

Individual methane prediction from milk MIR spectra, across multiple breeds, lactation stages, parities and country-specific dairy farming systems

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Abstract

Reducing the methane (CH₄) eructed by dairy cows is a challenging aspect of cattle breeding. To permit large scale studies focusing on genetics and management, we have searched for a rapid, inexpensive, and easy-to-apply tool for the estimation of daily quantity of CH₄ (g/d) eructed by dairy cows from a large scale databases. An equation has been developed to estimate individual CH₄ emission from milk MIR spectra. To enlarge the variability in CH₄ emission covered by this equation, we used more than one thousand CH₄ reference measurements obtained with the SF₆ or respiration chambers techniques from eight European countries: Belgium, Denmark, France, Germany, Ireland, Luxembourg, Switzerland and United Kingdom. These records came from different feeding system like grazing, maize- and grass-silage based diets, with or without linseed supplementation, and synchronized or non-synchronized supply of fermentable energy and rumen degradable protein. Multiple breeds and differentiated lactation profile were also covered in this dataset: Holstein, Jersey, Brown-Swiss and Holstein-Jersey cows with a large range of lactation numbers and stage of lactation. Their corresponding milk FT-MIR spectra were also available. All the MIR instruments used were standardized into a common format, following the European Milk Recording method. The calibration equation was developed using partial least square regression including linear and quadratic modified Legendre polynomials to take into account the lactation stage. The equation had a R²cv of 0.67 and a standard error of cross-validation (SECV) of 70 g CH₄/cow and day. These encouraging results allow us to envisage the use of this equation on a large scale of data in order to develop management and selection strategies and tools to help farmers to mitigate the CH₄ quantity eructed by their cows.

Keywords: Methane, milk mid-infrared, dairy cow, heritability