scanned in intervals of 2 nm over the spectral range 400 to 2500 nm, with a FOSS-NIRSystem II monochromator model 6500. The samples were packed in simple cells (Black) US-ISIH-0307, metal circular, 3.5 cm diameter and with a quartz window. Each sample was divided in two subsamples, to give two spectra for sample.

Fig. 2 FOSS-NIRSystem II monochromator model 6500, spectral range 400 to 2500 nm, in reflectance. * To the right: inside view

Fig. 3 Simple cells, metal circular, 3.5 cm internal diameter and with a quartz window

Calibration and Validation



Validation of the equation was conducted with a total of 40 external forage samples (20 grasses and 20 legumes).

RESULTS AND DISCUSSION

The calibration collective showed a high variability (CV 36.63%), due to a marked heterogeneity of species and stems and leaves, different cutting ages (between 5 and 20 weeks for grasses), varying in vegetative stage and geographical origin.

Table 1 Statistical parameters and predictive potential of the selected equation for NDFD.

Calibration							Validation			
Nc	SEC	SEVC	SEPc	R^2	RPD	r	Nv	SEPv	R^2v	r
230	2.1	3.2	3.6	0.95	4.4	0.96	40	4.3	0.93	0.96

N_C: samples for calibration; SEC: Standard Error of Calibration; SECV: Standard Error of Cross Validation (Error NIRS); SEP_c: Prediction Standard Error (calibration); R^2: Coefficient of Determination; RPD: ratio (Sd /SECV); r: Correlation coefficient; N_C: samples for Validation; SEPv: Standard error of prediction (validation); R^2v: Coefficient of determination (validation).

The selected equations proved as suitable for NDFD prediction for their low standard errors (SEC SEVC and SEPC) (Table 1), when considering the complexity of the product.
The coefficient of determination > 0.90 shows an adjustment of the model, also the index RPD (ratio DS / SECV) presents values > 3, demonstrating the predictive power of the selected equations.
There is a high correlation between predicted data and reference data, in both the validation and calibration (r>0.90).

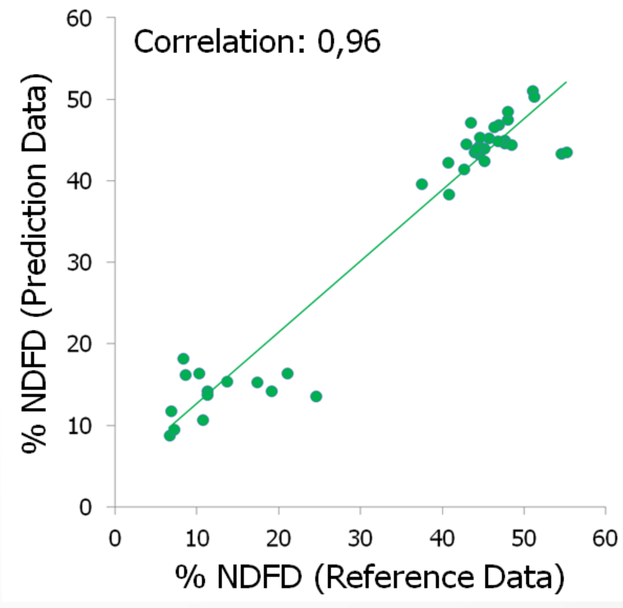


Fig. 4 Correlation for NDFD (Validation samples)

CONCLUSIONS

A reliable calibration equation to predict NDFD of tropical forages by NIRS was generated.

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