



Variations in feed efficiency, intake, and methane emissions among finishing beef cattle

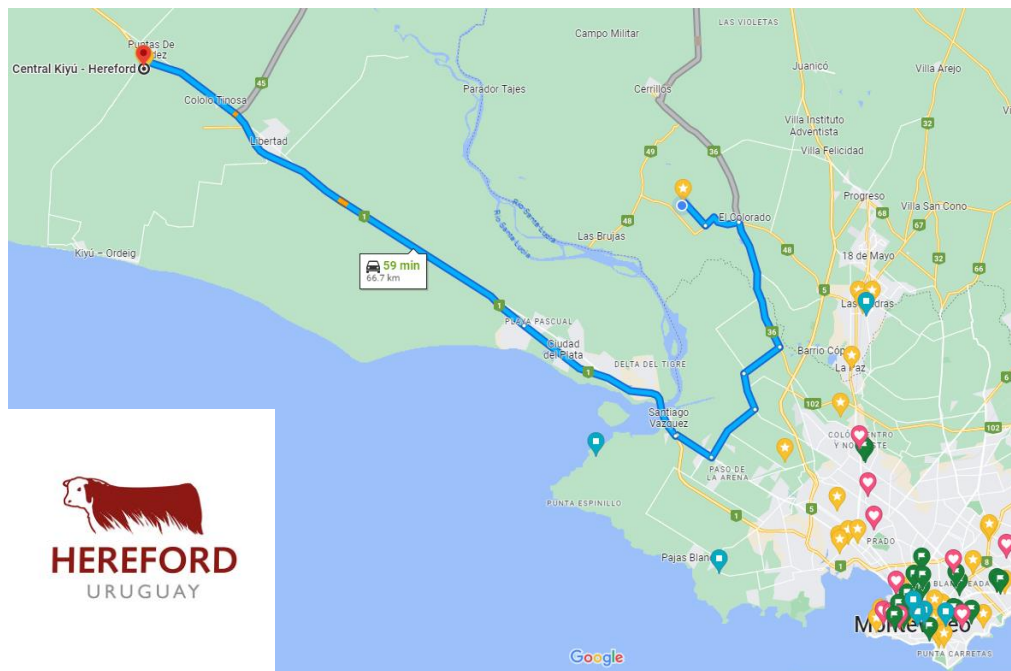
ICAR - Feed and Gas Workshop

May 23rd, 2023. Toledo

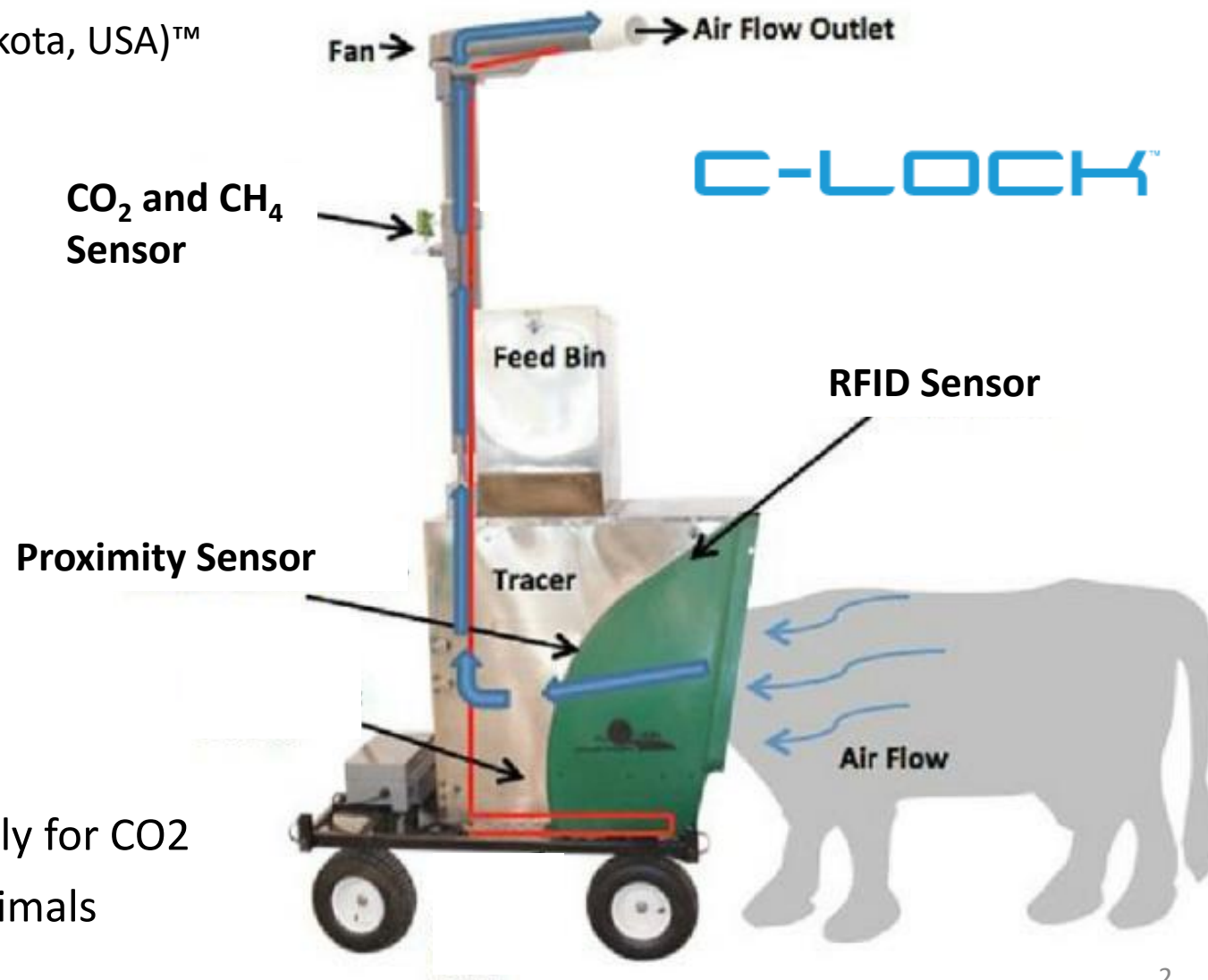
Enteric Methane Emissions Measures

Short-term visit feeding stations

(GreenFeed, C-Lock Inc., Rapid City, South Dakota, USA)™



- Low labor/maintenance requirements
- Auto-calibration System for CH4 and monthly for CO2
- One unit, capable of measuring multiple animals



Experimental Design



Training
15 days

Trial
70 days



- CH₄ Measures at the same time RFI trials (we take advantage of same moments)
- 1 Pen with automatic feeding station (GrowSafe)
- 2 Green Feed Units (sync)
- Breed: 70 Hereford Steers (16-18 months)
- Periods: Nov/Feb (Spring/Summer2022)

Operational Procedure Configuration

| | |
|---------------------------------------|--------------|
| Drop weight (g) | 35 |
| Drop Dispense Interval (s) | 30s |
| Max Time between Feeding Periods (s) | 10800s (3hs) |
| Max Drops per Feeding Periods (drops) | 5 |
| Max Feeding Periods | 8 |

CO2 Calibrations regularly (every 4 weeks)
Adjustable cattle chute



Diet Composition

Diet during trial:

- sorghum silage
- Corn grain

(25:75)



Chemical composition (% of DM)

| | Concentrate | TMR |
|-------------------------|-------------|-------|
| Dry matter | 91.62 | 61.74 |
| Crude protein | 12.70 | 12.58 |
| Neutral detergent fiber | 13.18 | 11.30 |
| Acid detergent fiber | 22.02 | 21.77 |
| Either extract | 1.19 | 1.92 |
| Ash | 6.61 | 4.62 |
| Gross energy, MJ/Kg DM | - | 4.47 |

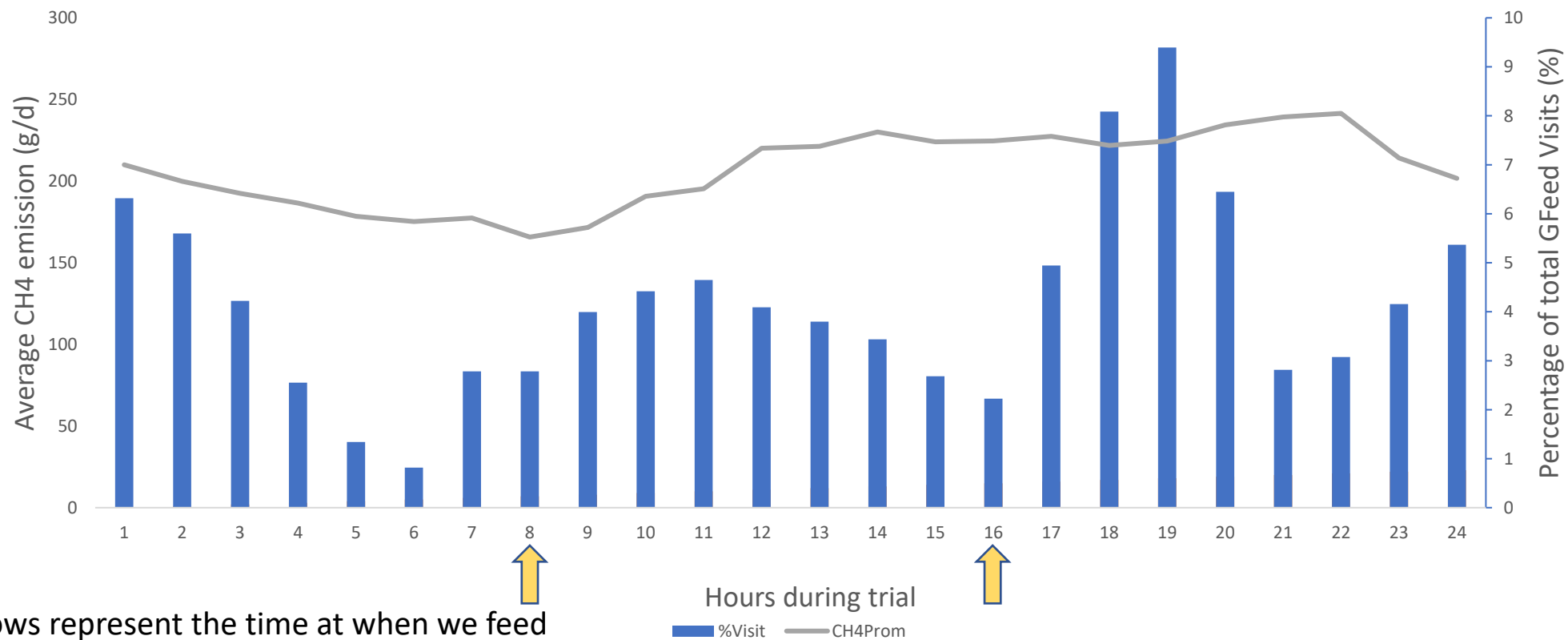
Frequency distribution of visits and diurnal pattern daily CH₄ emissions

Average Daily Methane Production (DMP): 209±25 g/day

Visit Avg: 04:10 min
 Visit Min: 03:00 min
 Visit Max: 07:37 min

Valid Visit: > 3min & > 30 visits (Arthur et al., 2017)

Recruitment rate: **64%** (45 animals in 70)



Arrows represent the time at when we feed

Descriptive and Correlations to Methane Emission

Traits for Feed Efficiency Measures

| | n | Mean | SD | Min | Max |
|---------------------------|----|--------|-------|--------|--------|
| DMI (kg/day) | 70 | 11.26 | 1.16 | 8.17 | 13.53 |
| ADG (kg/day) | 70 | 1.38 | 0.18 | 0.99 | 1.83 |
| BW (kg) | 70 | 508.16 | 32.88 | 441.50 | 588.92 |
| MTW (kg ^{0.75}) | 70 | 106.51 | 5.04 | 96.23 | 118.15 |
| BKFat (mm) | 70 | 11.17 | 2.26 | 6.30 | 18.00 |
| RFI (kg/day) | 70 | 0.00 | 1.01 | -2.10 | 1.37 |

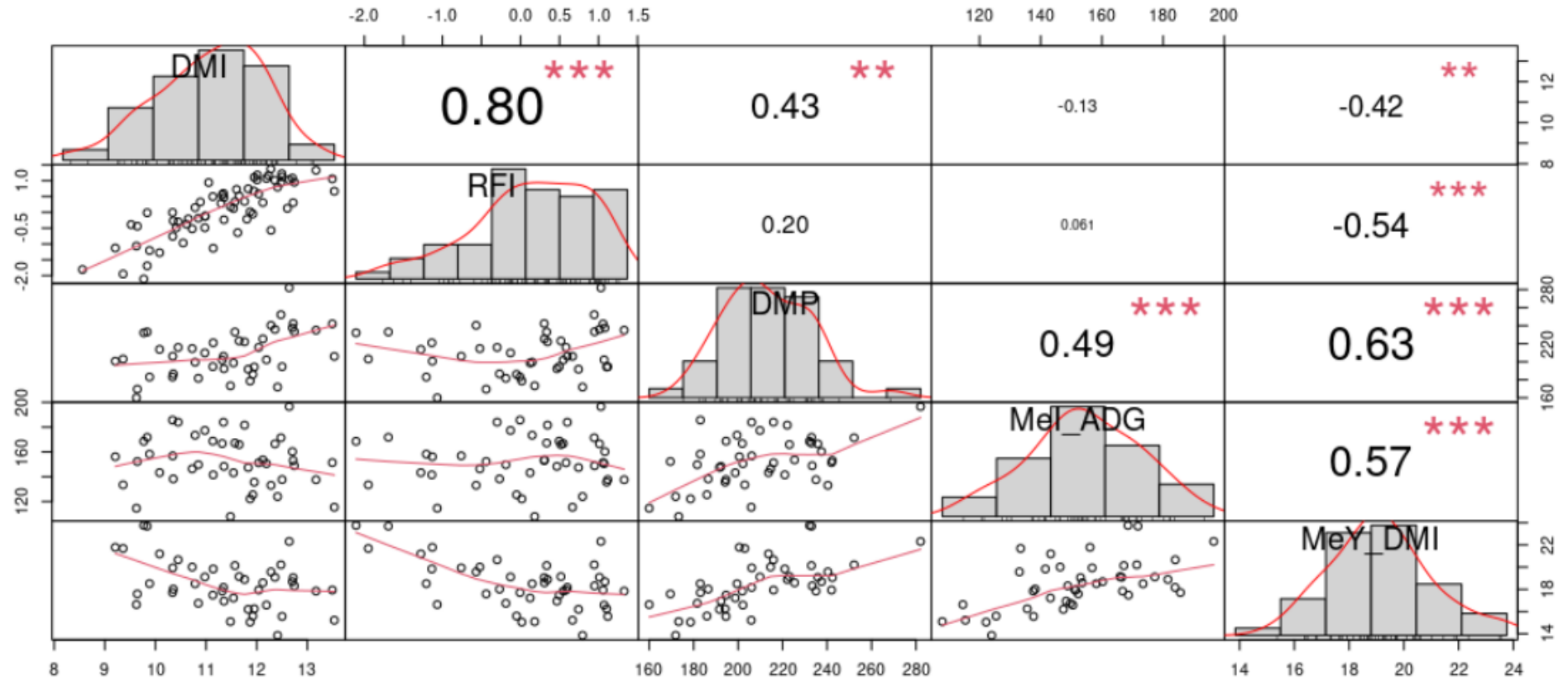
Traits for animals with methane emission measures

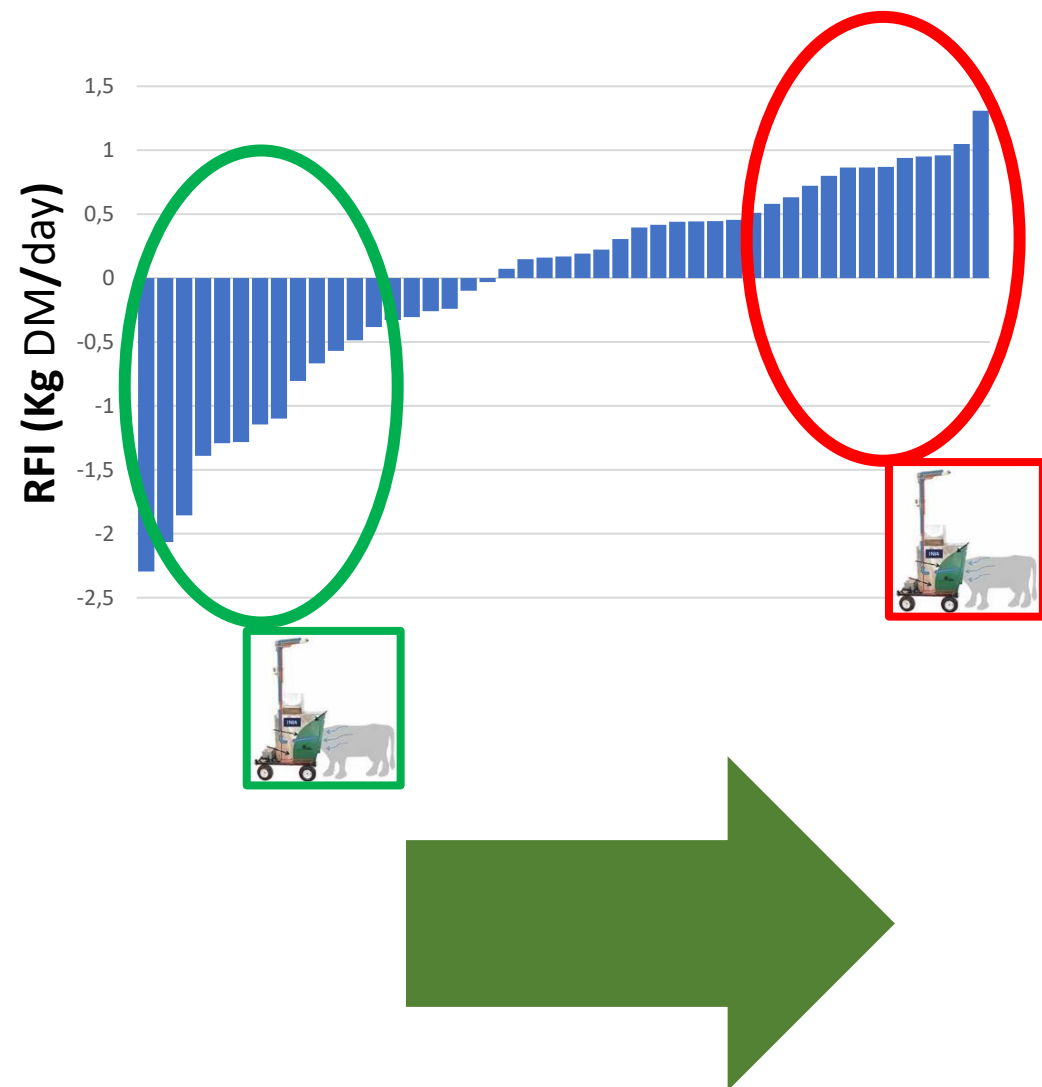
| | n | Mean | SD | Min | Max |
|---------------------|----|--------|-------|--------|--------|
| DMI (kg/day) | 45 | 11.41 | 1.14 | 9.21 | 13.53 |
| RFI (kg/day) | 45 | 0.07 | 0.89 | -2.11 | 1.33 |
| DMP (g/day) | 45 | 209.44 | 25.29 | 160.00 | 282.10 |
| raDMP (g/day) | 45 | 210.60 | 25.52 | 161.70 | 287.40 |
| MeI ADG (g/Kg /day) | 45 | 152.58 | 20.48 | 107.80 | 196.60 |
| MeY DMI (g/kg/day) | 45 | 18.45 | 2.23 | 13.85 | 23.76 |

High Correlation between DMP y raDMP
($r = 0.959$, $pv = 2 \times 10^{-16}$)

Descriptive and Correlations to Methane Emission

Correlation between intake (DMI) and Methane emissions (DMP) was **Cor = 0.43** (pv = 0,003).

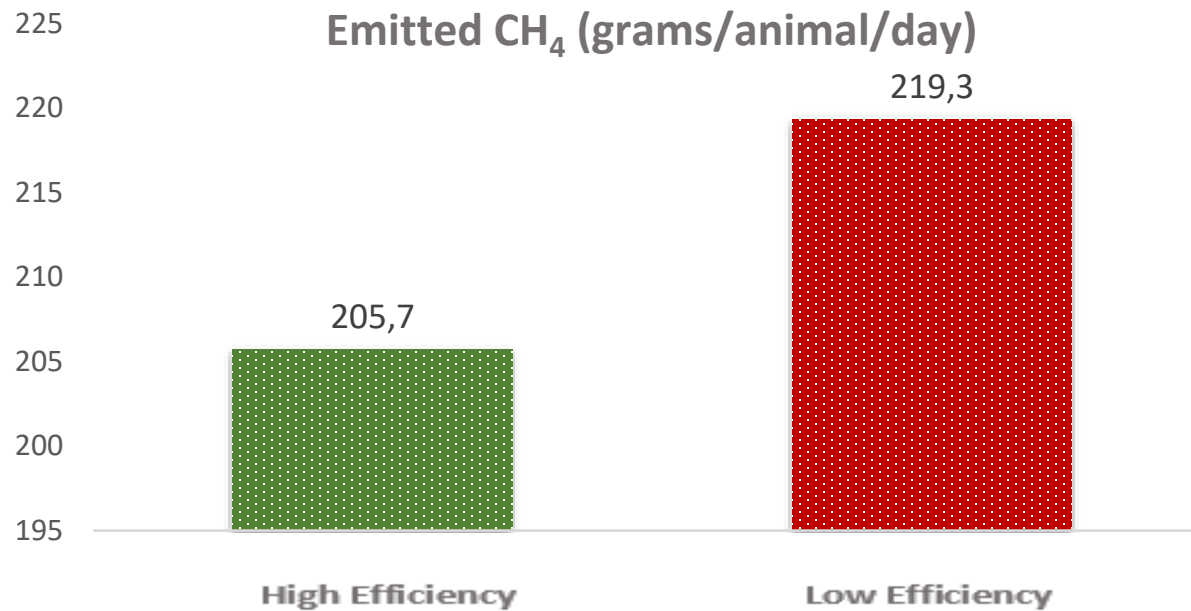
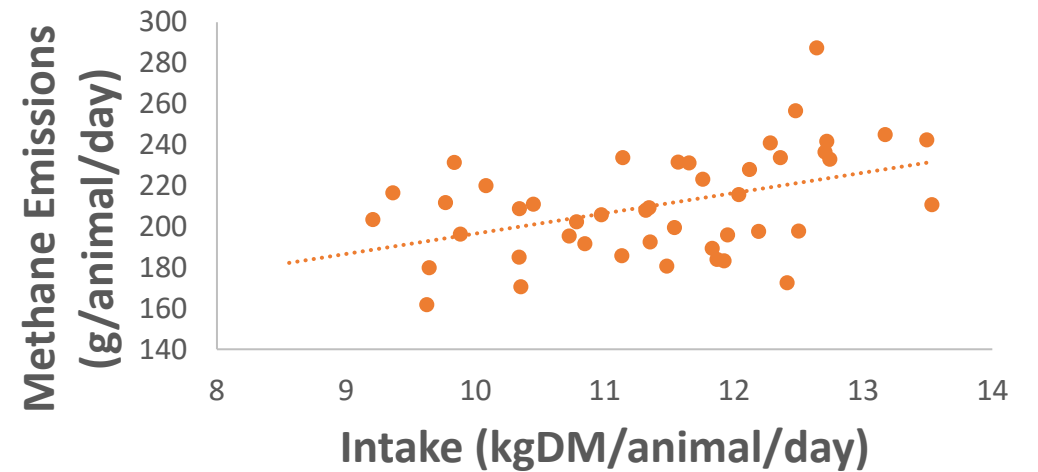
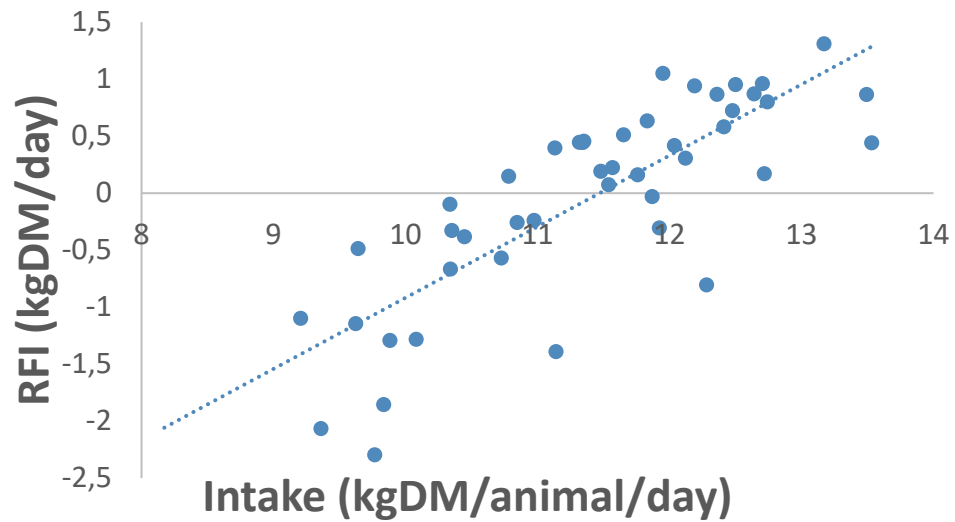




| Characteristic | High Efficiency (23) | Low Efficiency (23) |
|-----------------------------|-------------------------|------------------------|
| RFI (kg DM/day) | -0,93 | 0,84 |
| Feed Intake (kg DM/day) | 10,4 | 12,2 |
| Average Daily Gain (kg/day) | 1,4 | 1,4 |
| Backfat (mm) | 10,7 | 10,9 |
| Live Weight (kg) | 503,9 | 510,8 |

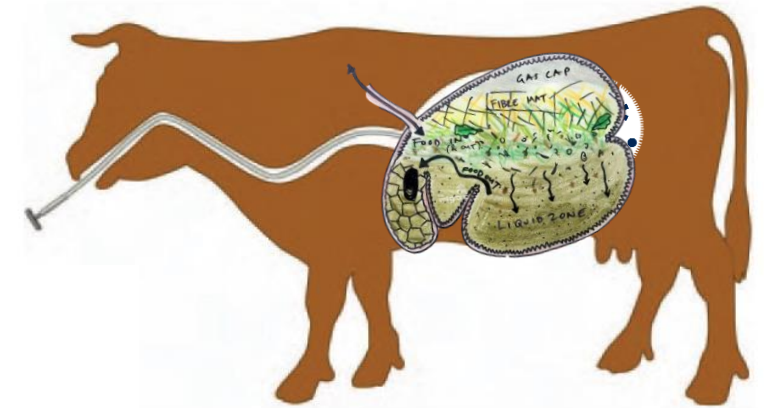
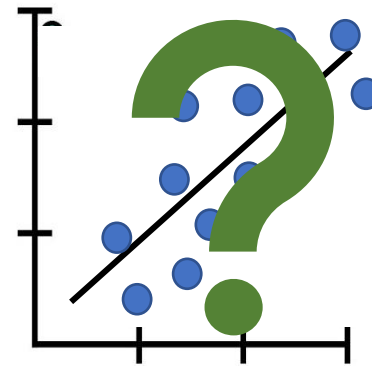
| Characteristic | High Efficiency (14) | Low Efficiency (15) |
|-----------------------------|-------------------------|------------------------|
| RFI (kg DM/día) | -1,11 | 0,79 |
| Feed Intake (kg DM/day) | 10,2 | 12,3 |
| Average Daily Gain (kg/day) | 1,4 | 1,4 |
| Backfat(mm) | 10,6 | 10,7 |
| Live Weight (kg) | 506,3 | 517,6 |

Methane emissions and feed intake

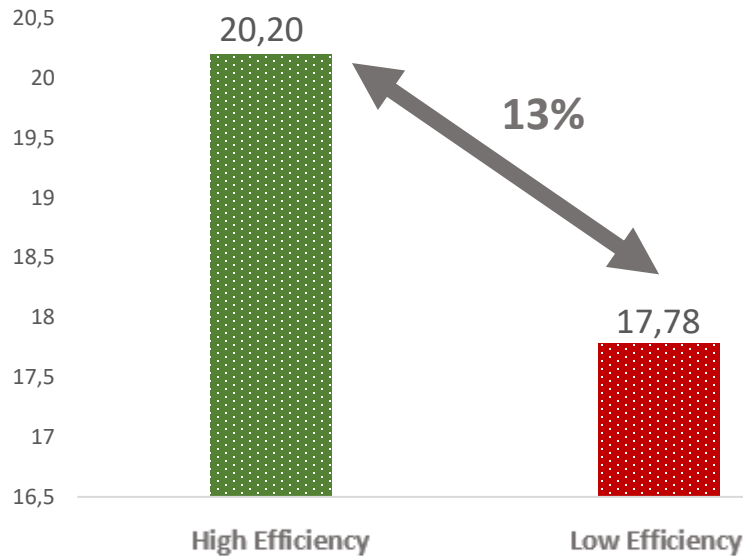


High efficiency Vs Low efficiency

- Similar production levels
- With 2 kg DM Intake less per day
- Lower methane emissions per day



Methane Yield (gCH₄/kg DMI)



HIPOTHESIS:

The higher the efficiency, the better feed digestion?

➤ Better efficiency in feed use?

➤ + Fermentation -> Higher Emission?

Thank you

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