



Restricting feed intake of inefficient lactating cows affects feed efficiency and methane emissions

Fischer A., Edouard N. and Faverdin P.



FISCHER et al.



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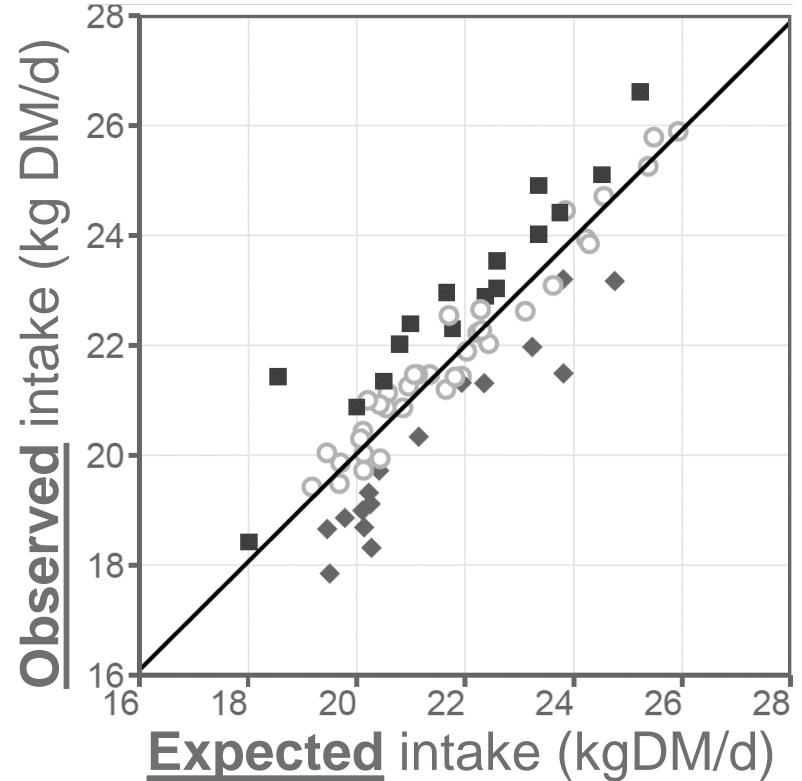
Estimating feed efficiency

Feed efficiency = RFI =

Observed feed intake

—

Expected Feed Intake



Estimating feed efficiency

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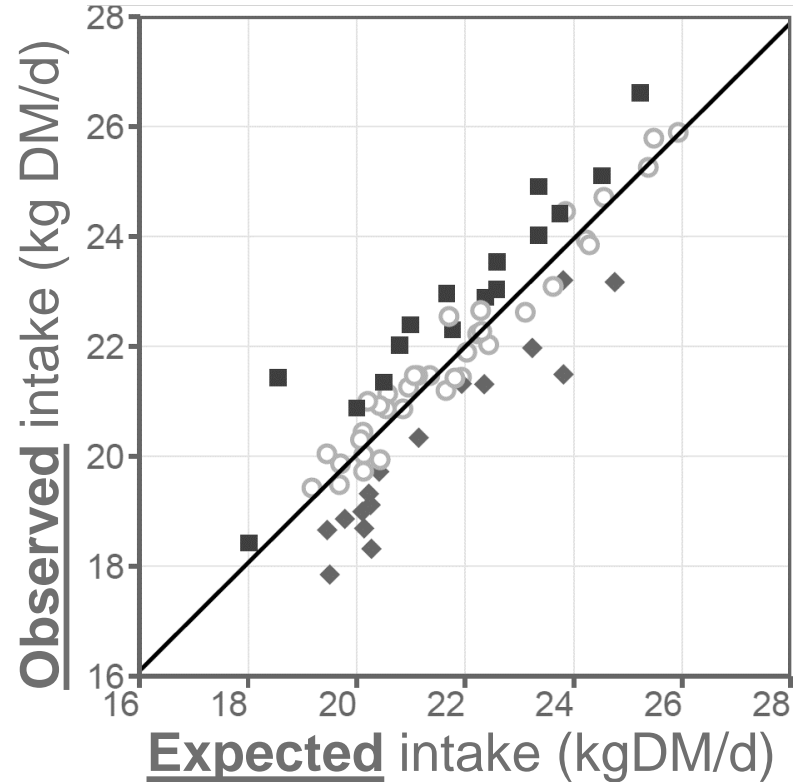
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Expected Feed Intake



Expected DMI = sum of requirements for :

- Milk production
- Maintenance
- BW loss
- BW gain
- Gestation



Estimating feed efficiency

Feed efficiency = RFI =

Observed feed intake

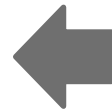
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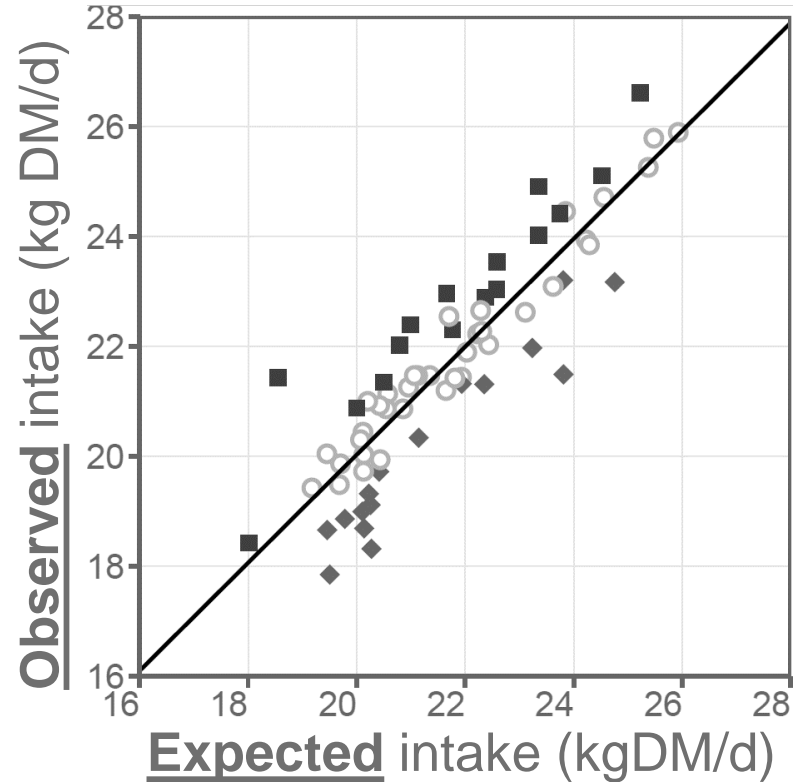


Expected DMI = sum of requirements for :

- Milk production
- Maintenance
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- BW gain
- Gestation



**Equations
feeding
systems**



Estimating feed efficiency

Feed efficiency = RFI =

$$\frac{\text{Observed feed intake}}{\text{Expected Feed Intake}}$$

Positive =

Ate more

than expected

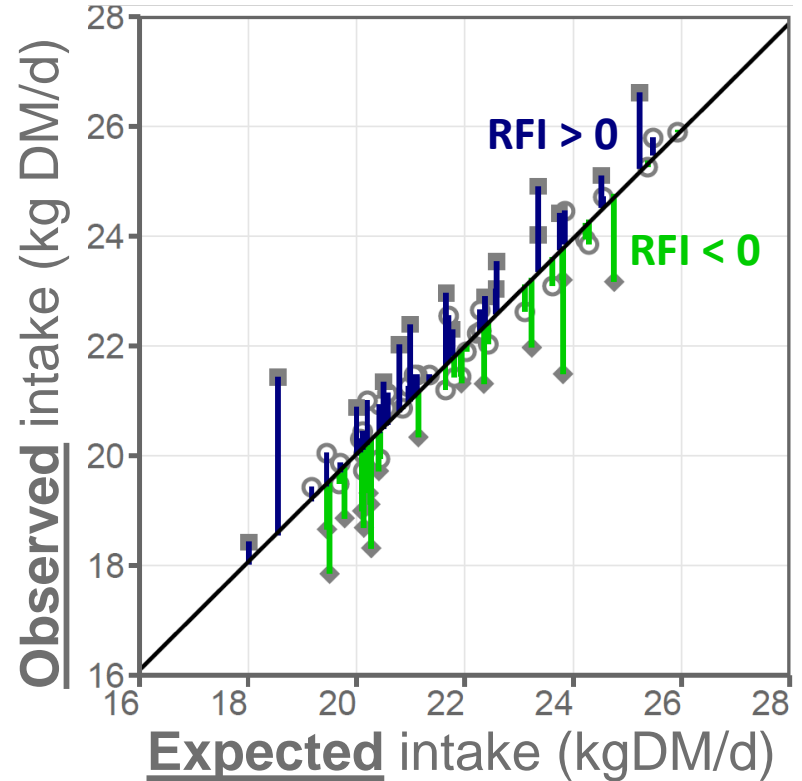
→ **Least efficient**

Negative =

Ate less

than expected

→ **More efficient**



Asked question....

Why do **inefficient cows** need to **eat more** than the efficient ones, for **similar energy requirements**?

Hypothesis:

Within same diet, cows are less efficient because they overconsume, and consequently it lowers feed digestibility and/or changes efficiency of energy use

Objective

Hypothesis:

Restricting the cows to the feeding level of the most efficient should improve their feed efficiency



Does feed restriction

- 1/ improve feed efficiency of less efficient dairy cows,**
- 2/ without compromising their performance and**
- 3/ change methane production**



?

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Method

Experimental Design

- ❖ 68 Holstein cows (19 primiparous)
- ❖ Diet : 64.5 % Maize Silage + 35.5% concentrates
- ❖ Monitored phenotypes:
 - ❖ DM intake (1 / d / cow)
 - ❖ Milk Yield (1/ d /cow)
 - ❖ Milk fat and protein (1/milking for 2 days/week)
 - ❖ Body weight (after morning milking)
 - ❖ BCS (1/month)
 - ❖ Methane (2-6 visits/cow/d)



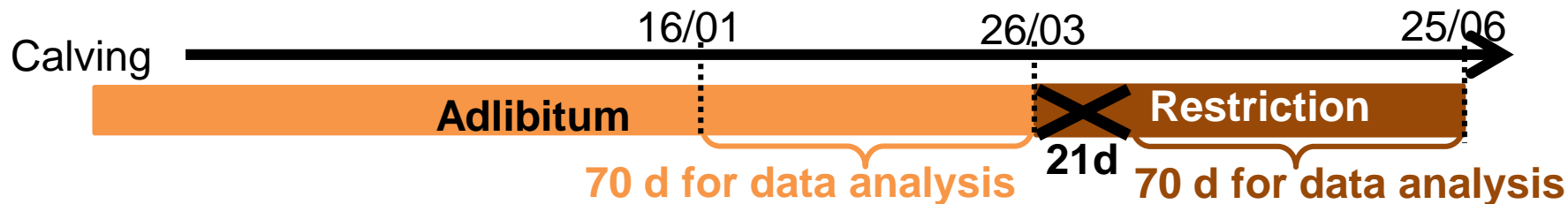
Greenfeed by



Method

Experimental Design

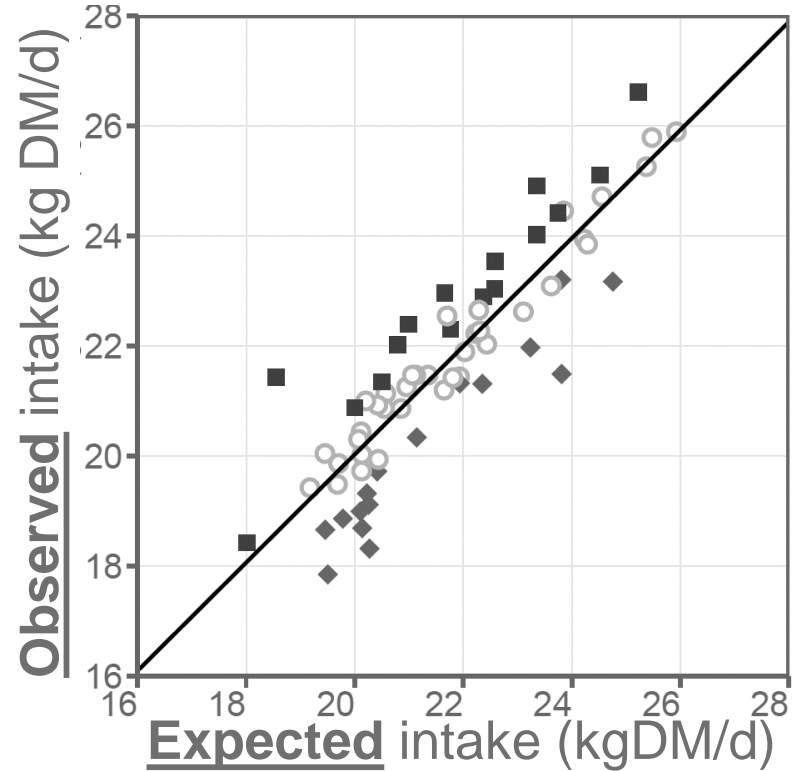
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Method

Feed restriction

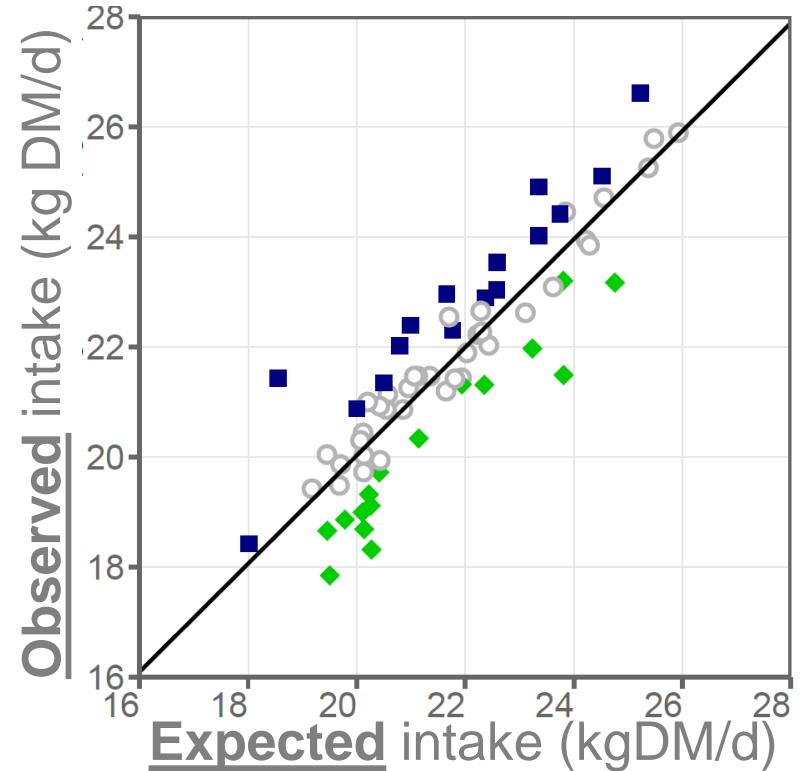
- 1. Estimate ad libitum feed efficiency



Method

Feed restriction

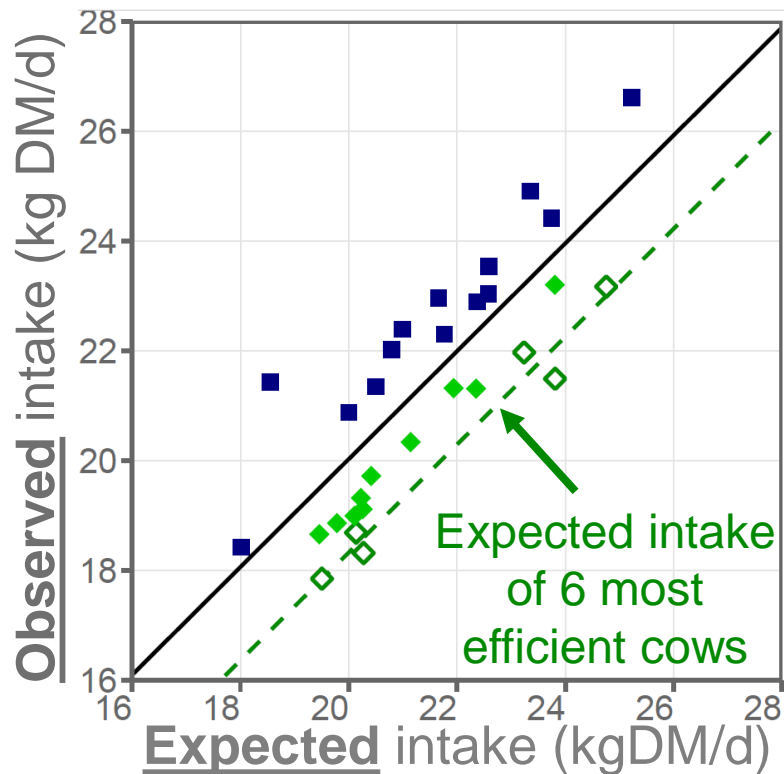
1. Estimate ad libitum feed efficiency
- 2. Identify the 15 most and 15 least efficient cows



Method

Feed restriction

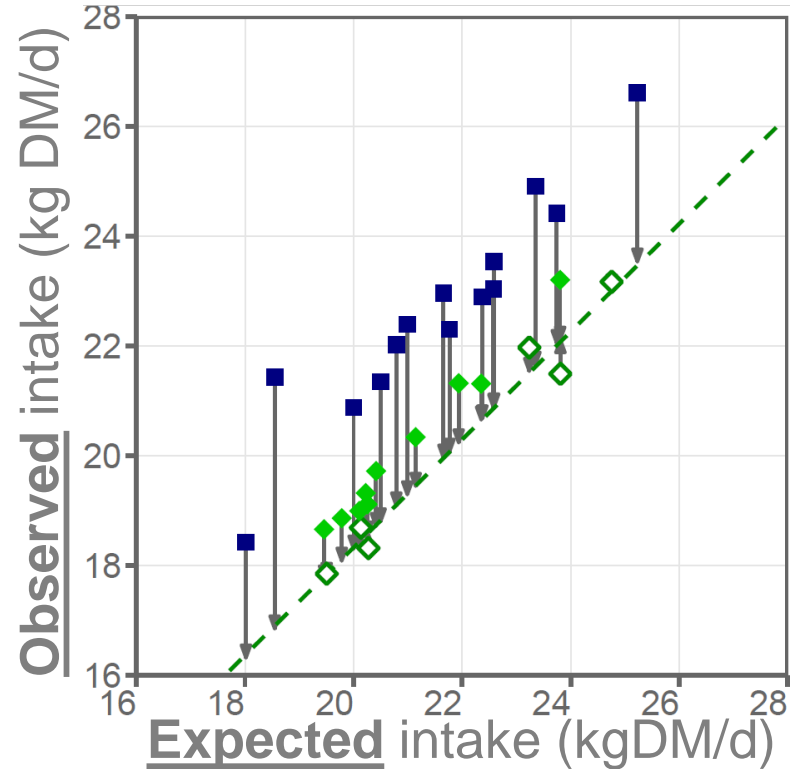
1. Estimate ad libitum feed efficiency
2. Identify the **15 most** and **15 least** efficient cows
- 3. Estimate expected intake of the **6 most efficient** cows



Method

Feed restriction

1. Estimate ad libitum feed efficiency
2. Identify the **15 most** and **15 least** efficient cows
3. Estimate expected intake of the **6 most efficient** cows
- 4. Estimate the restriction: bring all cows to the intake level of the **6 most efficient cows**

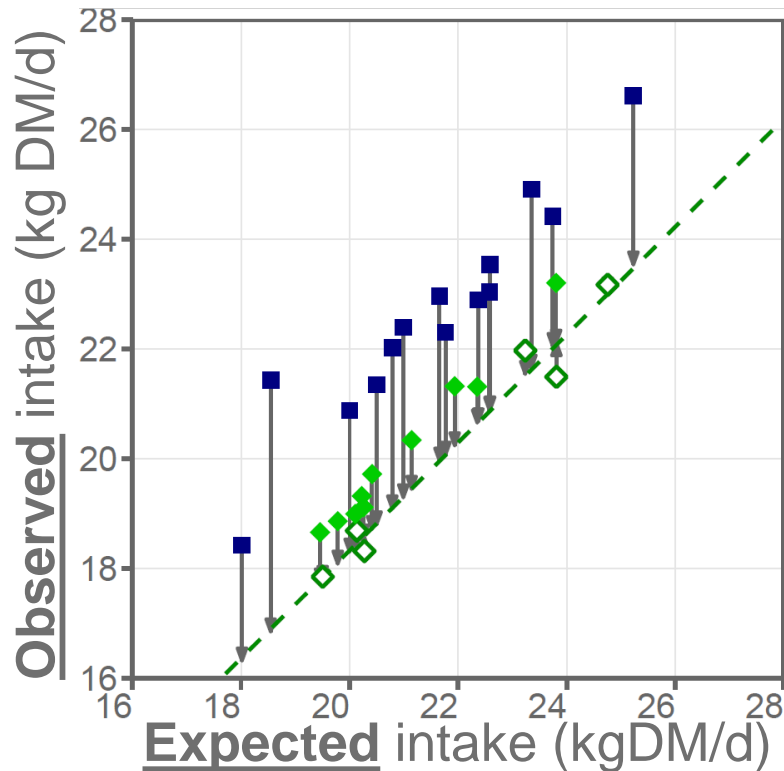


Method

Feed restriction

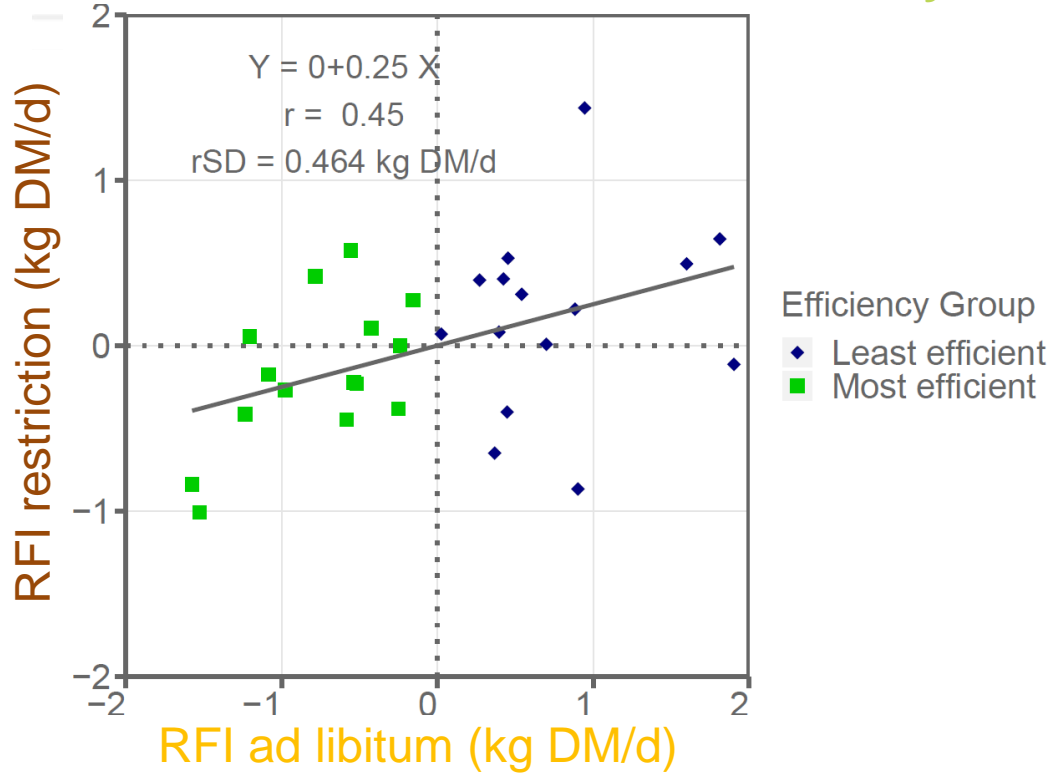
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! Restriction is higher for least efficient cows



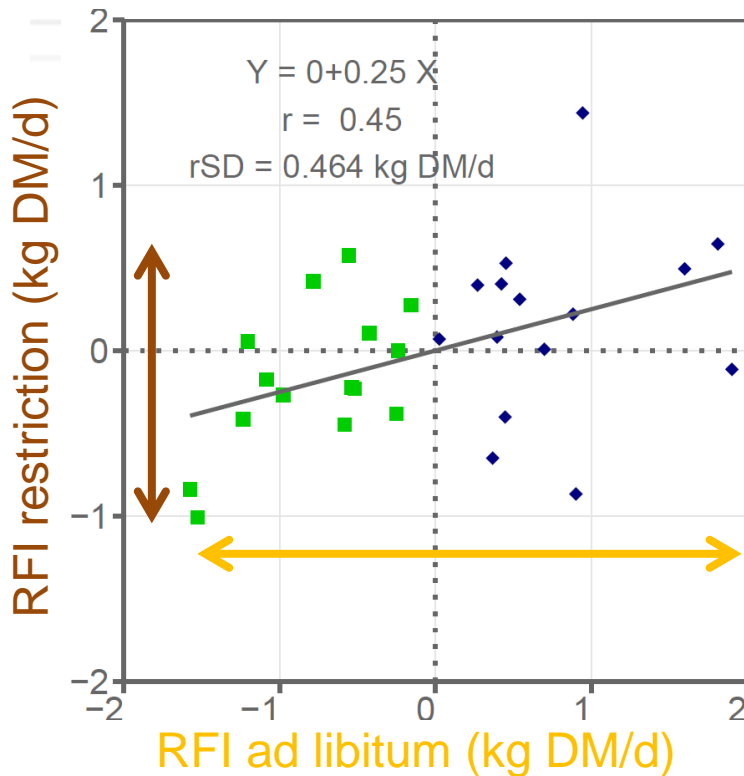
Results

Feed restriction effect on feed efficiency



Results

Feed restriction effect on feed efficiency



<i>RFI</i>	Ad libitum	Restriction
SD	0.94	0.52
CV	4.4	2.6

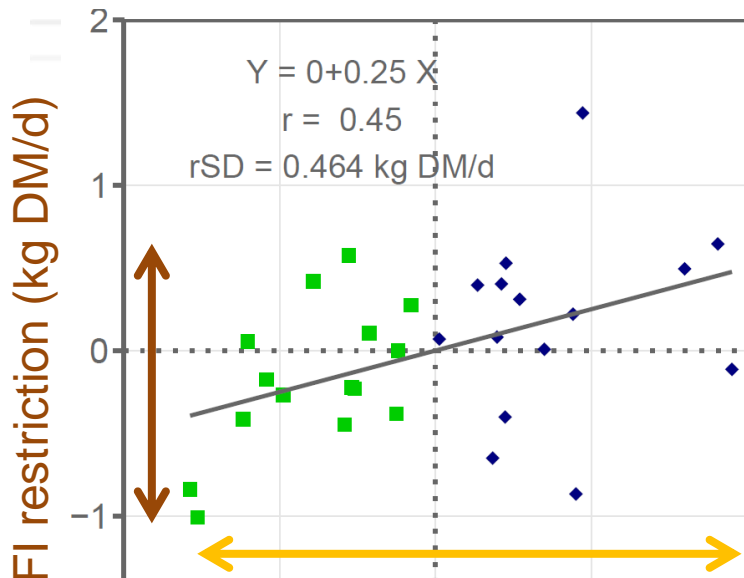
Efficiency Group

- ◆ Least efficient
- Most efficient

Red annotations: A red arrow points from 0.94 to 0.52 with a division symbol $\div 1.8$. Another red arrow points from 4.4 to 2.6 with a division symbol $\div 1.7$.

Results

Feed restriction effect on feed efficiency



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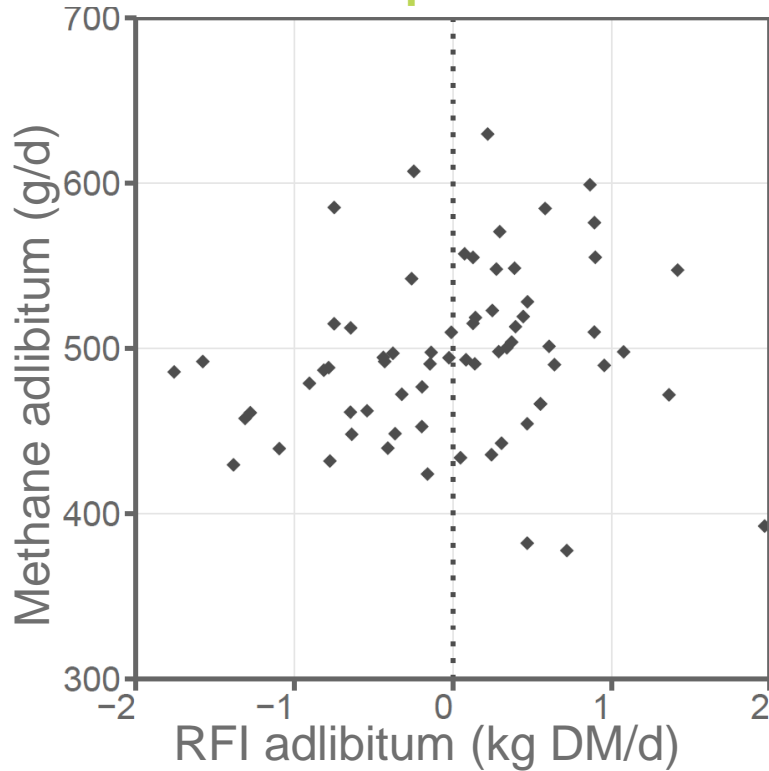
- ◆ Least efficient
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Red annotations: $0.94 \div 1.8 = 0.52$ and $4.4 \div 1.7 = 2.6$

- Feed restriction reduced variability of feed efficiency by 1.8
- Small variability of feed efficiency during restriction
→ Are the cows still different in feed efficiency ?

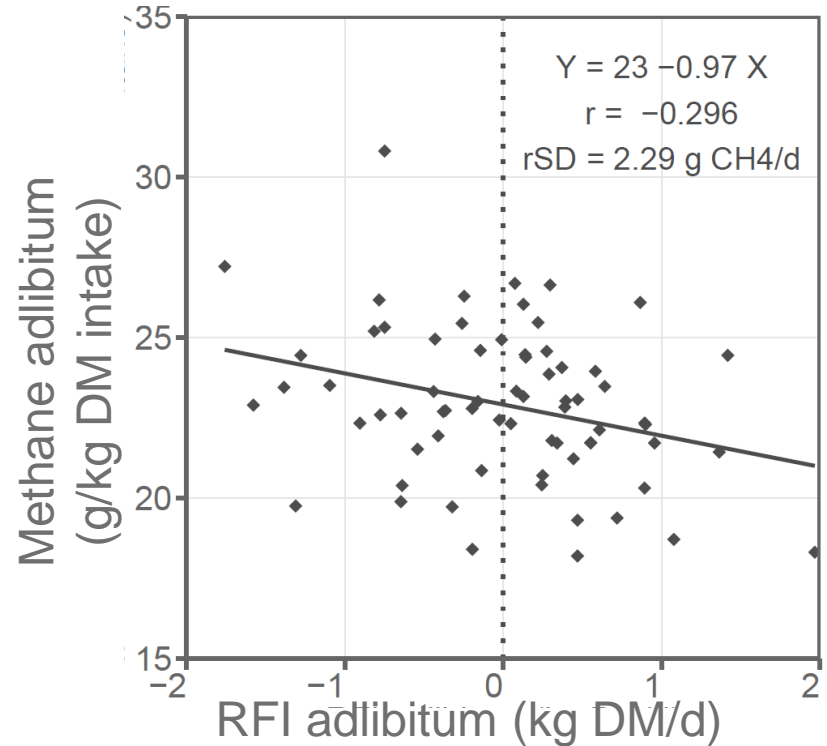
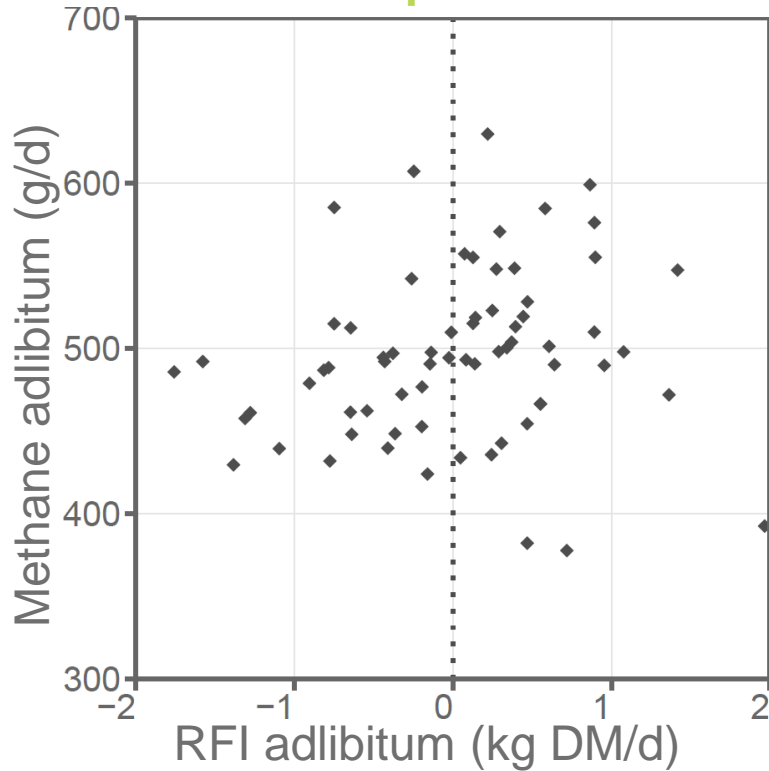
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Methane production and feed efficiency during ad libitum feeding



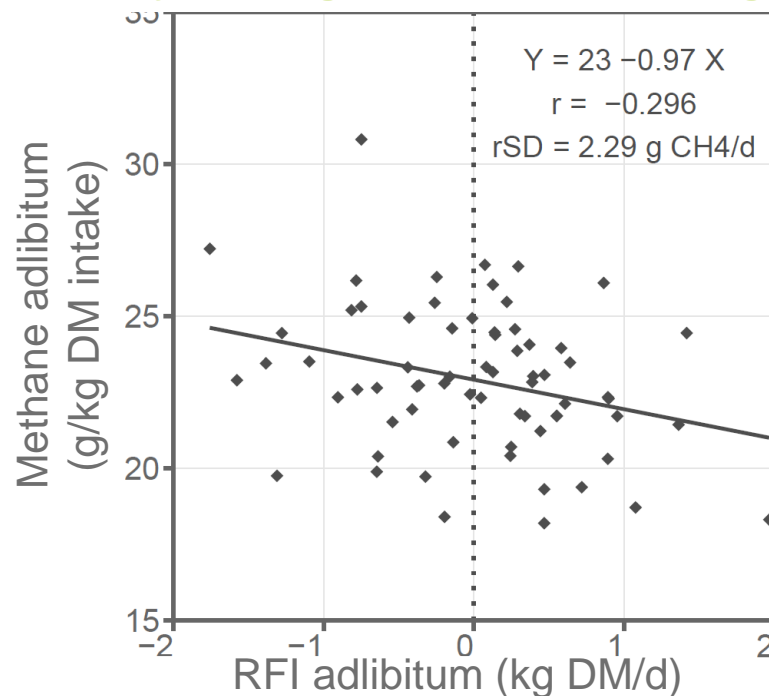
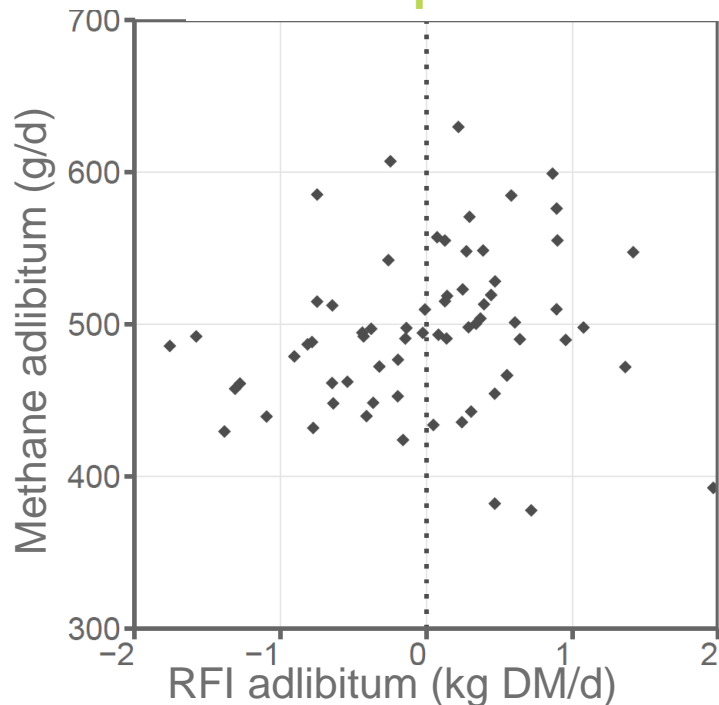
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Results

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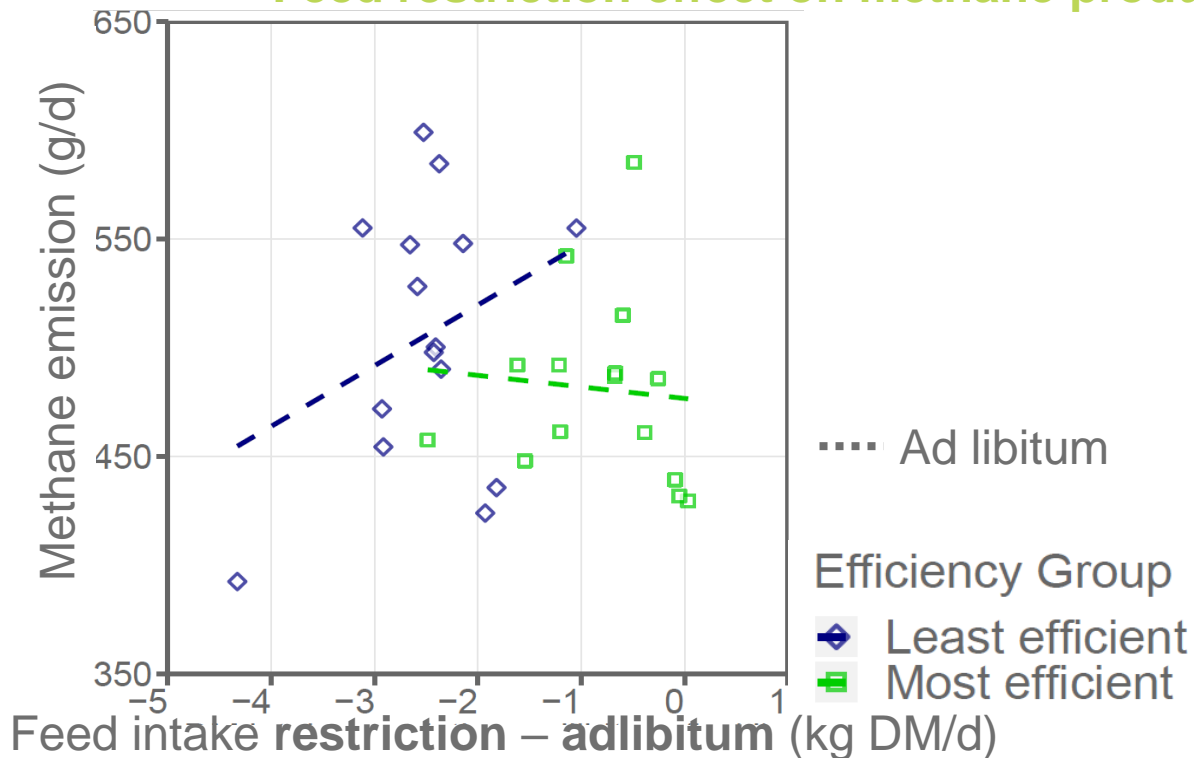


Ad libitum feeding:

**the more feed efficient a cow is,
the more methane she emits per kg DM intake**

Results

Feed restriction effect on methane production



..... Ad libitum

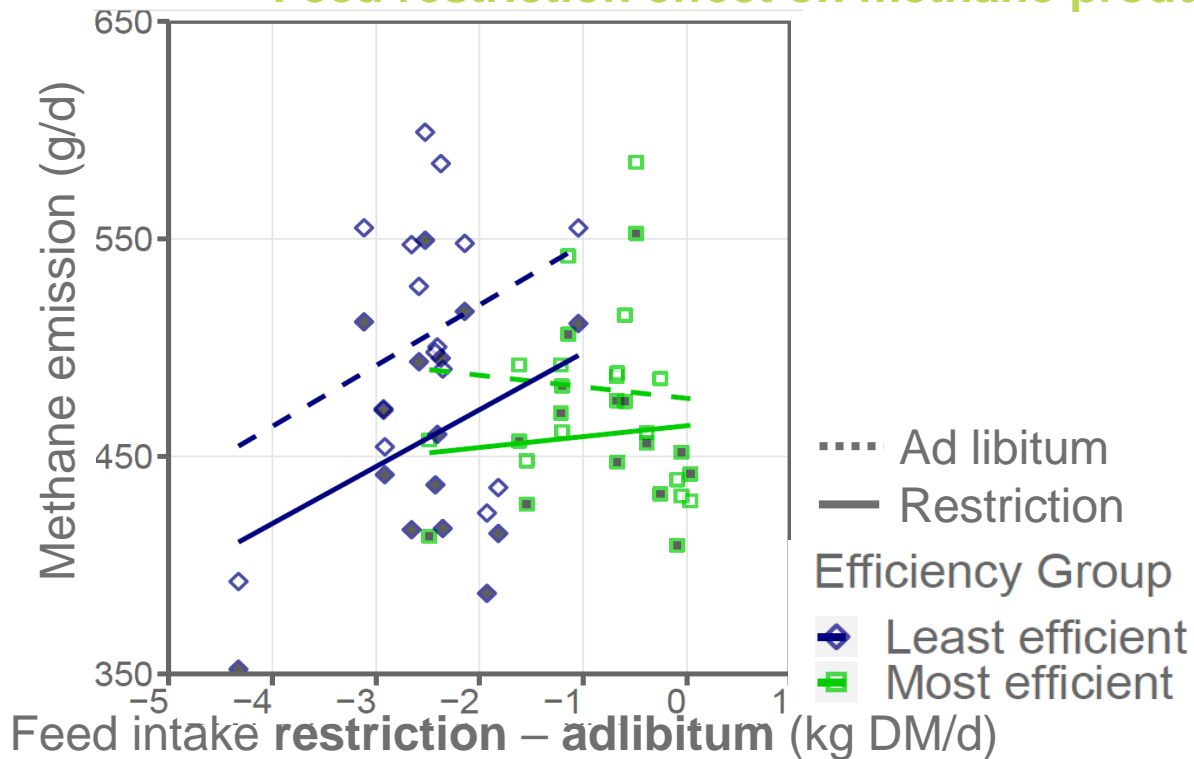
Efficiency Group

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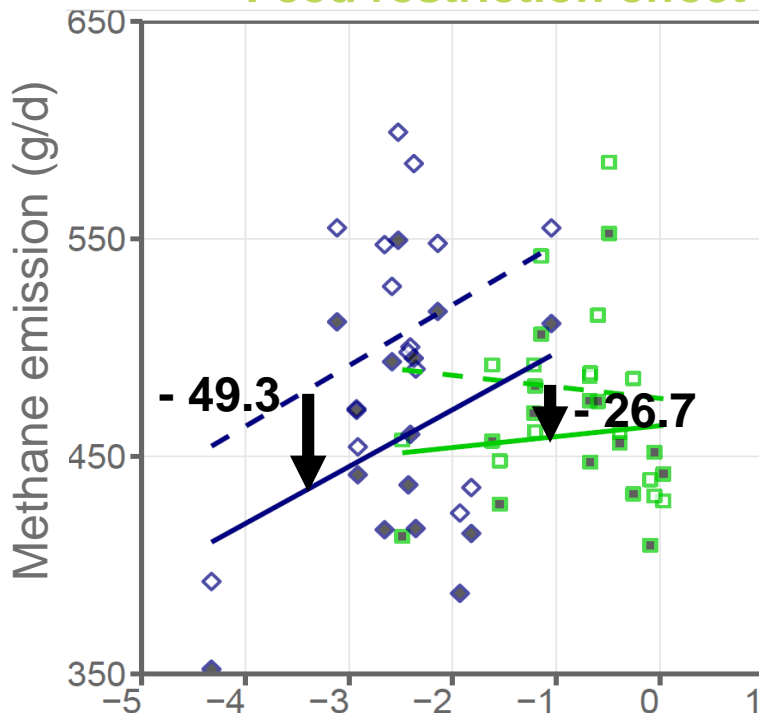
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Results

Feed restriction effect on methane production



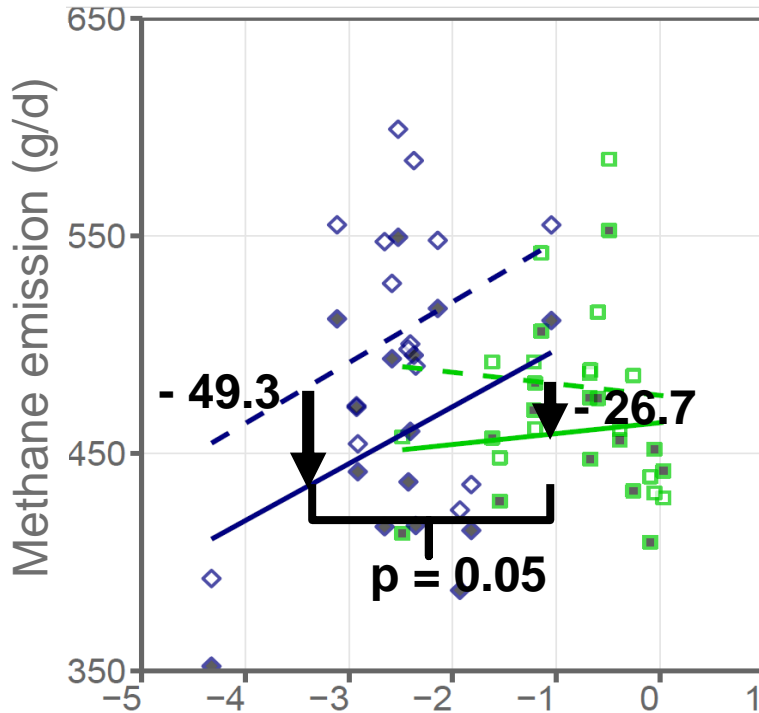
- Least efficient cows emit 49.3g/d less methane when restricted

- Ad libitum
- Restriction
- Efficiency Group
- ◆ Least efficient
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Feed intake restriction – ad libitum (kg DM/d)

Results

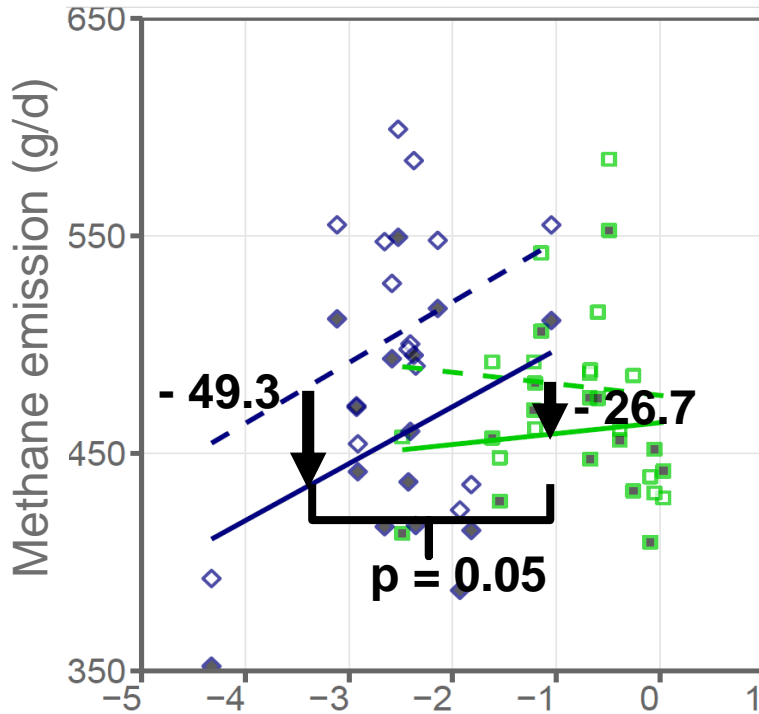
Feed restriction effect on methane production



- Least efficient cows emit 49.3g/d less methane when restricted
 - The reduction in methane emission is significantly higher for least efficient than most efficient cows, when feed restricted
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Results

Feed restriction effect on methane production



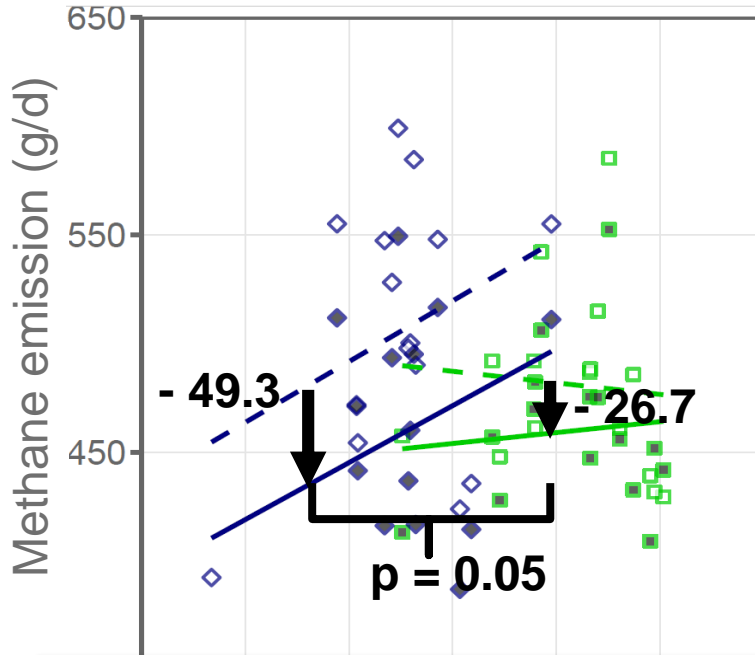
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Methane / kg DM intake:
No difference between
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Methane / kg DM intake:
No difference between least and most efficient cows

**Restriction only impacted methane production per day:
the least efficient cows reduced their daily methane production more
than the most efficient cows, due to restriction**

Conclusion

- ❖ **Restricting** less feed efficient cows to **feed level of most efficient COWS...**
 - ... **reduces** considerably **feed efficiency differences** between cow
 - ➔ **Precision feeding**, by reducing feed offered to least efficient cows, **improves feed efficiency of the least efficient cows**

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→ **Digestibility involved as mechanism for feed efficiency ?**

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 - ...**reduces** daily **methane emissions** more **for least efficient cows** than for most efficient cows
- **Digestibility involved as mechanism for feed efficiency ?**
- ❖ The **more** feed **efficient** a cow is, the **more methane** she emits **per kg DM intake**
- ❖ **No correlation** between feed efficiency and **methane** emission **per day**

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*Coming soon:
submission for publication*



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