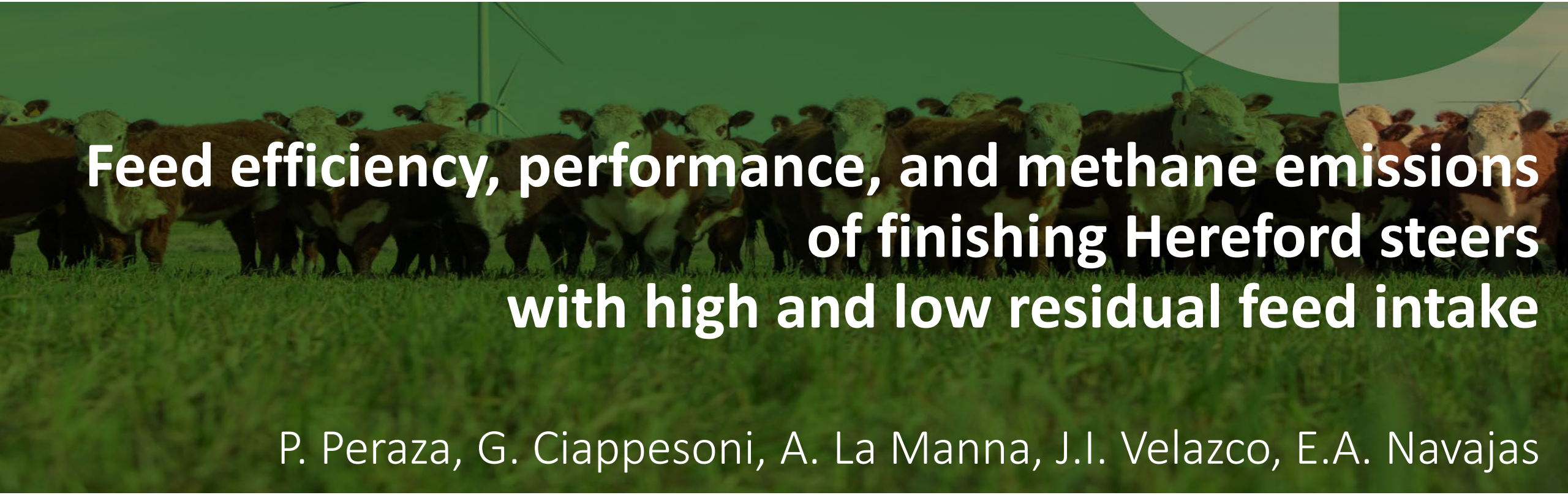

Feed efficiency, performance, and methane emissions of finishing Hereford steers with high and low residual feed intake

P. Peraza, G. Ciappesoni, A. La Manna, J.I. Velazco, E.A. Navajas

75th Annual Meeting of the European Federation of Animal Science
Florence, Italy – September 1st / September 5th, 2024

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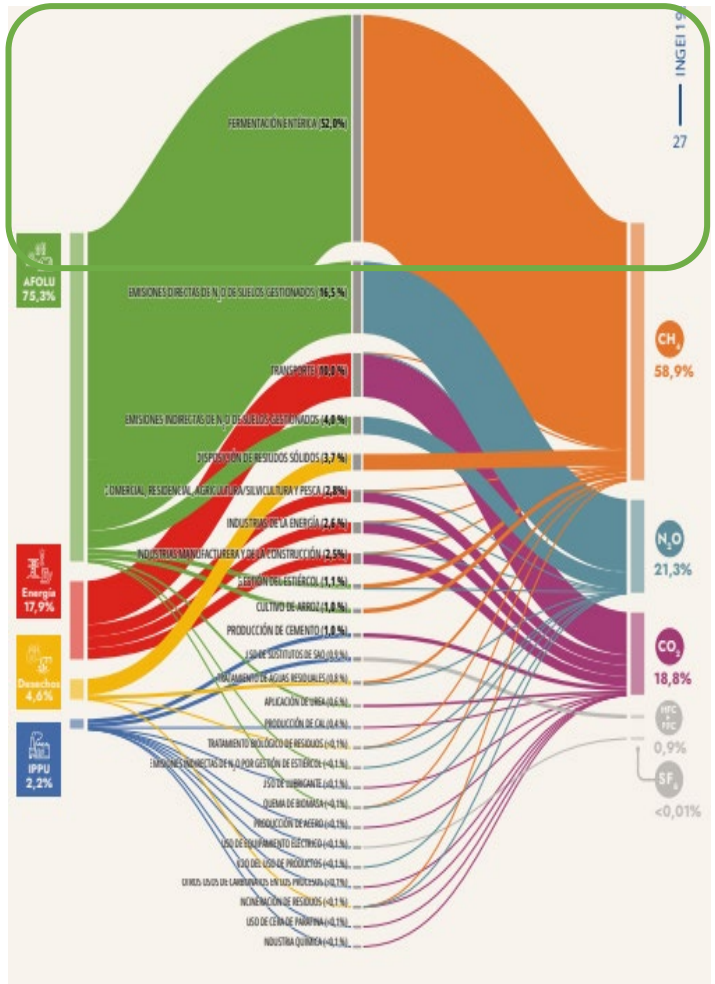
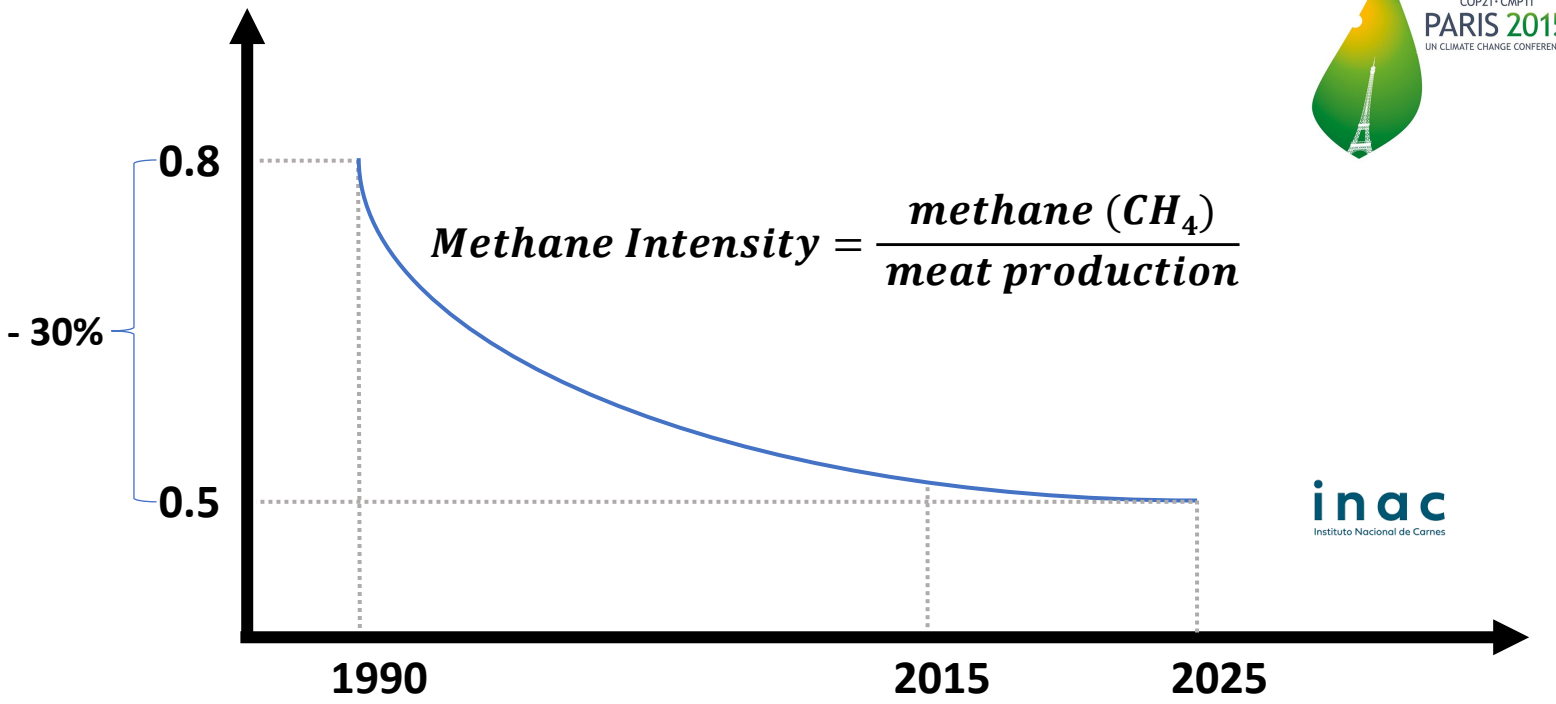
Uruguay: Greenhouse gas emissions

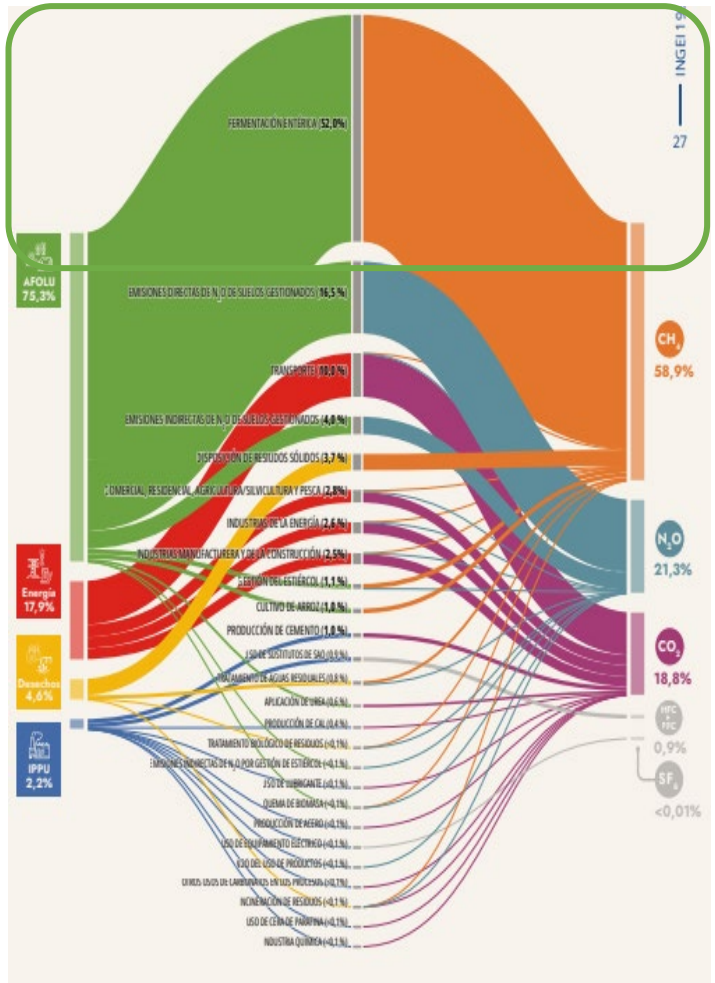


- Methane is 59% of the total GHG emitted
  (52% only originated by enteric fermentation)



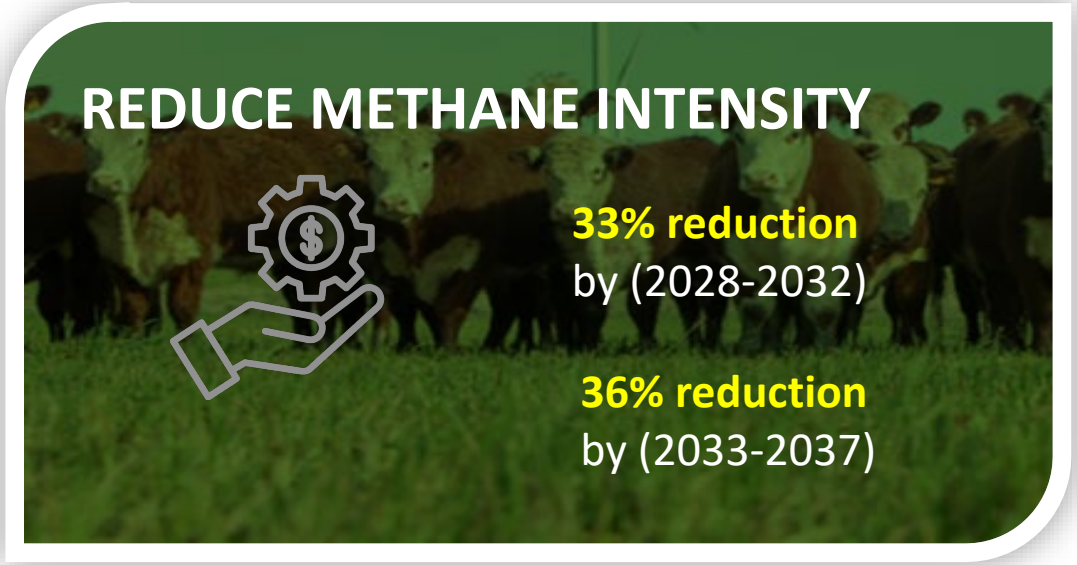
*[1] INGEI - https://www.gub.uy/ministerio-ambiente/politicas-y-gestion/inventarios-nacionales-gases-efecto-invernadero-ingei
*[2] Gaston Berheim – Expo Prado 2022

Uruguay: Greenhouse gas emissions



- Methane is 59% of the total GHG emitted
  (52% only originated by enteric fermentation)

- Uruguay is focused on gas intensity mitigation strategies on livestock farming



Efficiency

Hypothesis/Objective

Selection for feed efficiency could improve methane intensity without compromising performance

Explore the associations between feed efficiency and:

Performance Traits:
Feed Intake (FI)
Average Daily Gain (ADG)
Metabolic weight (mMW)
Residual feed intake (RFI)

Methane Traits:
Methane Emissions (CH4)
Methane Intensity (MeI)
Methane Yield (MeY)

Material & Methods

Efficiency and Methane Emissions Measurements

GrowSafe Feed Intake Systems (Vytelle, Calgary, Canada)

- Feed and water *ad libitum* during trial
- Finishing diet (before slaughter)

RFI = Actual Intake – Expected Intake

Metabolic Weight (mMW)
Average Daily Gain (ADG)
Subcutaneous Fat Thickness (Bfat)

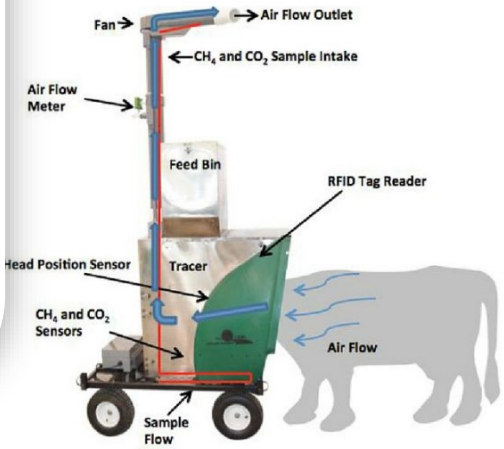
Dry Matter Intake = test + ADG + mMW + Bfat + e

(Basarab et al., 2003; Koch et al., 1963)

GreenFeed Short Visit Feeder Stations C-Lock Inc. Rapid City, South Dakota, USA)

- Record CH_4 in the animal's production environment
- Set-up: Max 5 drops (35g) every 3hs, 8 times/day (24hs)
- QC: Valid visits > 2.5 minutes | > 30 visits

(Arthur et al,.2017)



Efficiency and Methane Emissions Measurements

Adaptation/Training period
15 days

Evaluation period
70 days

Simultaneos measures: Intake (RFI)/Weight/CH_4measures

- Years: 2022/2023

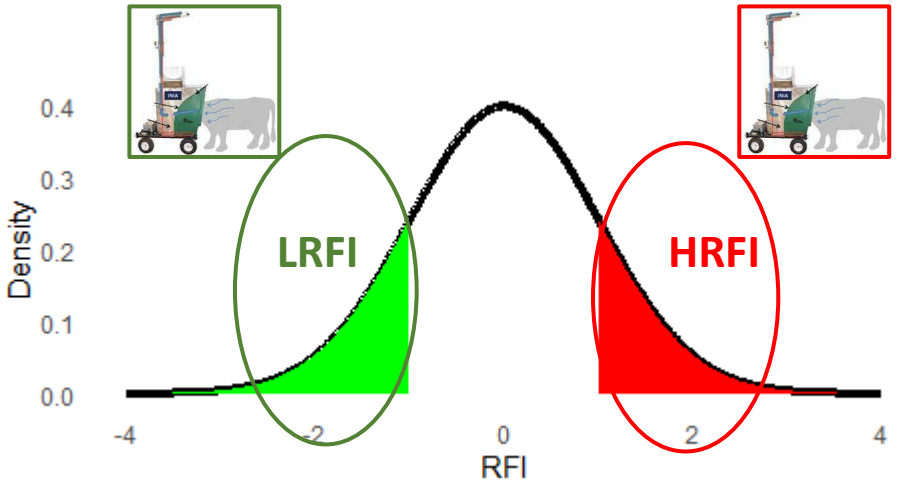
140 Hereford steers

Age: 548 ± 26 days

InitialBW: 450 ± 32 (kg)

FinalBW: 554 ± 37 (kg)

- GF Pellet and GrowSafe TMR: Similar in E (Sum DMI)



Recruitment for GF was ~ 70%

To evaluate performance and methane traits on animals we

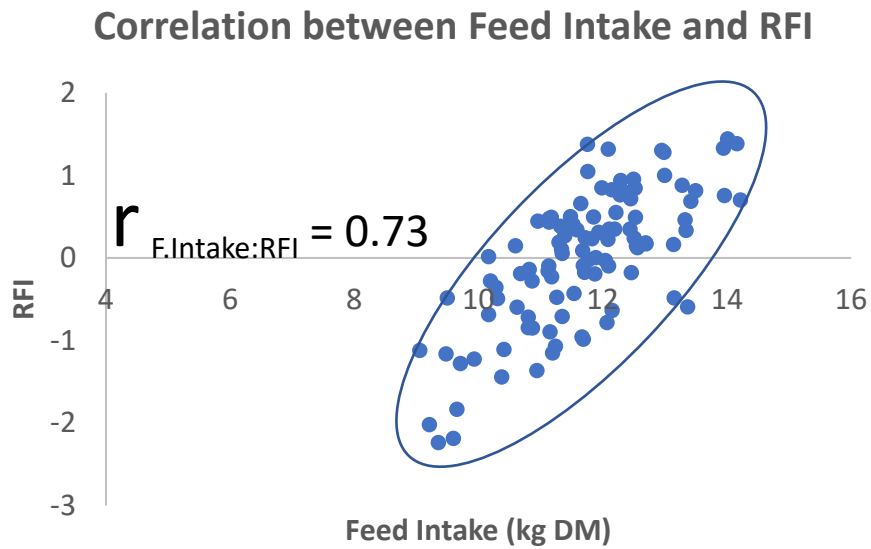
Y = Year + RFI Group + Year * RFI Group

Results & Discussion

Performance Traits on classified animals based on feed efficiency (RFI)

N = 90	FEED EFFICIENCY GROUPS		
Performance Trait	**Low Efficiency (HRFI)**	**High Efficiency (LRFI)**	**Significance**
Feed Intake (kg DM/d)	**12.51 ± 0.12 a**	**10.61 ± 0.12 c**	***
ADG (kg/d)	1.48 ± 0.03	1.46 ± 0.03	ns
Metabolic weight (kg)	107.23 ± 0.78	105.54 ± 0.77	ns
Fat Thickness (mm)	11.85 ± 0.36	12.02 ± 0.36	ns
RFI (kg/d)	**0.831 ± 0.06 a**	**-0.927 ± 0.06 c**	***

Tukey-Kramer multiple comparison test for significance.
*** p value<0.001, ** p value<0.01, * p value<0.05, ns: non significative



Animal classification into efficiency groups:

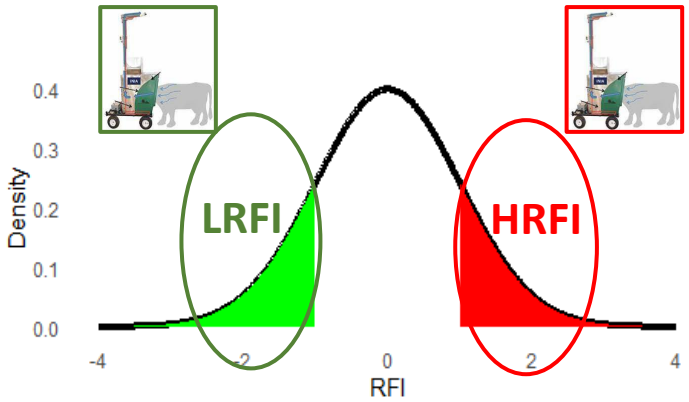
- Significant difference in feed intake
- Highly efficient animals ate 17% less than low-efficiency steers
- Non-significant differences for performance traits

Results & Discussion

Performance Traits on classified animals based on feed efficiency (RFI) & methane records

n = 67	FEED EFFICIENCY GROUPS		
Performance Trait	**Low Efficiency (HRFI)**	**High Efficiency (LRFI)**	**Significance Efficiency class**
Feed Intake (kg DM/d)	12.58 ± 0.14 **a**	10.59 ± 0.14 **b**	***
ADG (kg/d)	1.51 ± 0.03	1.46 ± 0.03	ns
Metabolic weight (kg)	12.58 ± 0.14	10.59 ± 0.14	ns
Fat Thickness (mm)	11.73 ± 0.38	12.16 ± 0.38	ns
Efficiency - RFI (kg/d)	0.816 ± 0.08 **a**	-0.980 ± 0.07 **b**	***

Tukey-Kramer multiple comparison test for significance.
*** p value<0.001, ** p value<0.01, * p value<0.05, ns: non significative



- Feed Efficiency groups presented significative differences on Intake and RFI as observed in the total population.
- High Efficiency –> intake ~ 15%

Results & Discussion

Performance Traits on classified animals based on feed efficiency (RFI) & methane records

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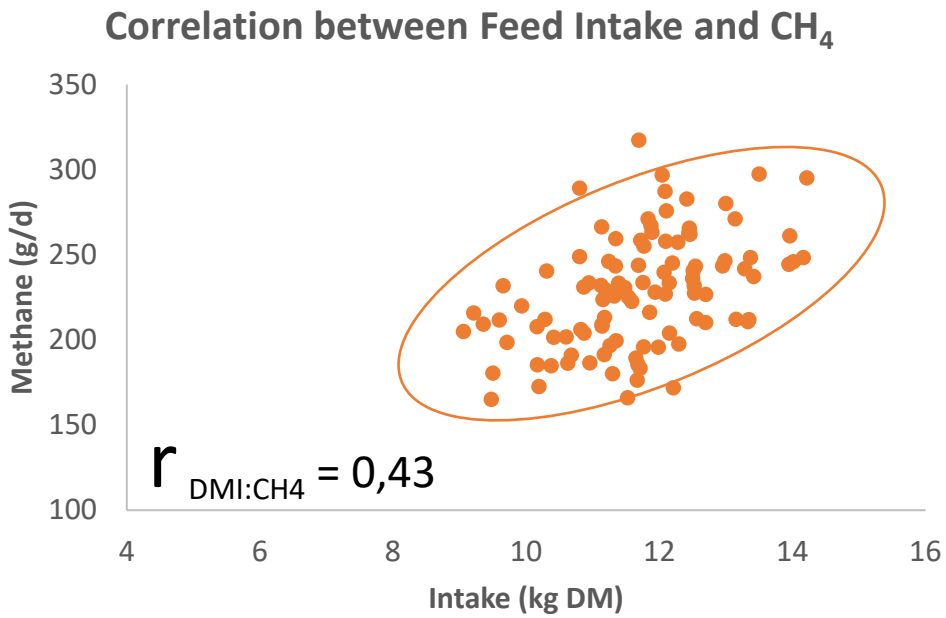
Fat Thickness (mm)	11.73 ± 0.38	12.16 ± 0.38	ns
Efficiency - RFI (kg/d)	0.816 ± 0.08 **a**	-0.980 ± 0.07 **b**	***
Animals w/CH4	33	34	
Methane (g/d)	235.95 ± 4.94 **a**	214.98 ± 4.99 **b**	**
CH_4 Intensity (g/kgBW)	0.457 ± 0.01 **a**	0.427 ± 0.01 **b**	*
CH_4 Intensity (g/kg/d)	156.12 ± 4.13	147.9 ± 4.17	ns
CH_4 Yield (g/kgDM)	18.74 ± 0.42 **b**	20.38 ± 0.42 **a**	**

Tukey-Kramer multiple comparison test for significance.
*** p value<0.001, ** p value<0.01, * p value<0.05, ns: non significative



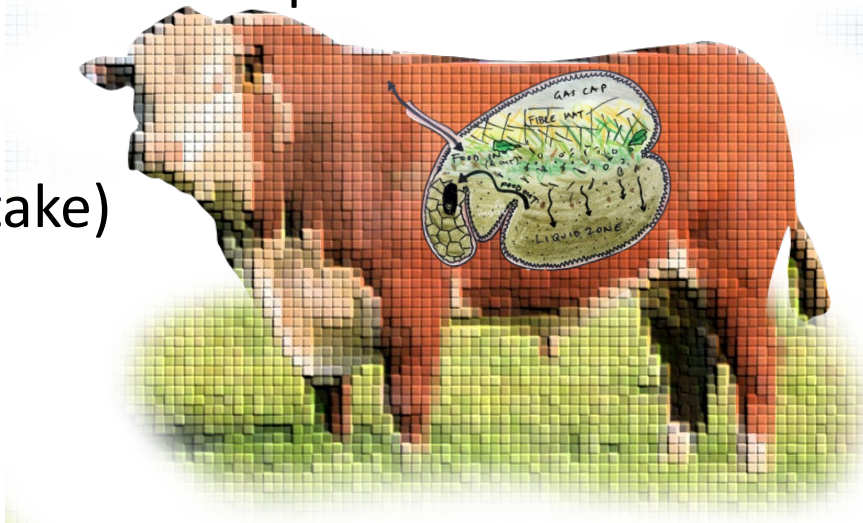
Highly efficiency animals presented:

- Lower intake (kgDM) ~ 15%
  - Lower gross methane emissions (g/d) ~ 8%
    - Lower Methane Intensities (g/ Kg) ~ 7%
      - Higher Methane Yields (g/ Kg DM) ~ 8%

Conclusions

The potential for selection of animals with higher feed conversion efficiency:

- Reduce feed intake (without compromising performance) in line with of production goals
- Daily gross methane emission reduction (directly linked to intake)
- Lower emission intensities as a sustainable goal
  to reduce the impact of global warming



- ….ongoing projects to unravel these relationships with the microbiota diversity

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Project: FSA_1_2018_1_152872

Institut Pasteur de Montevideo


Thank you!
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