

Predicting methane emissions of individual grazing dairy cows from spectral analyses of their milk samples

Donagh Berry, M. Frizzarin, B. Lahart, M. Kennedy, L. Shalloo, M. Egan, K. Starsmore, S. McParland

Teagasc, Ireland

Donagh.berry@teagasc.ie

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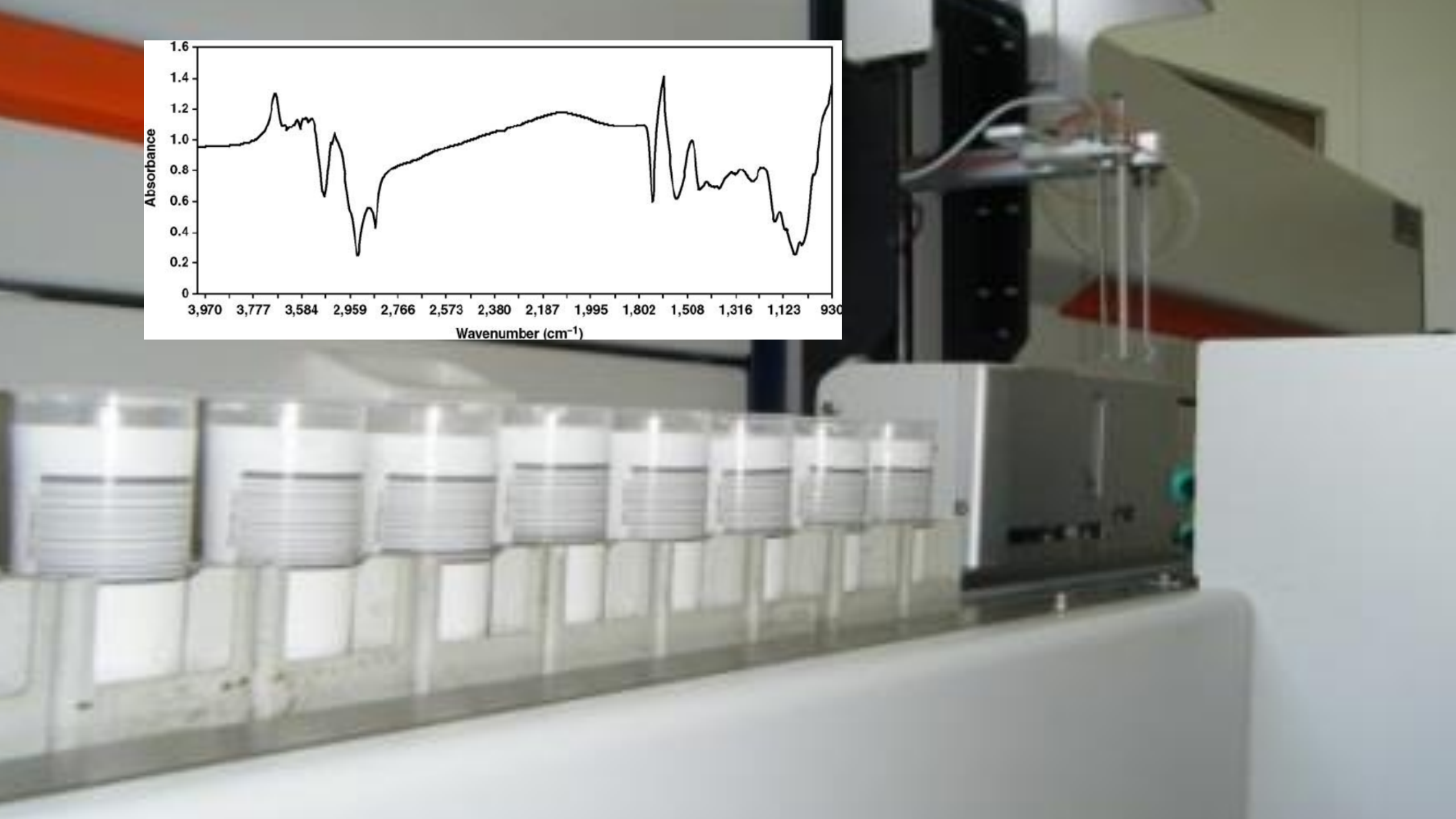
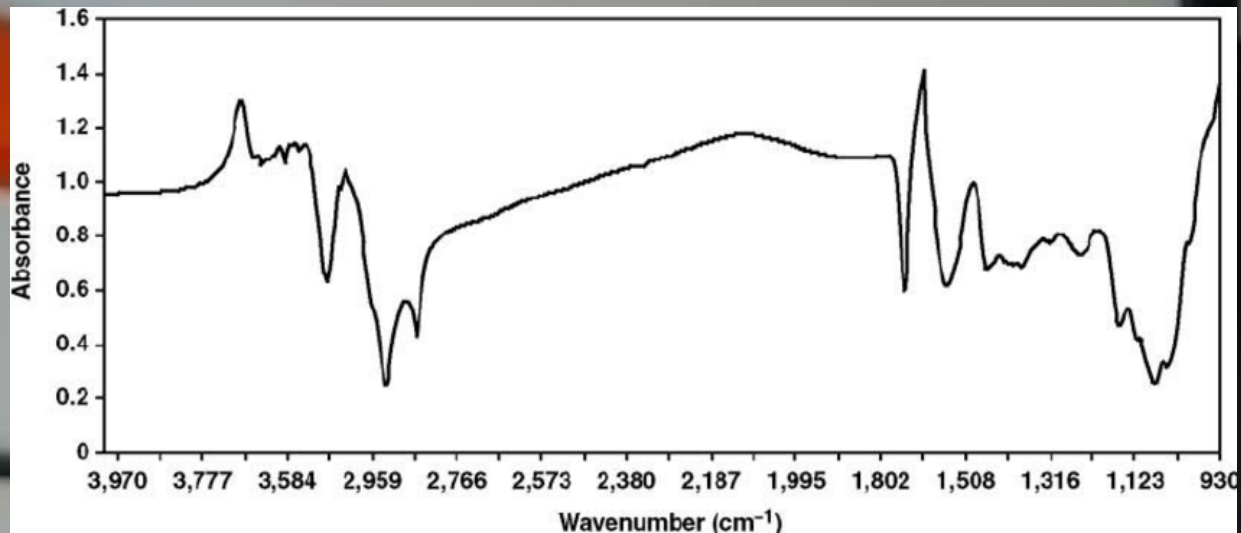


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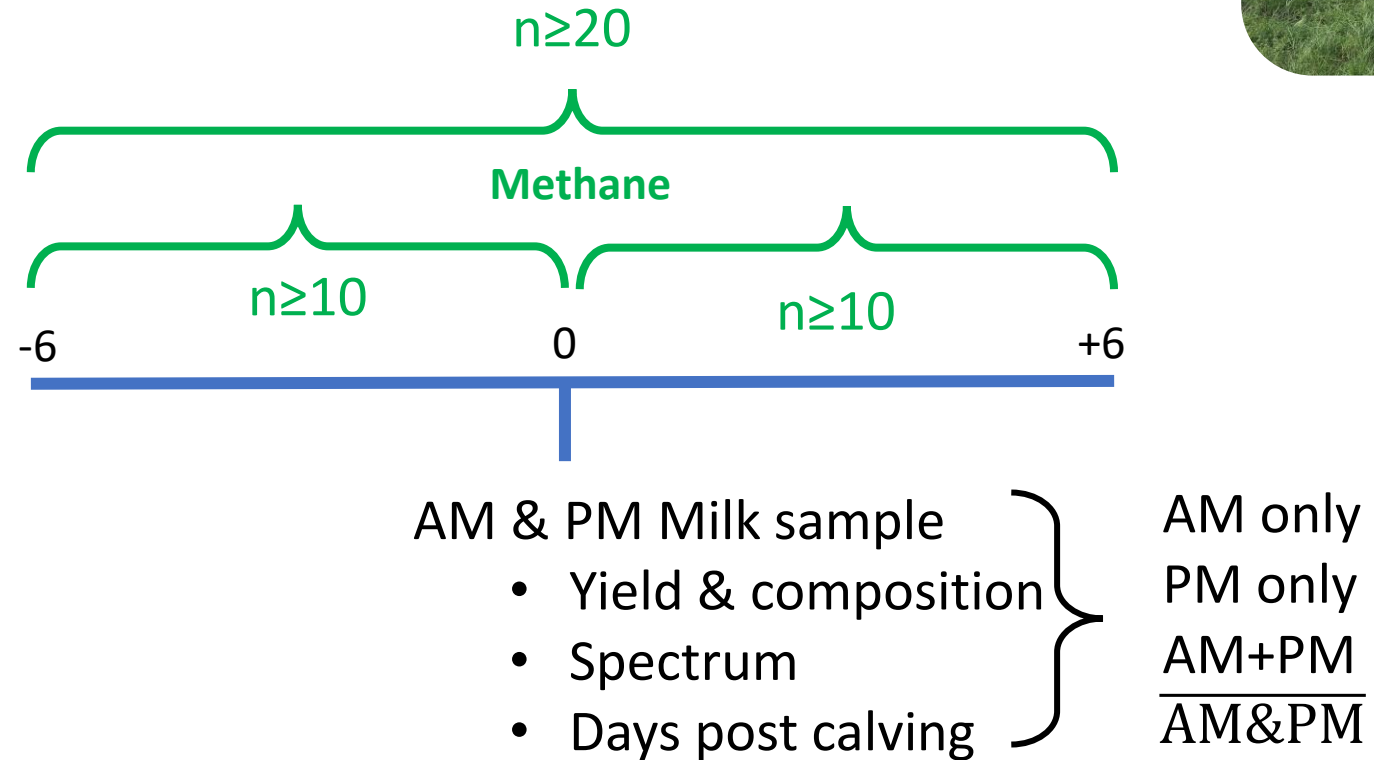






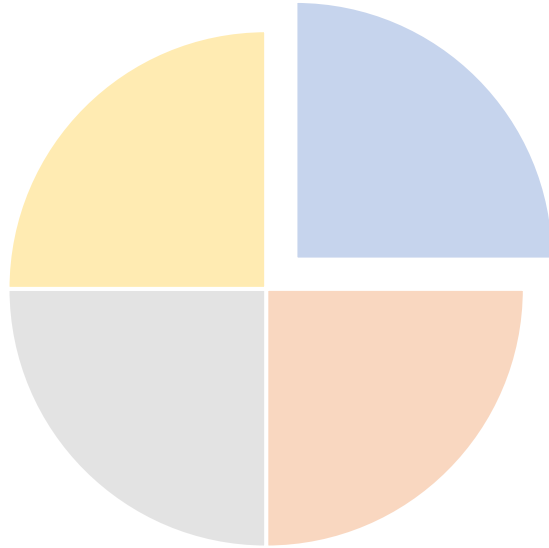
Data

- 93,888 individual methane spot measures (>2 minutes)
 - 384 lactations from 277 dairy cows

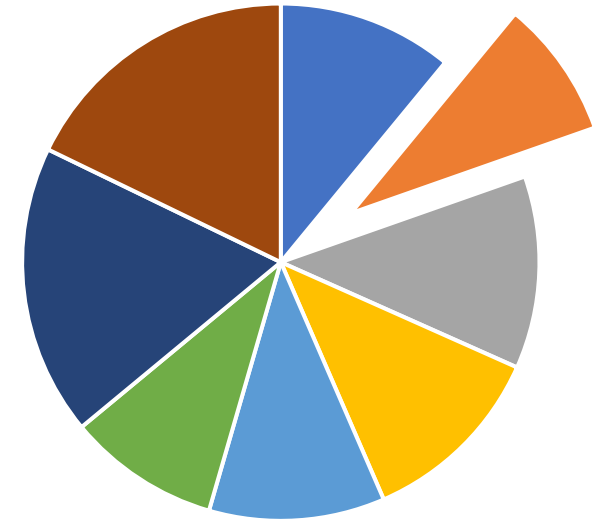


Approach

Four fold cross-validation



One farm out



$$\text{Methane} = \int (\text{spectrum, days in milk, yield, fat\%, protein \%})$$

Partial least squares or neural networks

Results

- $\mu = 323.4$ g/d
- $\sigma = 75.2$ g/d
- Average of 30 spot measures to ± 6 days
 - 111 minutes
- Repeatability = 28%

- Little difference
 - AM v PM, neural networks v partial least squares
- Flanking 6 days > previous 6 days > subsequent 6 days
- Holstein > Jersey > Crossbreds

Results

Experiment	RMSE (g/d)	r
1	34.39	0.69
2	37.04	0.58
3	36.76	0.71
4	37.44	0.55
5	41.10	0.65
6	37.26	0.68
7	40.55	0.62
8	35.71	0.68

Methane = $\overline{AM+PM}$ + yield + days post calving

Results

Model	No spectra	With spectra
Spectra		0.55 (0.07)
DIM	0.32 (0.13)	0.55 (0.06)
Yield	0.10 (0.18)	0.64 (0.05)
Composition	0.32 (0.13)	0.57 (0.06)
DIM + yield	0.52 (0.10)	0.64 (0.06)
DIM + composition	0.41 (0.10)	0.55 (0.06)
Yield + composition	0.32 (0.07)	0.62 (0.05)
DIM + yield + composition	0.54 (0.09)	0.64 (0.05)



Conclusions

- OK predictions of methane from milk samples
 - Good enough???
 - Needs more validation
- Add to the pipeline of predictions from milk samples
- What to do with the results?