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AFCP The AgriFood Charities Partnership

AHDB

Evaluating Enteric Equations for Predicting Dairy Cattle Methane Emissions

Background:

- Cattle are the largest cause of methane emissions from human activity [1]
- Methane has a global warming potential **25** times higher than carbon dioxide over 100 years [2]
- Main process contributing to methane emissions is the enteric fermentation of cattle feed [3]
- Measuring emissions directly is difficult, so researchers have developed enteric prediction equations, based on different feed component variables of the cattle's diet e.g., dry matter intake, neutral detergent fibre and ether extract.

Aims:

1. Compile a set of enteric equations to compare their variability and ability to capture the effect of diet composition on methane emissions
2. Create a mean equation based on diet composition by assessing the variables most suitable for use in the equation that are not highly correlated

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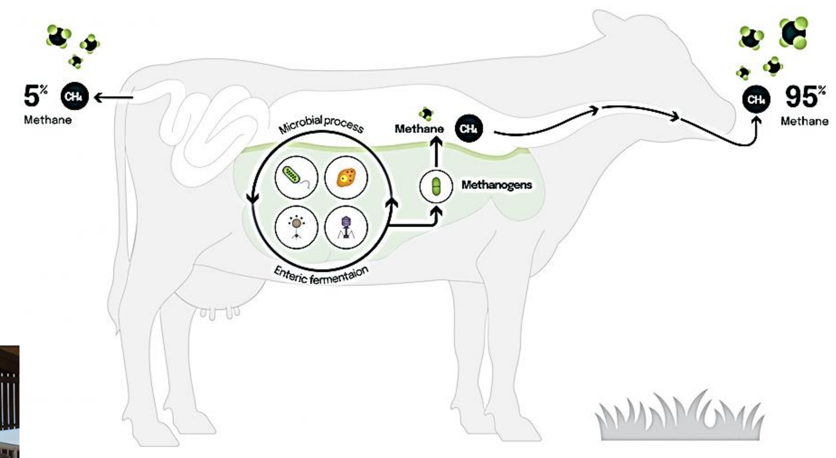

Material and Methods:

- Reviewed the literature and collected 102 international enteric equations
- A dairy nutritionist formulated seven UK specific dairy diets for various cow types e.g., lactating cows, dry cows and transitioning calves
- The equations were coded into R programming language and the results were plotted into a scatterplot
- It was observationally determined whether the equations were consistent in their ranking of least to most emitting diets

QR Code: AHDB PhD project overview

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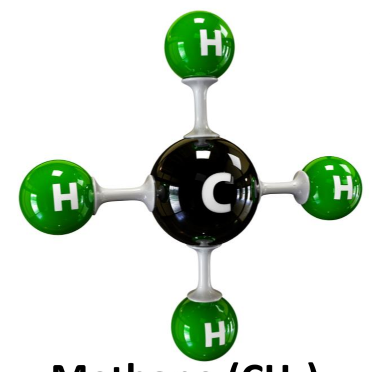

Methane (CH_4)

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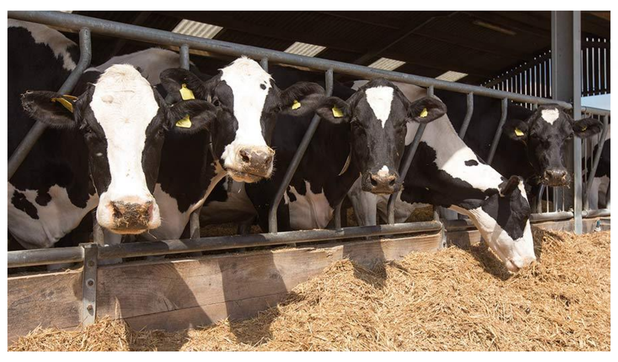

Results:

- Figure 1 shows the equations produced large variation in their methane emission results, ranging from 38 to 714 grams of methane per day
- The equations were fairly consistent in their ranking of the diets, as can be seen in Figure 1.

Figure 1: The predicted methane emissions using 102 enteric equations, against seven diets.

Figure 2 highlights that the correlation matrix shows several variables were too highly correlated to be used in the mean equation, as they would skew the results

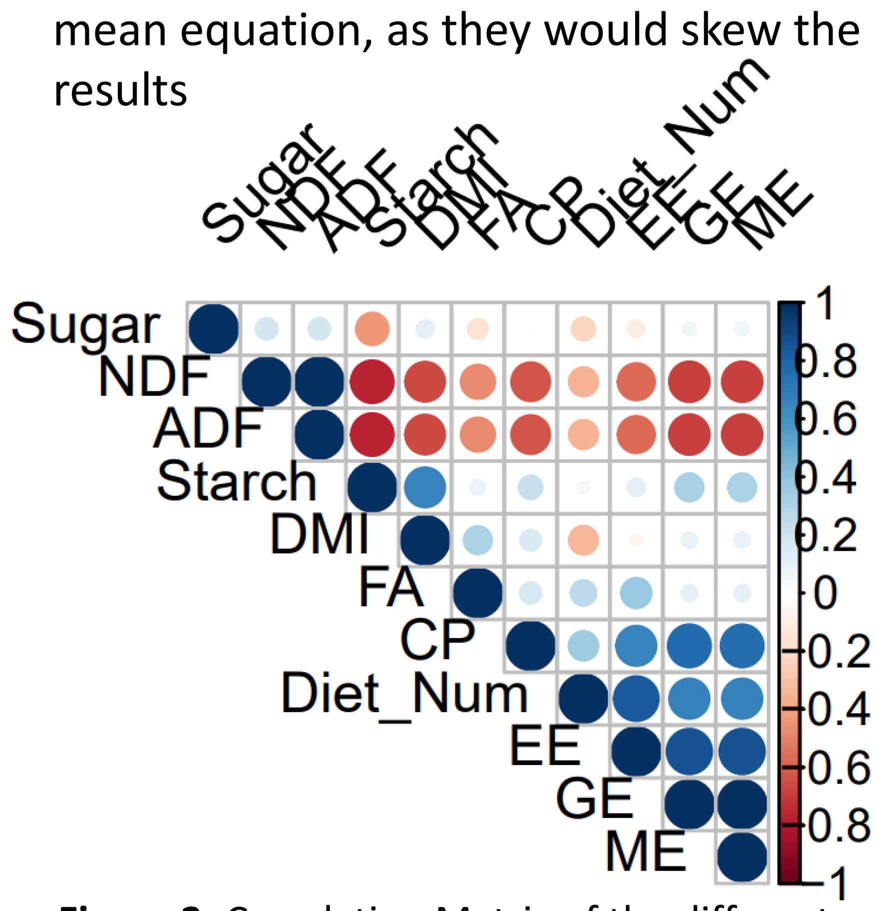

Figure 2: Correlation Matrix of the different feed component variables as percentage (%) of dry matter.

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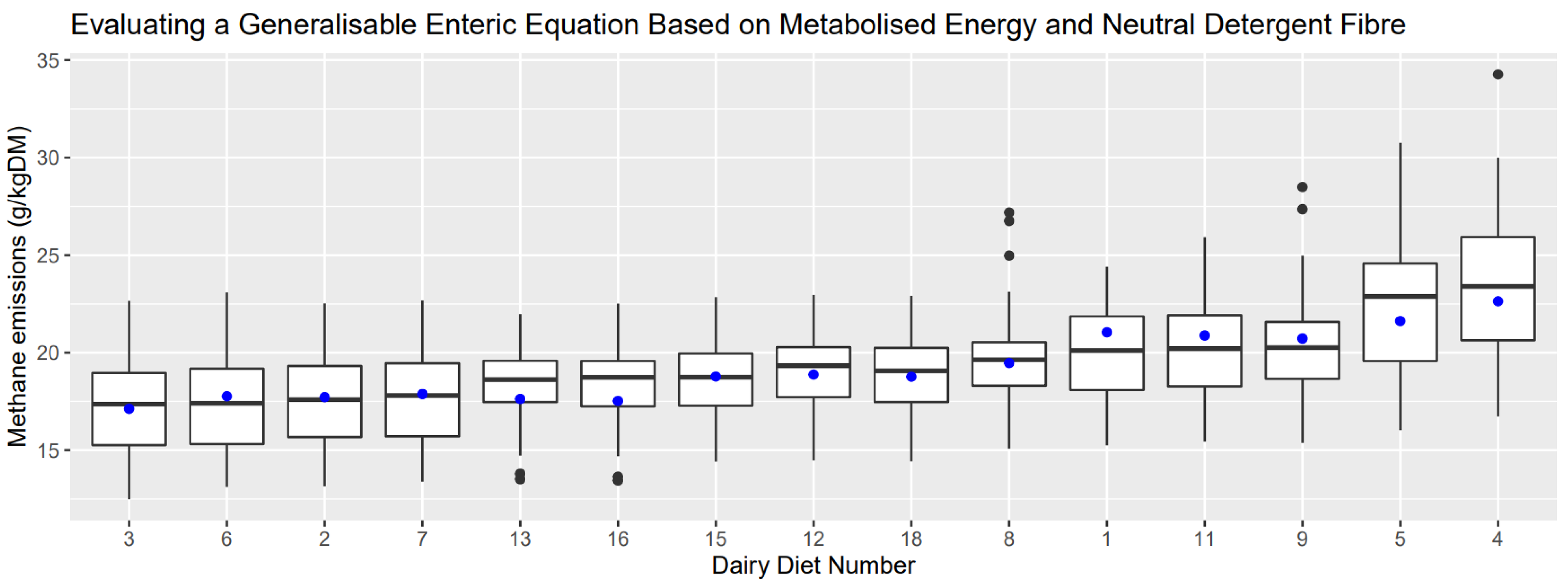

Figure 3: The performance of the mean equation against each diet. The boxplots represent the variation in emissions between equations for each diet, showing the upper and lower quartiles around the median, which is represented by the lines in the boxplots. While the blue dots represent the average emissions that would be represented by the generalisable equation, based on metabolised energy and neutral detergent fibre.

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Conclusions:

- The equations captured the effect of diet composition on emissions reliably, even if the predicted grams of methane varied
- Further research is needed into predicting enteric methane emissions more accurately, however, the mean equation will provide a reliable method for comparing the emissions between diets.

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Image Attributions:
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