Evaluate the precision of enteric methane and carbon dioxide emissions of sniffer method compared to respiration chamber method

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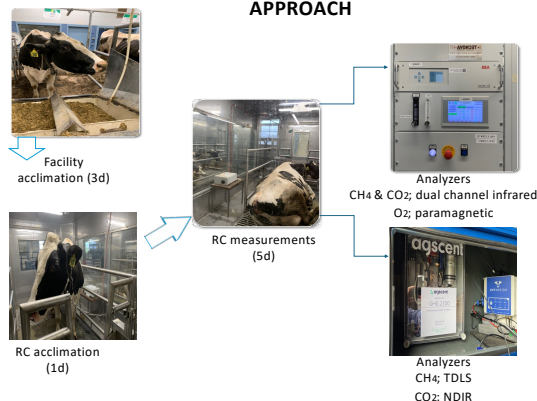College of Agriculture and Life Sciences
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INTRODUCTION

- The Sniffer (Agscent [AS]) method provides spot sample emissions for methane (CH_4) and carbon dioxide (CO_2) with high variability compared to respiration chambers (RC).
- The gold standard for precise CH_4 emission measurements involves housing animals in a RC, which allows for direct measurement of total gas emissions.
- The use of RC is expensive and labor intensive. Effective strategies to mitigate enteric CH_4 emissions depends on accurate, cost-effective methods to assess emissions from large number of animals.

OBJECTIVE

- Evaluate the precision and accuracy of a AS method for CH_4, CO_2 and ambient temperature (AT) in comparison to a RC method

APPROACH

Facility acclimation (3d)

RC acclimation (1d)

RC measurements (5d)

Analyzers
CH_4 & CO_2; dual channel infrared
O_2; paramagnetic

Analyzers
CH_4; TDLS
CO_2; NDIR

- Three multiparous lactating Holstein cows (688 ± 28 kg; BW, 29 ± 4 kg milk/d) were used in a completely randomized design.
- Cows were offered a TMR (DM basis: 55% corn silage, 12% grass haylage, and 33% concentrate).
- Agscent sniffer was placed inside the RC for 5 d to measure CH_4 and CO_2 concentrations, along with AT, enabling simultaneous gas concentration measurements.

RESULTS

Table 1: Mean concentration, Pearson's correlation, and concordance coefficient of CH_4 and CO_2 measured by RC and AS
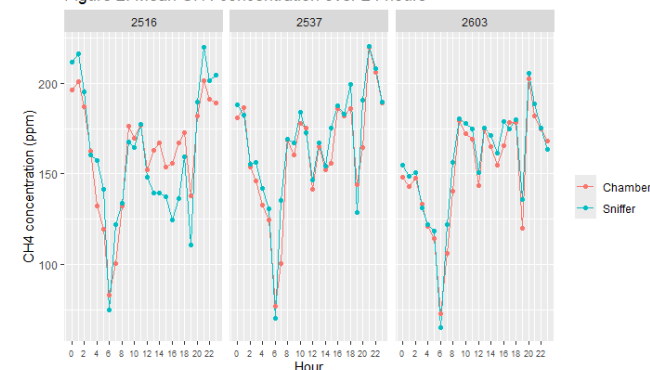
	RC	AS	SEM	P -Value
Mean: CH_4 ppm	158	161	55	*
Mean: CO_2 ppm	2444	2302	539	*
Pearson's correlation: CH_4	0.72			*
CCC: CH_4	0.71			*
Pearson's correlation: CO_2	0.66			*
CCC: CO_2	0.62			*

ccc; concordance correlation coefficient, * p- value at 0.05

Figure 1: Correlation of CH4 concentration between RC and AS

Each color corresponds to a different cow.
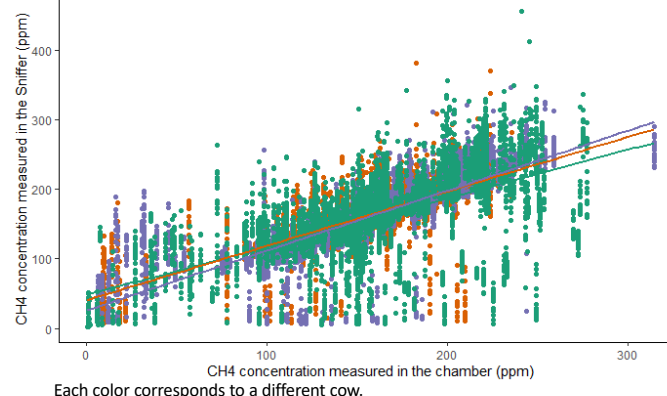
Figure 2: Mean CH4 concentration over 24 hours

SUMMARY & CONCLUSION

- The mixed-effects linear model, using AS measurements of CH_4, CO_2 and AT achieved 65% accuracy in predicting CH_4 concentrations compared to RC.
- Lin's concordance correlation coefficient showed strong agreement for CH_4 and CO_2.
- Our findings reveal strong correlations between RC and AS when gases are measured simultaneously, highlighting the need for further research to enhance gas measurement prediction models in open barn settings.

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