A simple method to predict methane emissions based on milk mid infrared spectra

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Context

Reducing methane (**CH_4**) emissions from dairy cows is a relevant challenge at two major levels:

➢ Environmental concerns

CH_4 → Important greenhouse gas (**GHG**)

CH_4 from cows = 40% of GHG emissions from agriculture sector

➢ Economical perspective

Animal efficiency → CH_4 production implies losses of gross energy intake

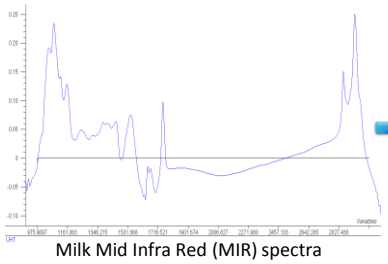
The main levers of actions are feeding, genetics and animal productivity.

→ Individual CH_4 emissions have to be quantifiable on a large scale to study the exact link with those levers.

Prediction of daily CH_4 emissions from milk MIR spectra

Ruminal fermentations → cause 95% of the CH_4 emissions from cows
→ influence milk composition (eg. fatty acids)

→ Link between CH_4 emissions and milk composition



Milk Mid Infra Red (MIR) spectra

Linked individual daily CH_4 measurement

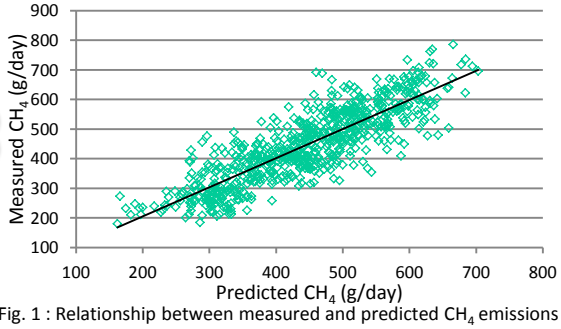


Fig. 1 : Relationship between measured and predicted CH_4 emissions

Table 1 : Statistical parameters of the equation to predict CH_4 from milk MIR spectra

	N	Mean	SD	R^2c	R^2cv	SEC	SECV
g CH_4/day	532	430	129	0.74	0.70	66	70

SEC: *standard error of calibration* ; **SECV:** *standard error of cross validation*

Possible to predict CH_4 from milk MIR spectra

Major interest : individual milk MIR spectra are already collected routinely during milk recording.

→ Examples of application of the prediction tool on the Walloon milk spectral database (n=2,047,893)

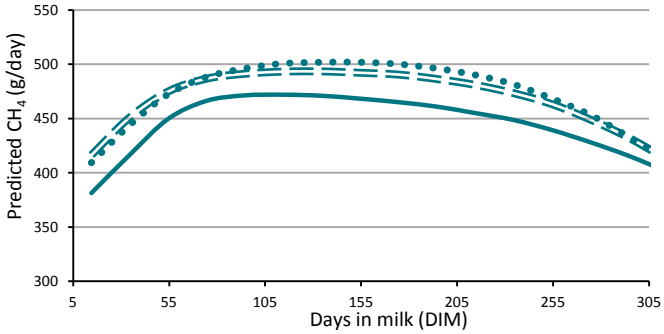


Fig. 2 : Evolution of CH_4 prediction in Walloon Region (Belgium) in function of the DIM and the parity

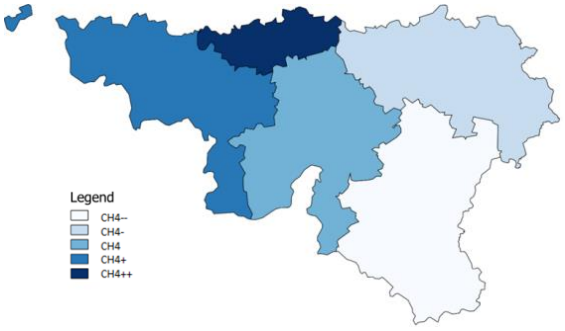


Fig. 3 : Evolution of CH_4 prediction in function of geographical location

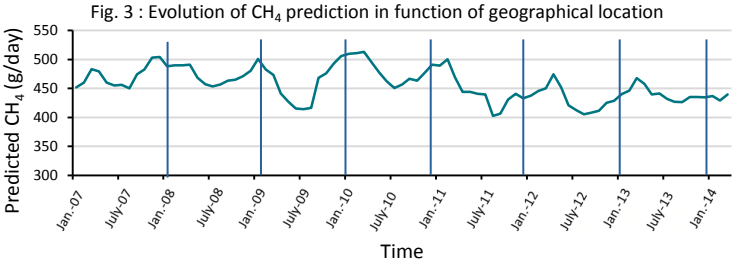


Fig. 4 : Evolution of CH_4 prediction in Walloon Region (Belgium) from 2007 to 2014

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Milk mid-infrared spectra enable prediction of lactation-stage-dependent methane emissions of dairy cattle within routine population-scale milk recording schemes

Take home message

The prediction of individual CH_4 emissions from milk MIR spectra of dairy cows is possible. As MIR information is available, it permits large scale applications (individual, herd, region, country levels) over years. Genetic selection, adapted good farming practices and diet/management advices can be initiated to reduce CH_4 emission which was not possible before.

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