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Reliable and standardized data: The foundation for accelerating AI in animal science – A case study in enteric methane measurement

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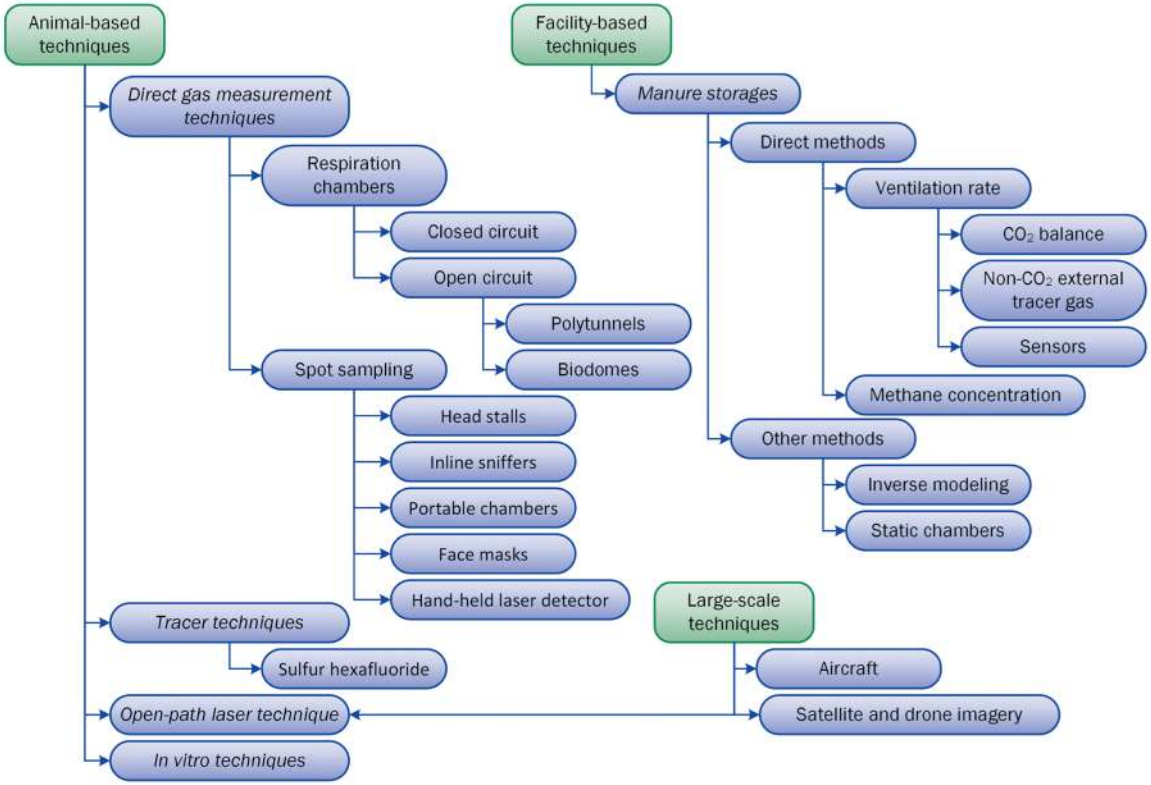
Techniques to determine CH_4 emissions at various levels



- Methane emission quantification remains uncertain
- Top-down and bottom-up estimates sometimes disagree
- Measurement methods can yield different results

(Tedeschi, et al., 2022)

Reliable CH_4 measurement data is key

(Source: www.wur.nl)

Respiration Chamber

- CH_4 flux (g/unit of time)
- Highly accurate and precise
- Costly, labor intensive, and restrict animal behavior

GreenFeed

- CH_4 flux (g/unit of time)
- Non-intrusive, short-term repeated measurements
- Rely on animal voluntary visits

Sniffer

- CH_4 concentration (ppm)
- High throughput
- Concerns over accuracy, repeatability, and precision

RC *= Respiration Chamber* ***GF*** *= GreenFeed system*

GreenFeed vs. Respiration Chamber

Validation of GF data based on RC data

Baseline (basal TMR)		Experimental period (treatment)		
CH_4 using GF	CH_4 using RC	Diet adaptation	CH_4 using GF	CH_4 using RC
3-d	**2-d**	**21-d**	**3-d**	**2-d**

- 16 dairy cows were randomly assigned to 1 of 4 dietary treatments:
  - 3-nitrooxypropanol (3-NOP)
  - 3-NOP + tannin extract
  - 3-NOP + essential oil
  - 3-NOP + oilseed

→ Create a wide range of emissions by feeding inhibitors.

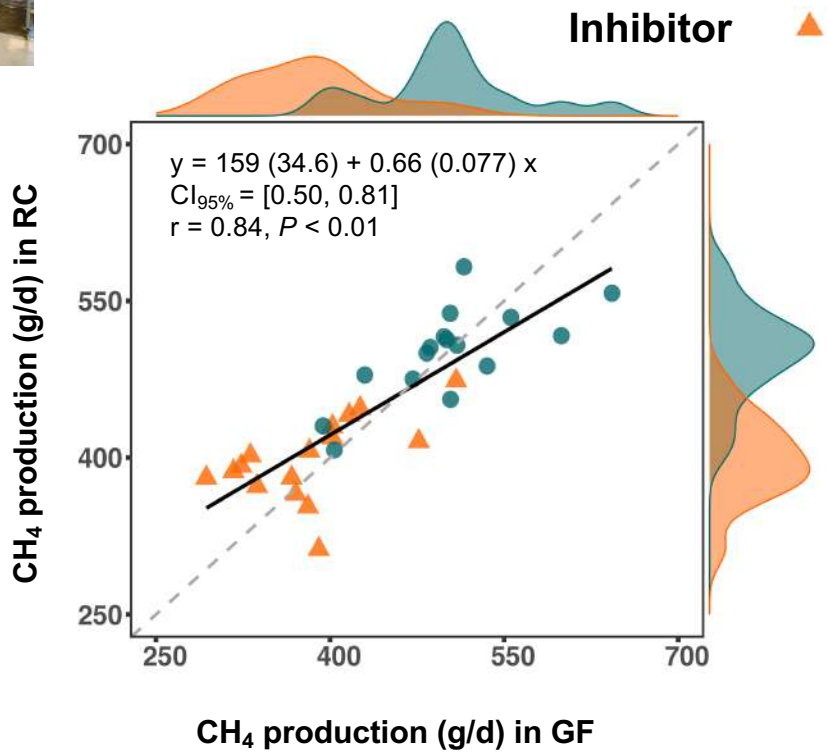
(Ma et al., 2024)

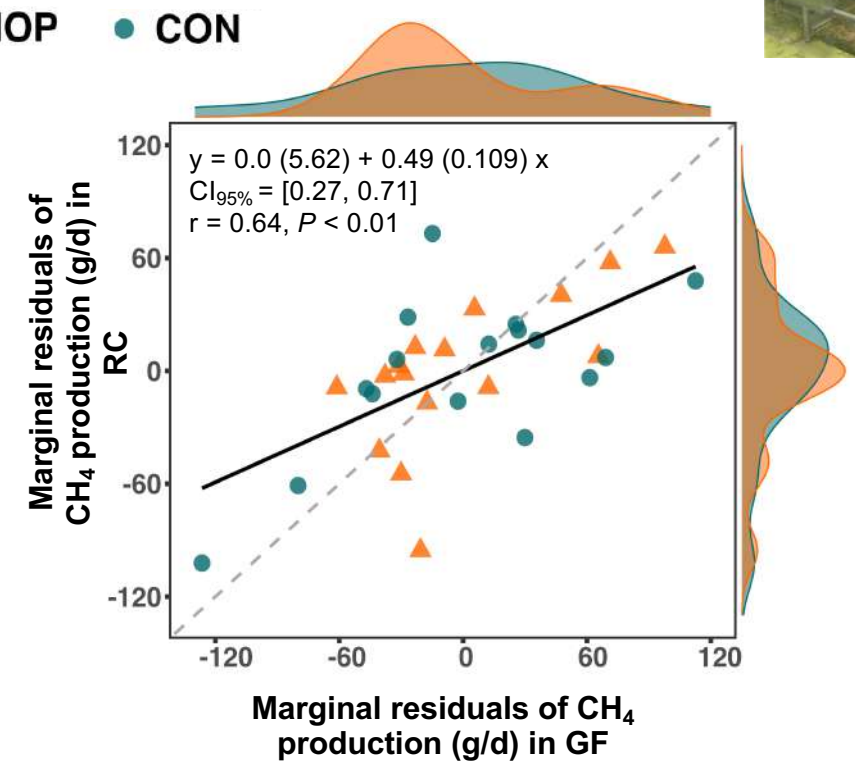
Descripencies in CH_4 production measured between RC and GF

GF

- Similar 3-NOP inhibition effect on **daily** CH_4 emissions

RC





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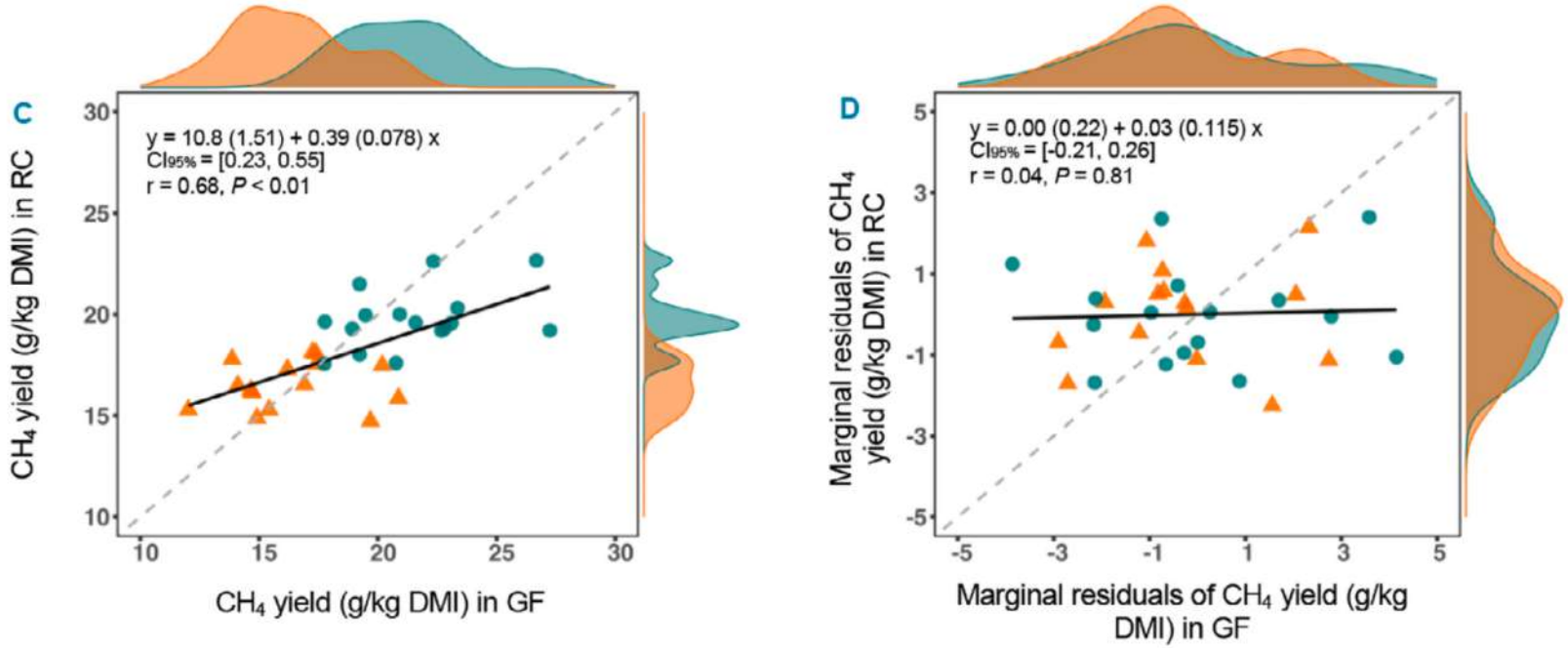
(Ma et al., 2024)

Descripencies in CH_4 yield measured between RC and GF

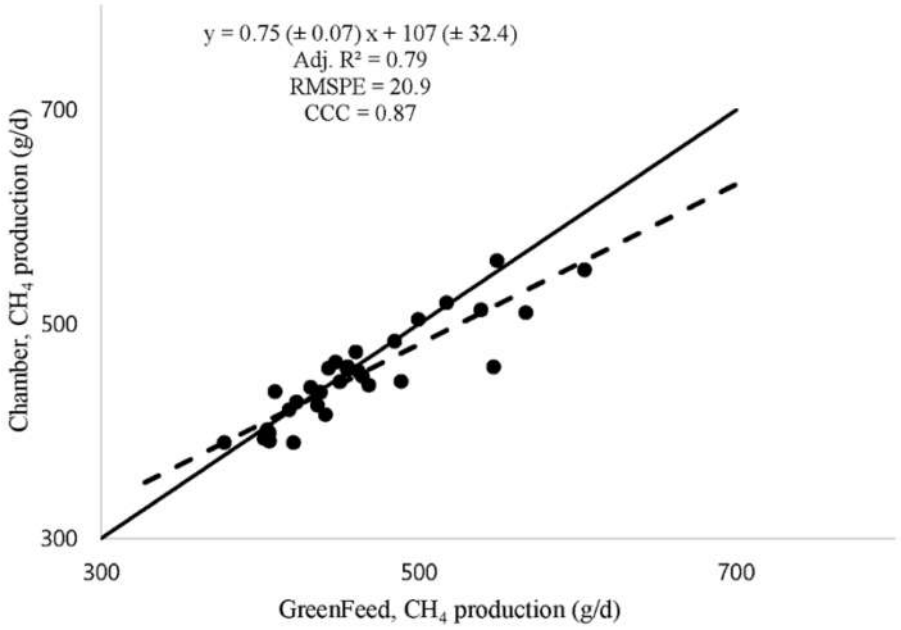
GF

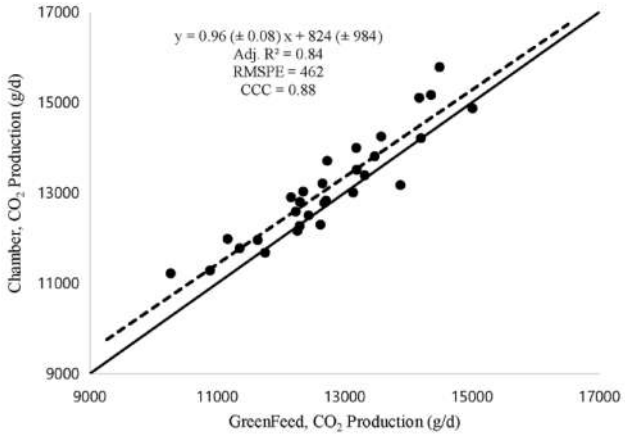
RC

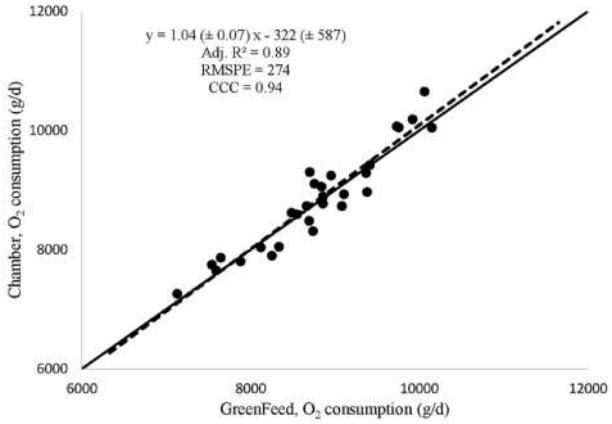


(Ma et al., 2024)

Descripencies in intraday CH_4 patterns measured between RC and GF





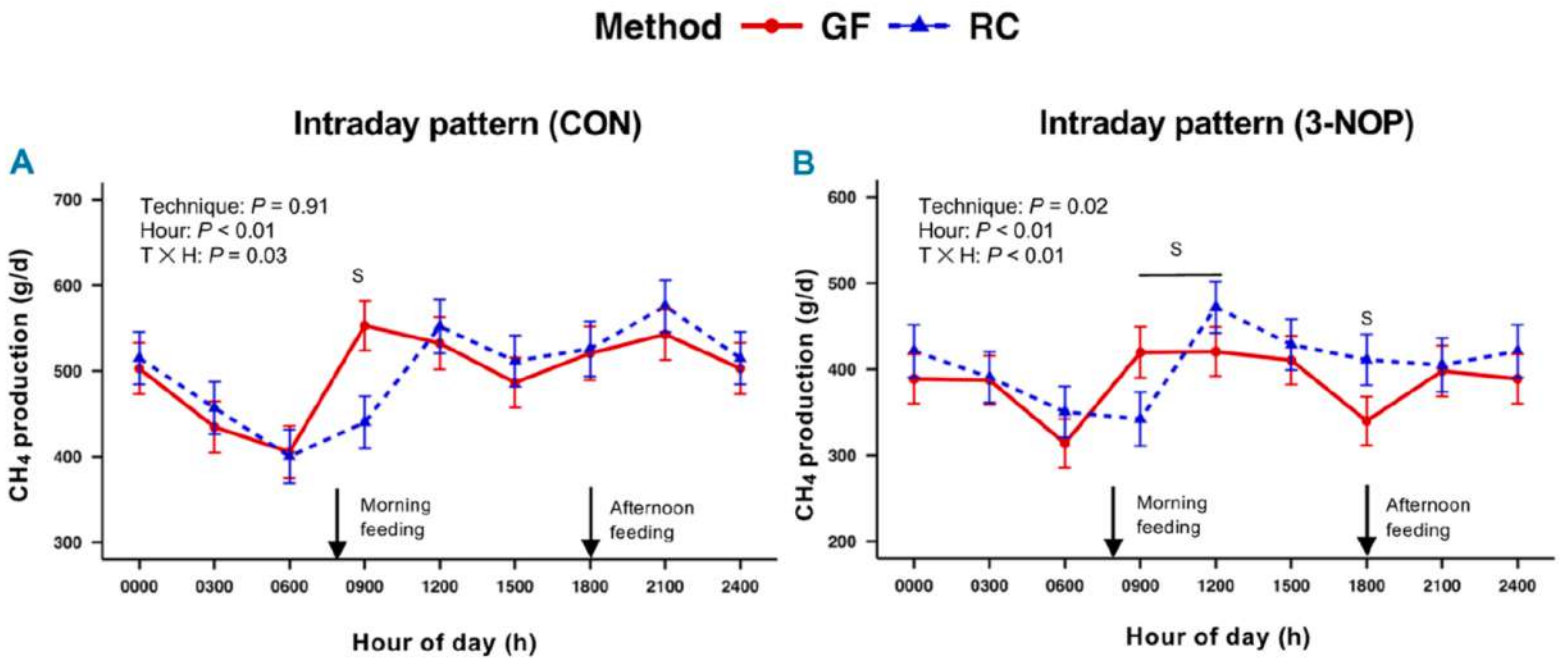


(Bayat et al., 2025)

Descripencies in intraday CH_4 patterns measured between RC and GF

GF

RC



- **Further exploration is needed!**

(Ma et al., 2024)

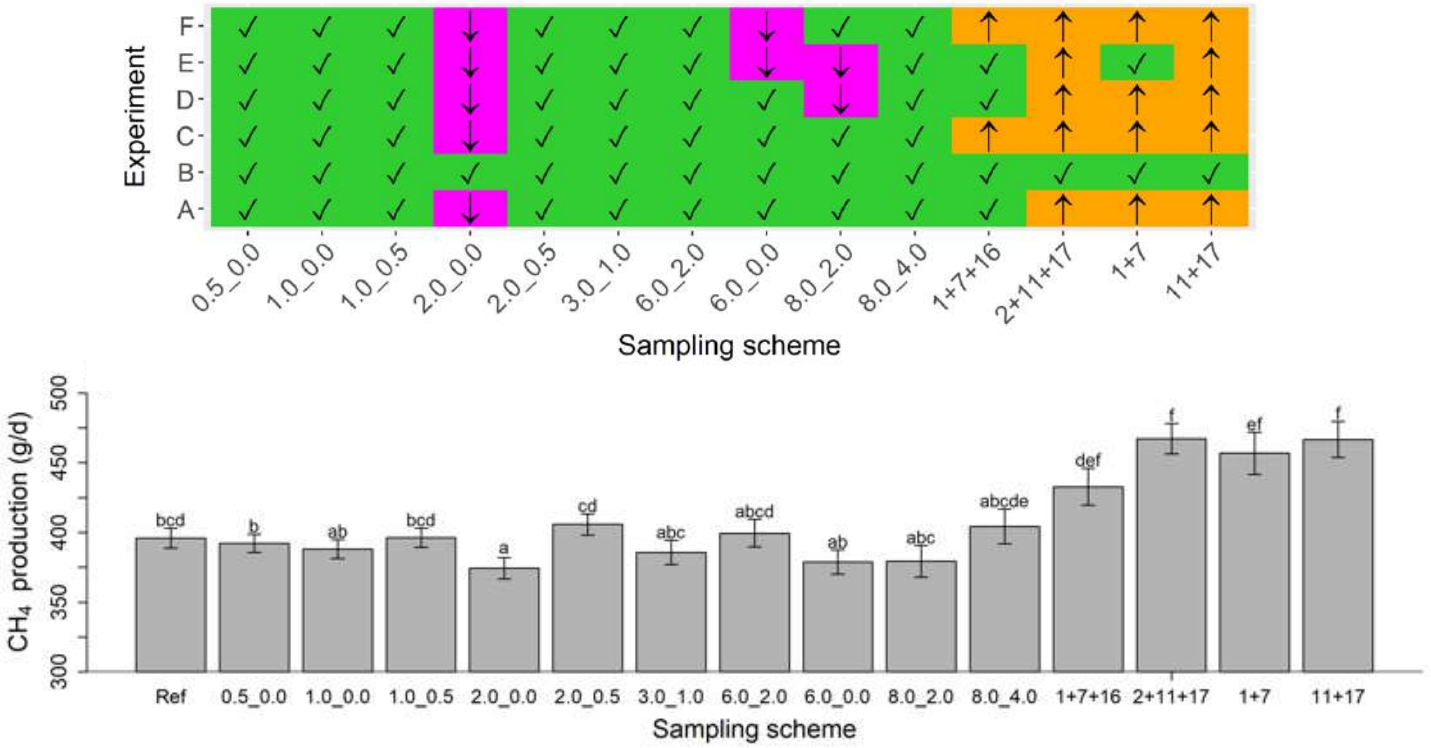
The GEMS Project - **G**reenFeed **E**missions **M**easurement **S**ystem

Develop guidelines for GreenFeed users: A Multi-disciplinary project including nutrition; genetics; statistical modelling; data analytics developed to create standardized tools for interpreting GreenFeed data.

Primary institutions

If you have GreenFeed data and would like to collaborate, let us know!

What is the best sampling scheme?



- Recommend: <3-h interval sampling, starting 1-h after feeding

(van Lingen et al., under review)

GreenFeed vs. CH_4 Sniffer

(Source: www.wur.nl)

Using CH_4 sniffers to select low-emitting cows

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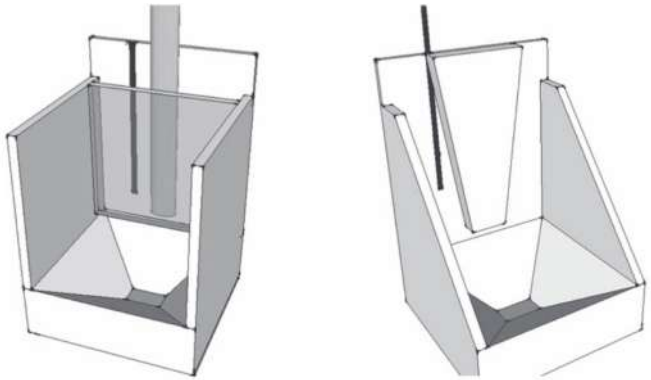
- **Canada** – Methane efficiency index 2023
  - 3,750 cows annually from 69 sniffers
- **The Netherlands** – Methane index 2025
  - Sniffers on 100 farms, collecting data from 13,000 Holstein cows and 1,400 sires
- **Norway & Denmark** – Methane index 2025
  - Over 16,000 sniffer measurements from individual animal
  - Phenotyping CH_4 concentration from Holstein, Jersey, and Nordic Red
- **……**

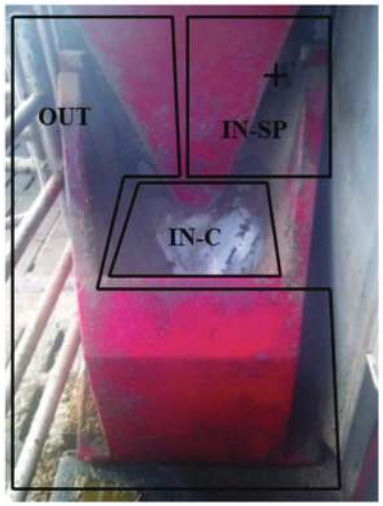
(Source: www.wur.nl)

Environmental factors to consider when using sniffers

- Sniffer sampling inlet location
- Muzzle to sampling distance



Nozzle placed in the **center** of AMS



Nozzle placed at **peripheral** of AMS

(Garnsworthy et al., 2012 ; Wu et al., 2015)

On-farm evaluation of multiple sniffers with GreenFeed

Objectives

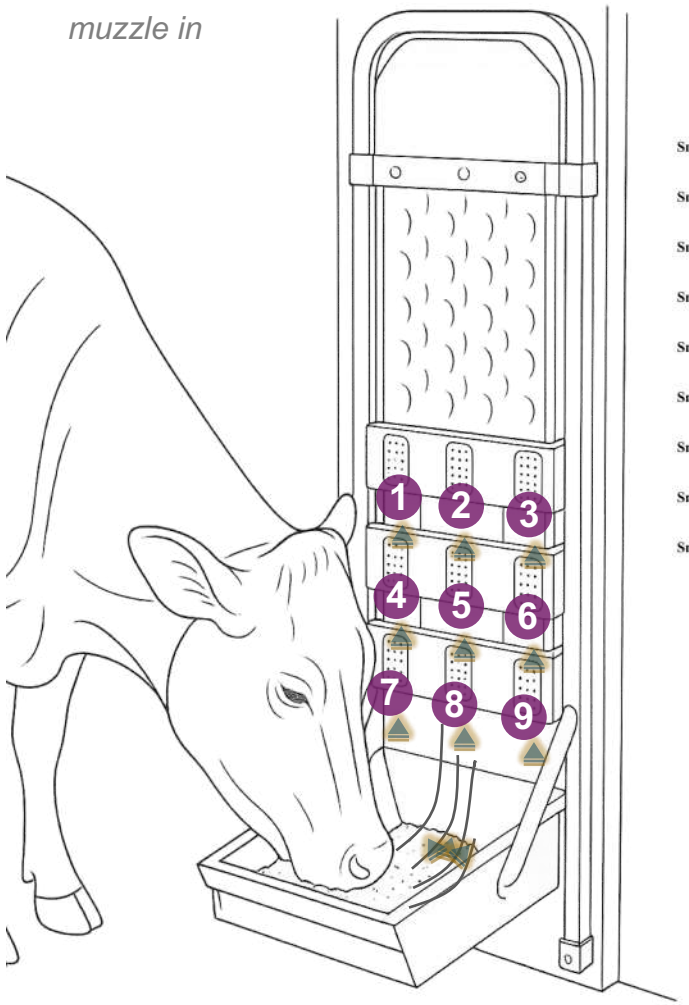
- Assess the effect of **sniffer nozzle location** within AMS on CH_4 concentrations.
- Compare the cow **rankings** of sniffer-based vs. GF-based CH_4 measurements.

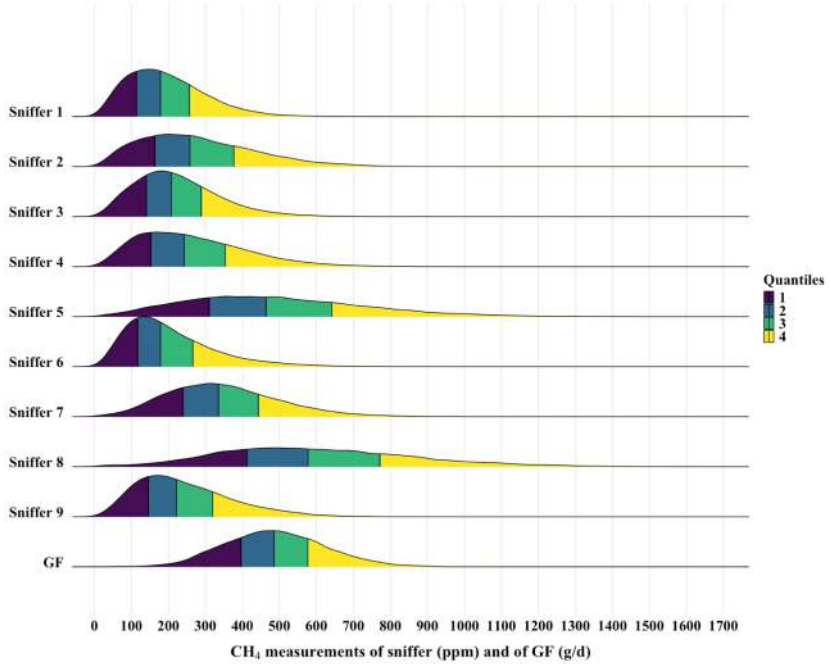
We **hypothesize** that even small differences in nozzle placement can influence the **CH_4 concentration measurements**, the inferred **cow rankings.**

(Ma et al., 2025)

Position-specific distributions

muzzle in



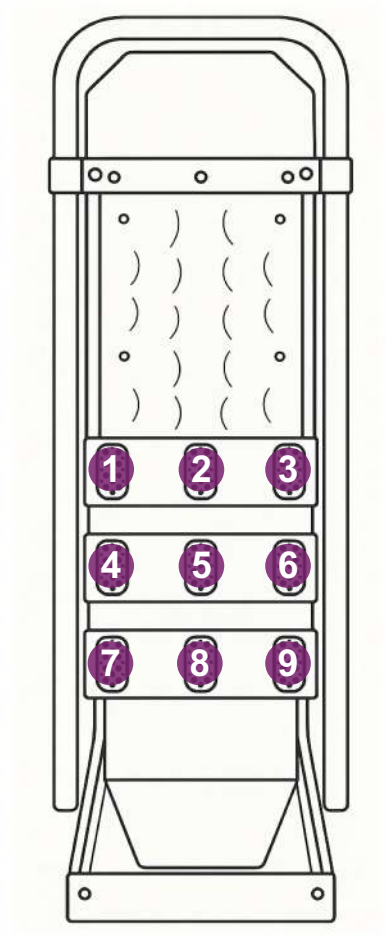


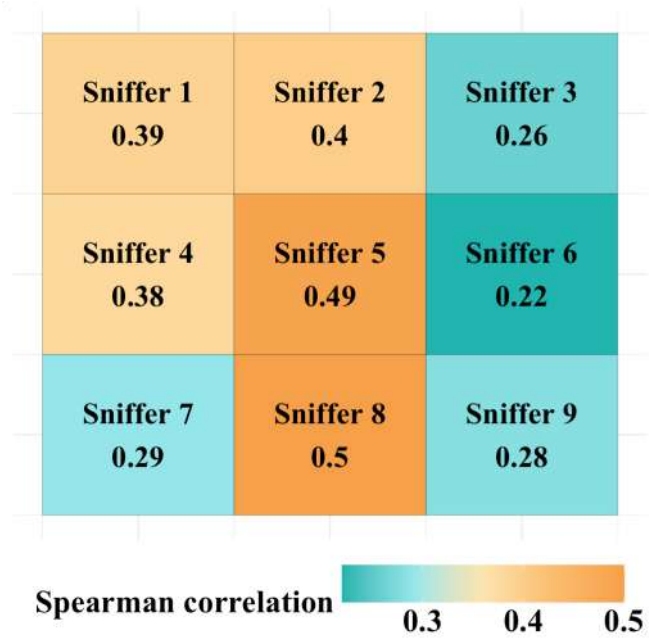
muzzle out

- Sniffer nozzle placement can influence the mean and variance of CH_4 concentration

(Ma et al., 2025)

Agreement in ranking cows – CH_4 sniffers vs. GF





Average CH_4 by cow

- Low to moderate ranking correlations
- Strength differed among sniffer placement
- Applying model correction did not improve correlation further

(Ma et al., 2025)

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Better methane **decisions start with better and standardized** methane **data.**

Thank you!

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