LINK Sustainable Livestock Production Research Programme

LK06894

Estimation of ruminant energy and degradability values of maize silage using Near Infrared Reflectance Spectroscopy

Executive Summary

Currently there are no rapid methods for the estimation of the energy value of maize silage. Improved feeding values are essential for efficient nutrient use.

Objectives

1. Generate accurate and repeatable NIRS equations to predict maize silage organic matter digestibility and hence ME value.
2. Generate accurate and repeatable NIRS equations to predict dry matter (DM), starch and nitrogen (N) degradability of maize silage.
3. Evaluate a cheap, rapid and reliable gas production system to replace the *in situ* method for the estimation of DM, starch and N degradability.

Project start date: 01/12/2009 Project end date: 30/04/2012

Results

1. A total of 90 samples of maize silage were collected from commercial farms in the UK over two years. The large variation of the samples covered most of the extremes of UK maize silage and allowing a wide range for equation NIRS development.
2. The predicted metabolisable energy contents estimated in sheep ranged from 9.1 to 12.0 MJ/kg DM.
3. The *in situ* rate of DM degradation was lower than silage values in the current Feed into Milk (FiM) database and therefore the calculated effectively rumen degraded DM content (using the FiM model) was low. This may reflect a shortcoming of the FiM model for maize silage. To overcome it is proposed that for maize silage it is a more rational to assume that a large proportion of the starch particles (i.e. the 'a' fraction) degrade at the same rate as the soluble components (i.e. the 's' fraction).
4. The high N solubility coupled with the low N content of maize silage meant that the N degradability data from most of the silage samples could not be fitted to the Orskov and McDonald (1979). If single values for 'a', 'b' and 'c' are accepted (calculated from the mean of the 90 samples), the estimate of effectively degraded N content of a maize silage would then be moderated by variation in its N content and N solubility.
5. Starch in the maize silages was highly degradable and was completely degraded within 24 h. Although starch degradability is not required by the FiM model, application of the FiM assumptions to starch gave very low effective degradability. If a modified FiM model is used where the 'a' fraction was treated as soluble, more realistic estimates of effectively degradable starch are produced.
6. Acceptable wet silage NIRS equations were developed for DM, crude protein, starch, NDF, pH, DM 'a' and soluble N. No NIRS prediction equations could be generated for the FiM 'b' and 'c' terms for DM and starch.
7. The Bioparametrics gas production method may be able to predict the FiM DM degradability parameters 'a' plus 'b', but was not able to separate the 'a' term from the 'b' term. The 'c' term could not be predicted by the gas production method.

Information transfer and expected benefits

The information gathered should improve the prediction of nutrient and energy content of maize silage, increase accuracy of diet formulation and reduce nutrient wastage.

These data will be incorporated into FAA maize silage calibration set for evaluation of new NIRS equations. Any improved equations are planned to be released to FAA members before the start of the 2012 maize silage analysis season.

The suggested modification of the Feed into Milk model for the dry matter and nitrogen degradation of maize silages will be presented to the UK ruminant feeding industry via FAA group members and technical and press articles.