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Evaluation of spectrometer type and handling procedures for prediction of herbivore diet crude protein from feces.

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INTRODUCTION

Fecal near infrared spectroscopy (FNIRS) has been used to estimate diet quality, and diet composition in free ranging herbivores. With adequate calibration, the technique has proven to be a precise and robust analytical tool. While FNIRS is much faster than traditional reference methods, there is a need to develop near real-time analysis of herbivore diets. Faster turnaround will facilitate: 1) producer risk management and decision making in the face of dynamic forage and climatic conditions on pasture and rangeland, and 2) sustainable grazing and conservation practices. A study was conducted to compare the calibration and validation results of FNIRS prediction models for predicting the diet dry matter crude protein (CP) concentration of cattle from fecal spectra.

EXPERIMENTAL

This study was conducted with a pre-dispersive FOSS NIR Systems 6500 scanning monochometer and a post-dispersive Perten DA 7200 diode array instrument. Cattle fecal samples (n=178, Nitrogen mean = 9.47+-1.77, max 15.31, min 5.13) collected in Kingsville, Texas (27.520291, -97.896862) were used to develop calibrations using the same samples on both instruments. Forced air drying at 60º C and milling to pass a 1 mm screen were preformed to develop the FOSS calibration and on the Perten instrument (GROUND). Two additional sample handling techniques were conducted on the Perten instrument. One being data collection on “fresh” or “as received” fecal samples (FRESH). The second being data collection on samples mechanically crushed to a mean particle size ranging from 1 to 3 cm (CRUSHED). Nitrogen was performed by total combustion. Partial least squares principal component analysis was used to develop predictive calibrations in each instance by using The Unscrambler® software version 10.2. The numbers of principle components used for each of the calibrations were 8, 6, 9 and 10

for FOSS, GROUND, CRUSHED and FRESH respectively. The calibration R2 values for each of the treatments were 0.94, 0.90, 0.89 and 0.80 respectively. The corresponding calibration RMSE values for each of the treatments were 0.44, 0.50, 0.53 and 0.74 respectively. Similarly, the validation R2 values for each of the treatments were 0.84, 0.84, 0.80 and 0.60 respectively. The corresponding validation RMSECV values for each of the treatments were 0.62, 0.62, 1.06, and 0.73 respectively. The Ratio of Performance to Deviation (RDP) were 2.87, 2.86, 2.43, and 1,68 respectively.

RESULTS AND DISCUSSION

The FOSS treatment represents the standard procedure in our laboratory. Considering animal passage rate with 2 day mail delivery and 2 day turnaround time, a livestock producer or wildlife manager receives diet information within ~ 6 days of consumption. This timing is often adequate for extensive landscapes or stable weather conditions. However, in highly variable weather or intensively managed grazing operations, faster access to such information is warranted. Both instruments and each handling technique were comparable and performed adequately. However, the RDP of FRESH indicates water interference and the need of more work on optimization. This study provides proof of concept for using alternate sample handling techniques in an effort to more quickly disseminate nutritional information to grazing animal managers.

Presentation Type

Poster Only

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