

Comparison of fecal crude protein and fecal near-infrared reflectance spectroscopy to predict digestibility of fresh grass consumed by sheep

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Abstract :

Organic matter digestibility (OMD), an essential criterion for the evaluation of the nutrition of ruminants, cannot be measured easily at pasture. Therefore, the objective of this study was to test and compare 2 methods of OMD prediction based on the fecal CP content (CPf) or near infrared reflectance spectroscopy (NIRS) applied to feces. First, published equations derived from fecal N (Eq. 1_{CP}, n = 40) and from fecal NIRS (Eq. 1_{NIRS}, n = 84) were used to predict OMD of an independent validation data set from which in vivo OMD, ranging from 58 to 74%, was measured for 4 regrowth stages of *Digitaria decumbens*. Second, to establish equations usable in grazing situations and to improve the efficiency of the predictions, new equations were calculated from a large data set (n = 174) using CPf (Eq. 2_{CP}) or fecal NIRS (Eq. 2_{NIRS}). By applying the CPf method, Eq. 2_{CPf} (OMD, % = 88.4 – 263.9/CPf, % of OM; residual SD = 2.92, r² = 0.63) showed similar statistical parameters (P < 0.01) when compared with Eq. 1_{CP} (OMD, % = 86.6 – 266.2/CPf, % of OM; residual SD = 2.95, r² = 0.79). When using fecal NIRS, Eq. 2_{NIRS} showed decreased SE of calibration (SEC = 1.48) and of cross-validation (SECV = 1.75) and greater coefficient of determination of cross-validation (R²_{CV} = 0.85) than the previously published Eq. 1_{NIRS} (SEC = 1.78, SECV = 2.02, R²_{CV} = 0.77). The validation of the 4 equations on the validation data set was satisfactory overall with an average difference between the predicted and the observed OMD ranging from 0.98 to 2.79 percentage units. The Eq. 2_{NIRS} was nevertheless the most precise with a decreased residual SD of 2.53 and also the most accurate, because the SD of the average difference between predicted and observed OMD was the lowest. Therefore, fecal NIRS provided the most reliable estimates of OMD and is thus a useful tool to predict OMD at pasture. However, an adequate number of referenced data are required to establish good calibration. Indeed, better calibration statistics were obtained by increasing the dataset from 84 (Eq. 1_{NIRS}) to 174 (Eq. 2_{NIRS}). In contrast, using fecal N on a set of 84 or 174 points did not improve the prediction. Both methods are useful for predicting OMD at pasture in certain circumstances, using fecal NIRS when a large data set (n = 84 and n = 174) is available and fecal CP with smaller data sets (n = 40).

Key Word :

digestibility, fecal crude protein, near infrared reflectance spectroscopy, sheep, tropical grass