Abstract

# Prediction of the nutritive value of high moisture corn samples using near infrared spectroscopy and jack-knifing

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## Introduction

High moisture corn (HMC) is defined as a plant material harvested with 22% to 30 % moisture, ground and conserved in conditions of anaerobiosis. For both beef and dairy cattle feeders, storing grains at high moisture content is one practice that can improve their competitive position and reduce costs. The aim of this study was to evaluate the potential use of near infrared (NIR) reflectance spectroscopy to predict the nutritive value of high moisture corn (HMC). The use of the jack-knifing as a method to reduce redundant wavelengths was explored when the calibration models were developed.

## Materials and methods

HMC samples ($n = 98$) were collected from commercial farms during 1999 – 2002, representing a wide range of agronomic and soil characteristics across Uruguay, including different silo structures as well as different varieties and hybrids. Nitrogen (N), acid detergent fibre (ADF), and organic matter digestibility (OMD) were determined in the dry samples. Sample pH was determined on the liquid phase using a glass–electrode pH meter. Ammonia nitrogen (N-NH3) was estimated by distillation. Spectra were collected in the visible (vis) and near infrared (NIR) regions in reflectance (400–2500 nm). Calibrations between chemical and NIR data were developed using partial least squares (PLS) regression.

## Results and discussion

Table 1 shows the NIR cross-validation statistics obtained to predict the nutritive value of HMC samples.

No improvements in the *RPD* values for the calibration models using jack-knifing were obtained. However, a reduction in the number of latent variables or PLS factors used was noted, as a direct result of selecting fewer wavelengths for the development of the calibration models by the jack-knifing method.

**Table 1.** Cross-validation statistics for the prediction of the nutritive value of high moisture corn samples using Jack-knifing ($n = 98$).

| | $R^2_{cal}$ | *SECV* | *RPD* | *LV* |
|---|---|---|---|---|
| DM (%) | 0.84 | 2.68 | 2.9 | 6 |
| CP (%) | 0.85 | 0.55 | 2.0 | 6 |
| ADF (%) | 0.89 | 2.1 | 2.6 | 2 |
| OMD (%) | 0.84 | 2.09 | 2.3 | 4 |
| Ash (%) | 0.82 | 0.36 | 3.0 | 5 |
| pH | 0.87 | 0.36 | 1.7 | 7 |
| N-NH3 | 0.86 | 0.90 | 2.5 | 7 |

DM, dry matter, CP, crude protein; ADF, acid detergent fibre; OMD, organic matter digestibility; N-$NH_3$, ammonia nitrogen, n, number of samples in calibration after outlier removed, $R^2_{cal}$, coefficient of determination in calibration; *SECV*, standard error of cross validation; *RPD*, *SD/SECV*; *LV*, number of partial least square terms in calibration