A Star Tech, The Final Front-MIR: Estimated breeding values for mid-infrared derived predictions of energy traits in dairy cows

S. Smith[1], V. Hicks[2], M. Coffey[1], M. Winters[3] & E Wall[1]

[1]*Scotland's Rural College, Edinburgh, EH9 3JG UK*
[2]*National Milk Records, Chippenham, SN15 1BN UK*
[3]*Agriculture & Horticulture Development Board, Stoneleigh Park, CV82TL UK*

Abstract

The advantages in terms of time, cost and labour of using mid-infrared spectroscopy over reference methods to assess the biochemical properties of milk have seen its application escalate over the last decade. Building on the initial predictions of McParland et al. (2011), we used over 590,000 phenotypic records from 922 dairy cows from our experimental herd (Crichton Royal Farm, Dumfries, Scotland) to calculate three major body energy traits using the equations of Banos and Coffey (2010); Energy balance (EB, mega joules per day) a function of milk yield, fat and protein content, dry matter intake, body weight and body condition score; Energy content (EC, mega joules) a function of body weight and condition score, predicting body lipid and protein weight and Effectively energy intake (EI, mega joules per day). Calibration of concurrent spectral data with such phenotypic data by partial least squares analysis and tool optimisation has generated prediction tools for energy balance and energy intake with accuracies (correlation coefficient of predicted against reference using four-way cross validation) of 0.84 for both traits. These tools have since been applied to over 11.6 million animal test-date records collected nationally by NMR. Subsequent genetic analyses have estimated the heritabilities of MIR-predicted energy balance and intake at 0.07 and 0.10 respectively. This work details the results of estimated breeding values for MIR-derived energy predictions and national trends as part of routine genetic evaluations coordinated by EGENES. The initial genetic evaluations are being performed in agreement with AHDB Dairy with the objective of publishing estimated breeding values for energy balance and intake routinely for farmers to use in selection decisions. It also highlights the potential future use of MIR-derived traits in breeding goals and where this star technology has taken us with regards to the frontiers of 'freenotype' prediction.

Key words: Mid-infrared spectroscopy, phenotyping, breeding values