Development of a method to predict individual enteric methane emissions from cows based on milk mid-infrared spectra

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Objectives

Reducing enteric methane emissions from dairy cattle through the development of a method to predict those emissions from each dairy cow based on mid-infrared spectra of individual milk.

Materials and methods

➢ Methane measurement by the SF_6 method (tracer gas)

Fig. 1 : Bolus containing and emitting SF_6

In rumen

Fig. 2 : Device for collecting a sample of daily enteric CH_4 emissions

➢ Searching for CH_4 variability

➢ Four trials were conducted (Table 1)

- CH_4/24h X 5 days (CH_4 /kg milk)
- 50 ml of individual milk AM and PM → 2 MIR spectra/day
- Average daily milk spectrum (AMS)
- Methane emission of day X // AMS of day X

→ Equation of prediction

- Partial least squares regression
- Cross-validation

Table 1 : Daily milk production and diet for each trial

Trial	N cows	Mean of kg milk/d	Diet
1	2X4	17.4 ± 3.9 kg/d	Fresh pasture/ Corn silage(Cross-over)
2	3	26.2 ± 1.9 kg/d	Grass silage
3	12	25.5 ± 3.7 kg/d	TMR 1
4	6	26.0 ± 2.1 kg/d	TMR 2

TMR : Total Mixed Ration

Results and discussion

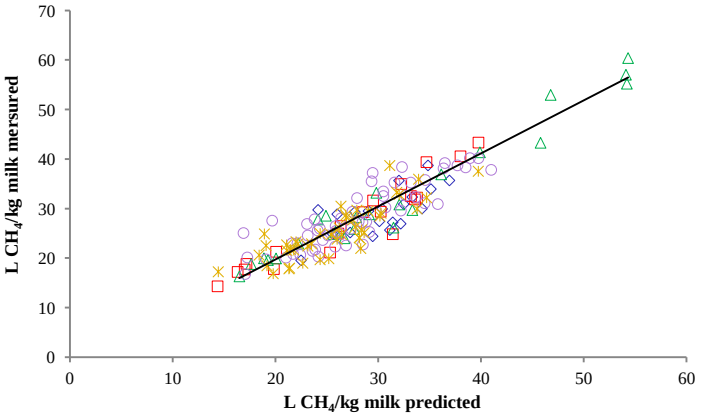

Fig. 3 : Relationship between CH_4 emissions measured and those predicted according to the type of feeding

Table 2 : Statistical parameters for the methane prediction equation

N	R^2c	R^2cv	SEC	SECV	RPD
165	0.84	0.74	3.1	3.94	1.96

SEC : standard error of calibration ; **SECV** : standard error of cross validation ; **RPD** : Ratio of performance to deviation

➢ R^2cv of 0.74 and RPD of 1.96 are very promising → Predicting the amount of enteric methane emitted from the milk MIR spectra appears to be possible and a first screening is feasible.

➢ Increasing the amount of data is crucial to confirm this trend and to compensate errors in the measurement of CH_4.

Conclusion

➢ The results are very encouraging and it seems possible to predict individual emissions of CH_4 through the MIR spectra of milk.

➢ More data should be collected in order to confirm this trend and improve the reliability of predictions. Then this equation can be used to select cows which are high milk producers and low methane emitters but also to define which diets, herd management, *etc.* are the most appropriate to reduce methane emissions.

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