RESEARCH

Predicting intake, digestibility of nutrients, and performance in grazing cattle using near infrared spectroscopy (NIRS) of the feces

PREDICTING FORAGE INTAKE ON PASTURE

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Background: In grazing situations, the intake and digestibility of forages is heavily influenced by fibre content and amount of lignin. Neutral detergent fibre (NDF) is a measure of fibre content in forages and can influence dry matter intake and overall animal performance. The undigestible NDF (uNDF) is the portion of NDF that cannot be digested. Forages can have the same NDF content but still differ considerably in uNDF.

Improving feed efficiency of grazing beef cattle has long been an industry goal. Unfortunately, it is extremely difficult to measure forage intake in grazing situations. This is why many studies looking at feed efficiency have used technologies such as GrowSafe to accurately measure feed intake. Other methods, such as dosing animals with a particular marker and measuring disappearance of the marker are time and labour intensive, and face challenges if the diet is not homogenous.

Near infrared spectroscopy (NIRS) is a rapid, cost-effective alternative to wet chemistry that has been used to determine the composition of feeds for some time. NIRS has also been used to analyze feces for diet residues. This project explored whether NIRS can be used in a variety of grazing situations to accurately predict forage intake.

Objectives: The objectives of this study are to:

1. Construct fecal NIRS calibrations to predict uNDF and lignin content to estimate feed intake
2. Develop broad based fecal NIRS calibrations capable of predicting fecal composition, forage intake, and total tract digestibility in grazing cattle
3. Evaluate performance and prediction capabilities of fecal NIRS to select for more feed efficient grazing cattle
4. Examine fecal nutrient losses of grazing cattle under different management and determine if fecal NIRS can be used to predict grazing intake and performance of individual animals

What they did: Several studies were conducted. The first two were intake and digestibility studies using eight heifers receiving four different diets over four different 28-day periods to assess whether uNDF and lignin could predict feed intake and digestibility. Diets fed included alfalfa and timothy hay at mid and late maturities as well as 50/50 combinations of alfalfa and timothy at both maturities. Measurements included feed quality analysis, individual feed intake, urine and fecal chemical composition, along with apparent total tract digestibility. Paired wet and dried fecal samples were scanned with NIRS.

Next, coupled diet and fecal samples were taken monthly from 156 steers grazing on four different pasture mixtures (perennial and annual). This study was repeated using new steers over a four-year period with forage and fecal chemical composition determined and scanned with NIRS.

Another grazing study utilized 150 cross breed steers grazing on mixed perennial pasture for 90-120 days over three years. Forage and fecal samples along with steer bodyweight were measured every three weeks and again chemical composition was determined and compared to the NIRS measurements.

Finally, 64 heifers were measured for residual feed intake (RFI) over 56 days. Fecal samples were taken weekly, analyzed for chemical composition, and scanned with NIRS and used to evaluate whether the uNDF calibrations could predict low or high RFI animals.

What they learned: The dried and ground fecal NIRS calibration equations had over 80% agreement with actual dry matter intake (kg/day) and dry matter digestibility (%), and over 75% agreement with forage quality indicators such as uNDF and NDF digestibility across a wide range of high forage diets. Additionally, preliminary work suggests wet fecal calibrations may be accurate enough to provide general screening in real time, rather than having to dry and grind fecal samples prior to analysis. The ability of NIR calibrations to predict certain chemical composition or intake parameters did change depending on how the parameters were reported. For example, prediction of dry matter intake expressed in kg per day was better than when dry matter intake was expressed as percentage of body weight. However, all intake calibrations generated good to excellent predictions.

What it Means: Developing a cheaper, easier way to measure forage intake and digestibility on pasture has great potential to help producers identify the animals that are performing optimally in extensive grazing environments. With more refinement and validation, the use of NIRS appears promising to help producers detect those animals that are making the best use of forage-based diets.

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