U.S. Department of Agriculture

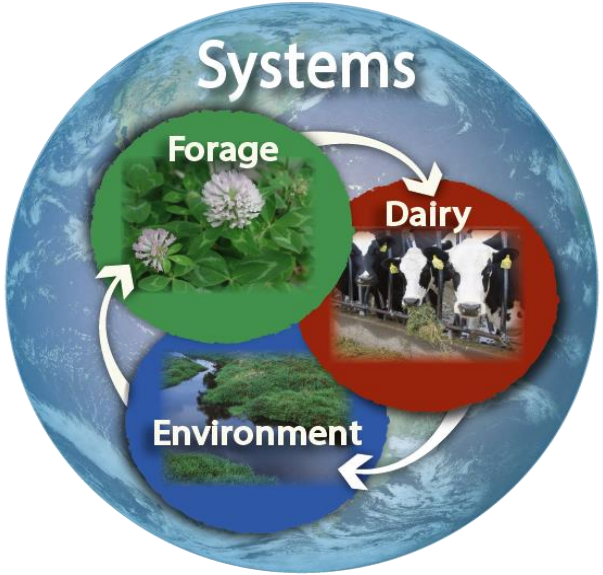
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

# Repeatability of feed efficiency of lactating dairy cows fed high and low starch diets


**Fischer A. and Kalscheur K.F.**

U.S. Dairy Forage Research Center

Oak Ridge Institute for Science and Education


EAAP, Ghent, August 28, 2019

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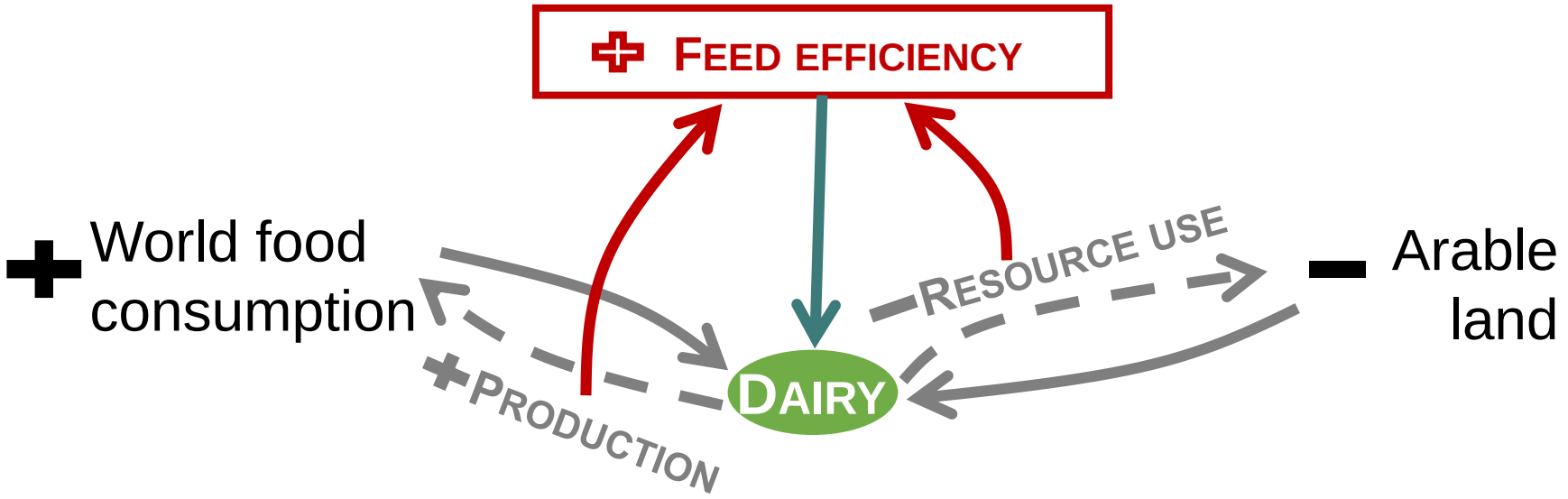

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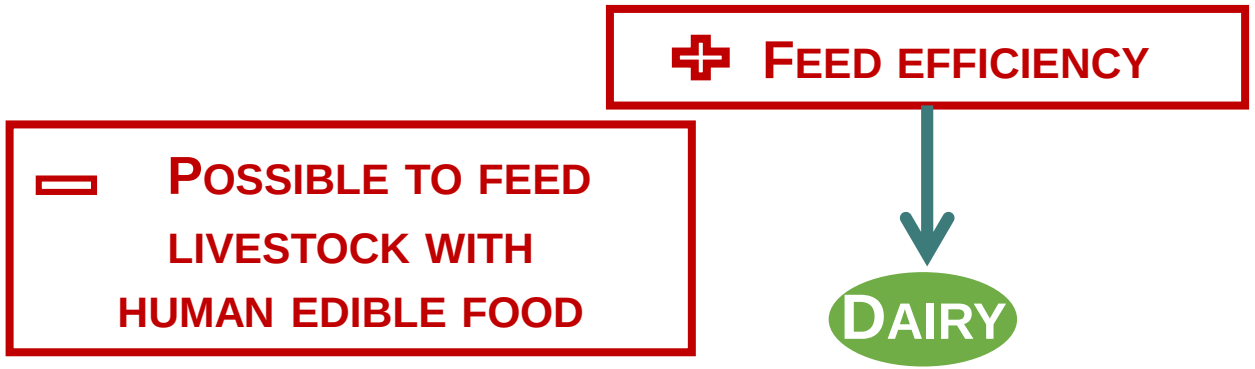

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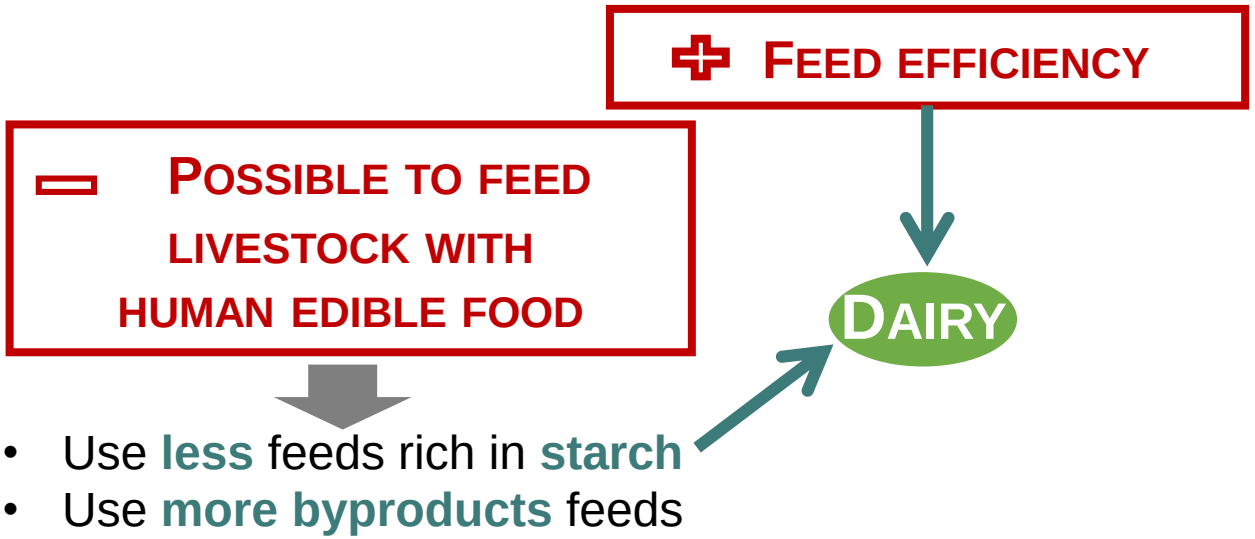


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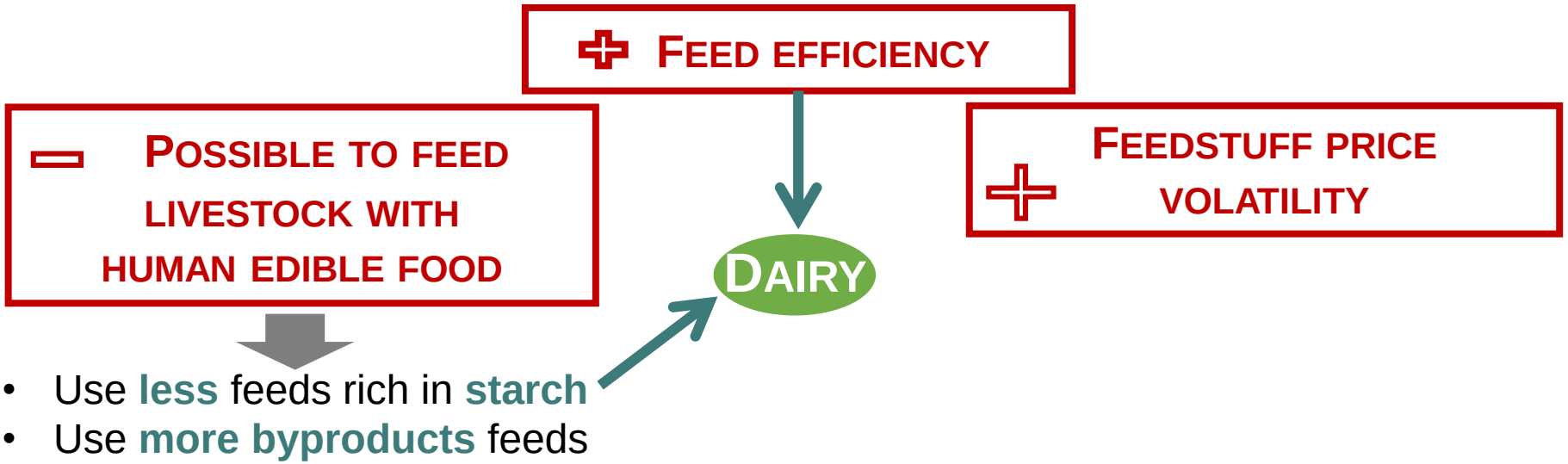

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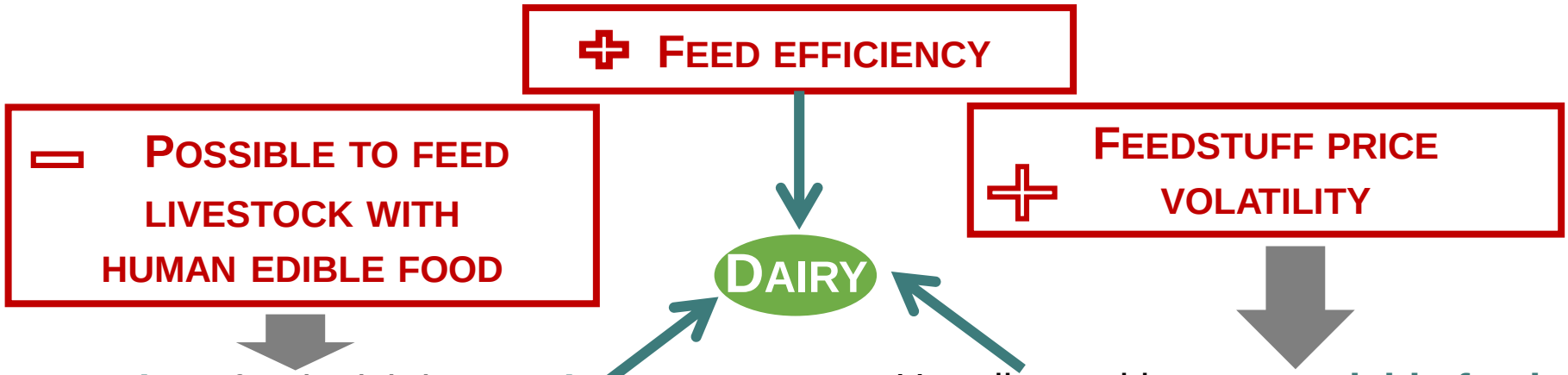


- Use **less** feeds rich in **starch**
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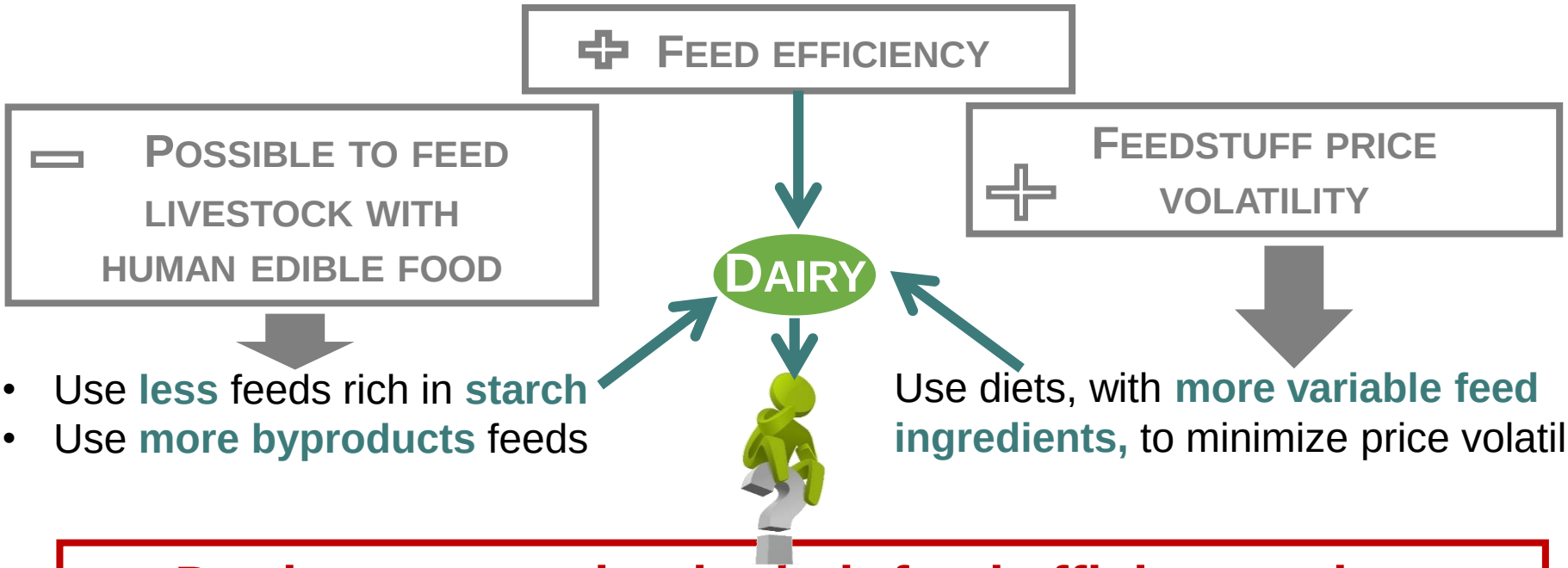
Use diets, with **more variable feed ingredients,** to minimize price volatility

# Dairy livestock challenges




**Do the cows maintain their feed efficiency when changing diets between high starch and low starch ?**

# Method *Diet composition*

| | HiStarch diet | LoStarch diet |
|---|---|---|
| % forages | 47.5 | 66.6 |
| % high moisture corn | 24.6 | 0 |
| % by-products | 11.4 | 24 |

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| % forages | 47.5 | 66.6 |
| % high moisture corn | 24.6 | 0 |
| % by-products | 11.4 | 24 |
| % DM | 50.5 | 45.5 |
| NDF (% of DM) | 29.5 | 36.9 |
| Starch (% of DM) | 26.6 | 12.9 |
| Net energy for lactation (Mcal/kg DM) | 1.68 | 1.58 |

# Method *Experimental Design*

USDA DFRC Prairie du Sac

- 62 Holstein cows (29 primiparous)
- Monitored phenotypes:
  - DM intake *(1/cow/d)*
  - Milk yield *(3 milkings/cow/d)*
  - Milk fat and protein *(6 milkings over 2 days/wk)*
  - Body weight *(after morning milking 3 days/week)*
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***Multiple linear regression** :*

FI observed = μ + a× MilkE + b×maintenance+ c× body reserves change + $\varepsilon$

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Add a repeated time effect within a random cow effect:

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FI observed = ( $\mu_{cow}$ + μ ) + a× MilkE + b×maintenance + c× body reserves change + error

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**Feed efficiency = RFI**

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*Statistical analysis to answer the questions*

**Do the cows maintain their feed efficiency when changing diets between high starch and low starch ?**

1. **Estimate feed efficiency**

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1. **Estimate feed efficiency**

FI observed = ( $\mu_{cow}$ + μ ) + a× MilkE + b×maintenance + c× body reserves change + error

**Feed efficiency = RFI**

2. **Identify the most (RFI < -0.5 SD), least efficient cows (RFI> 0.5 SD) and medium efficient cows (-0.5 SD ≤ RFI ≤ 0.5 SD)**

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*Statistical analysis to answer the questions*

**Do the cows maintain their feed efficiency when changing diets between high starch and low starch ?**

Do they maintain their feed efficiency within diet ?
( = repeatability)

Do they maintain their feed efficiency across diets ?
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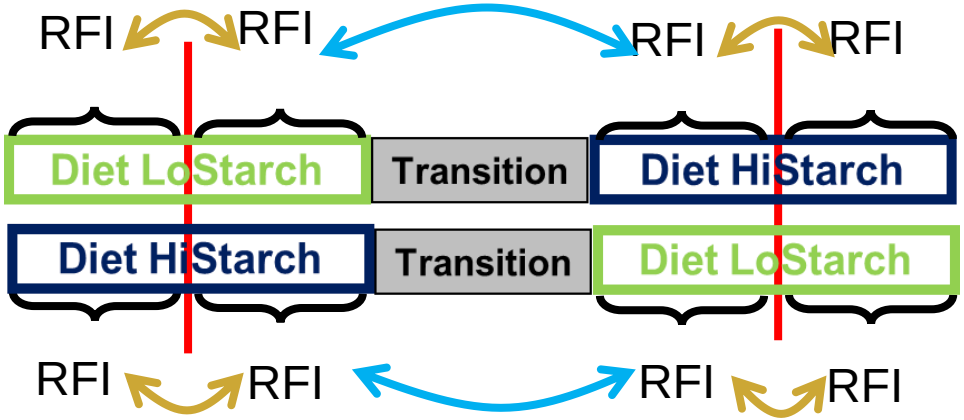
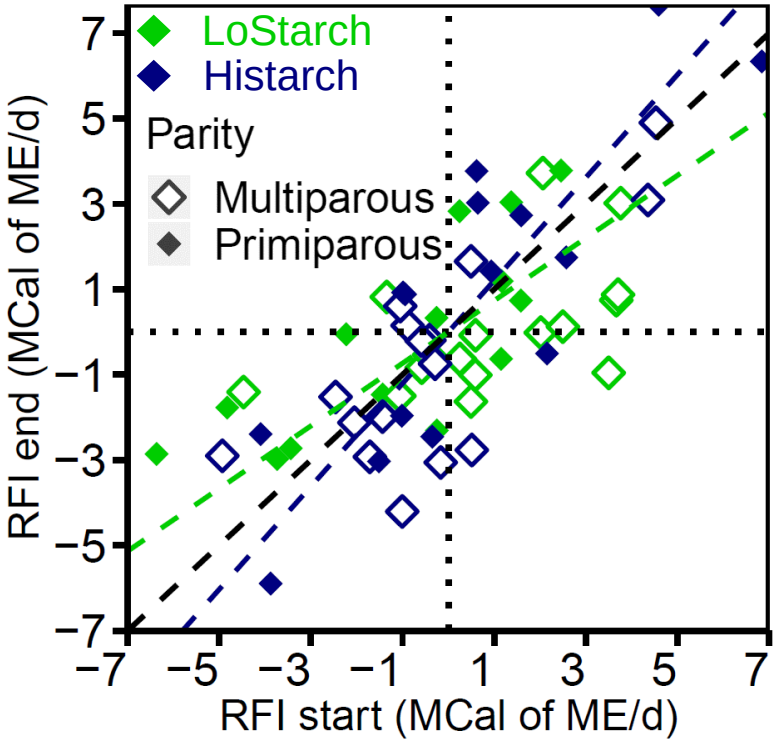


# Results

## *Repeatability within diet*




| | HiStarch | LoStarch |
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| r | 0.68 | 0.74 |
| SD *(Mcal of ME/d)* | 2.01 | 1.43 |

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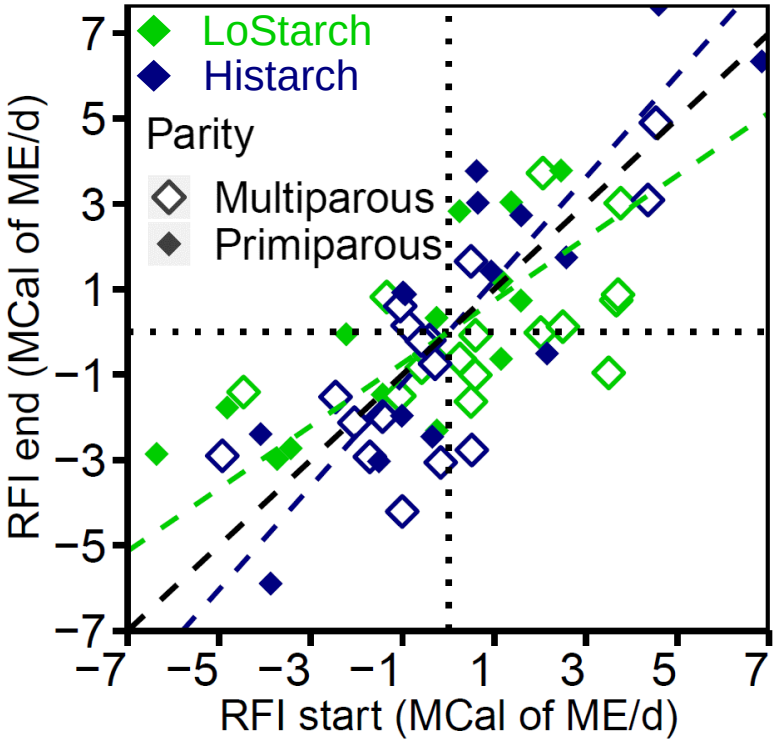


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SD Repeat. MEI = 2.3 - 4.1

- High correlations and small repeatability errors

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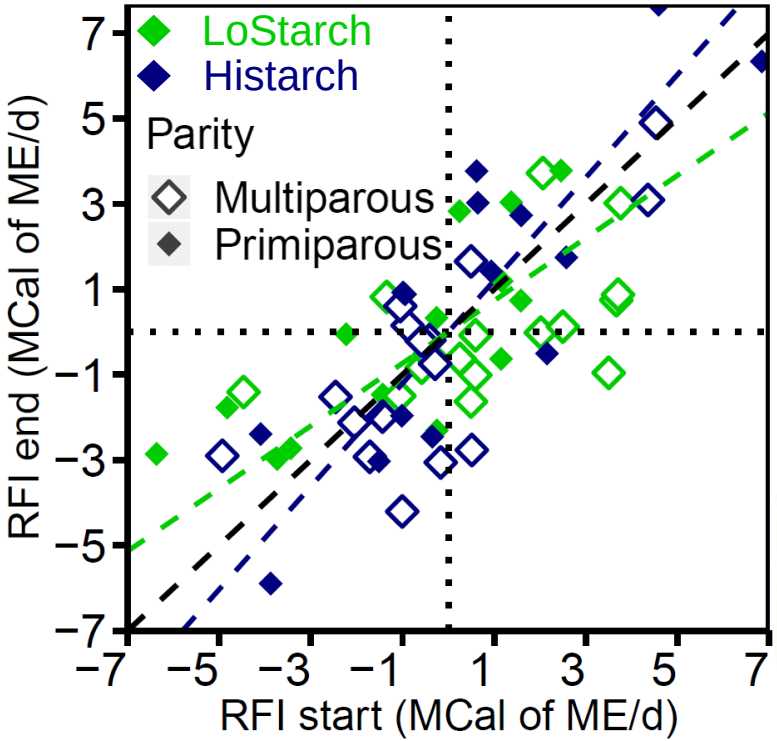


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- High correlations and small repeatability errors
- Reranking ?


- **<u>67.7%</u> <u>maintain</u>** their efficiency class **<u>within diet</u>**
- **<u>3.2%</u>** change **<u>by 2 classes</u>**

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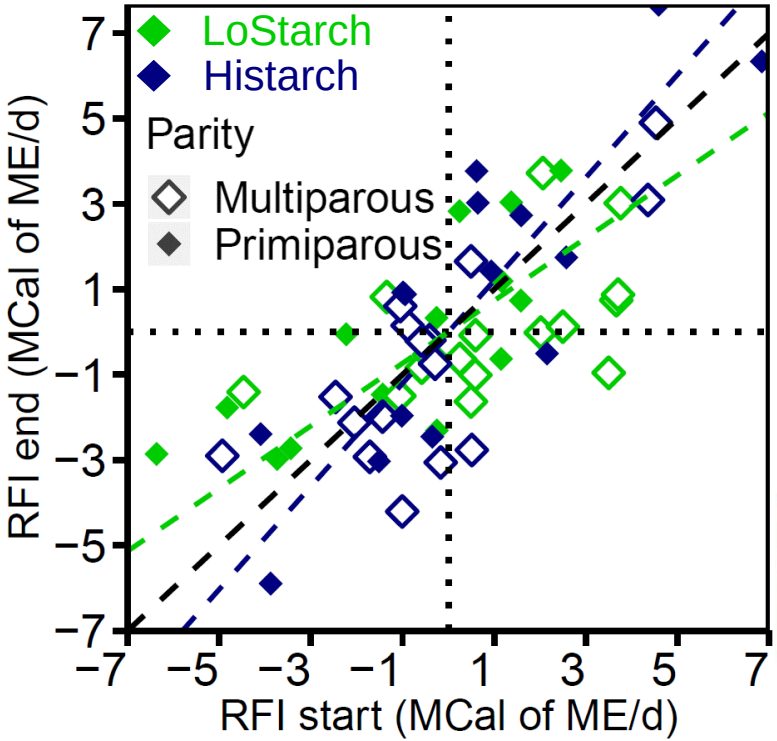


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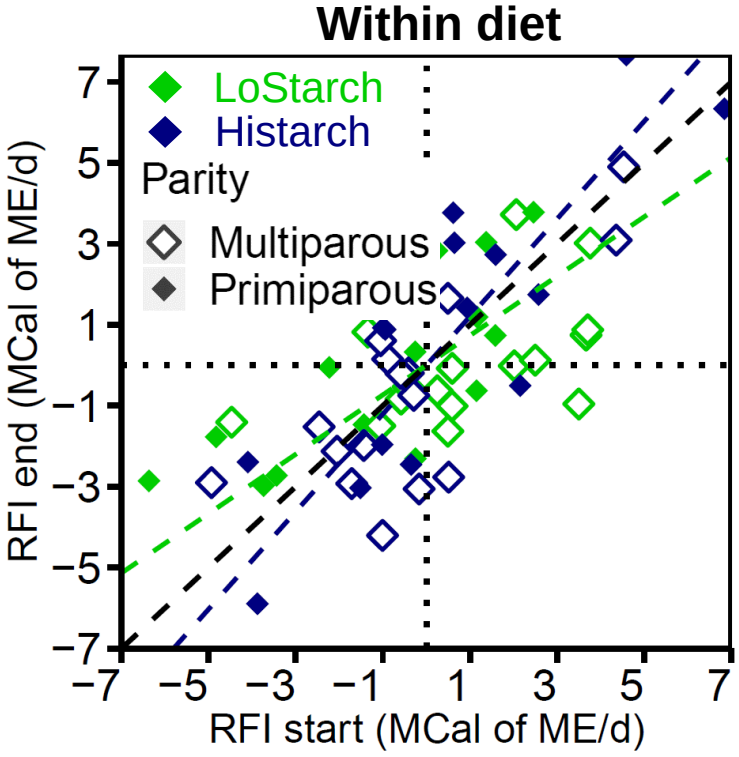
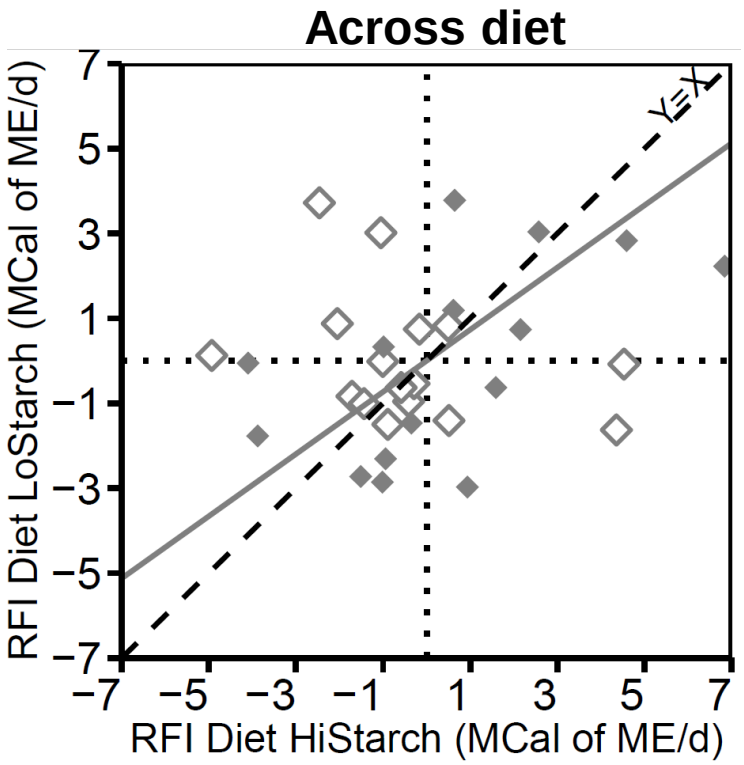
RFI is **<u>repeatable</u>** within diet

# Results

*Compare within and across diets repeatability*



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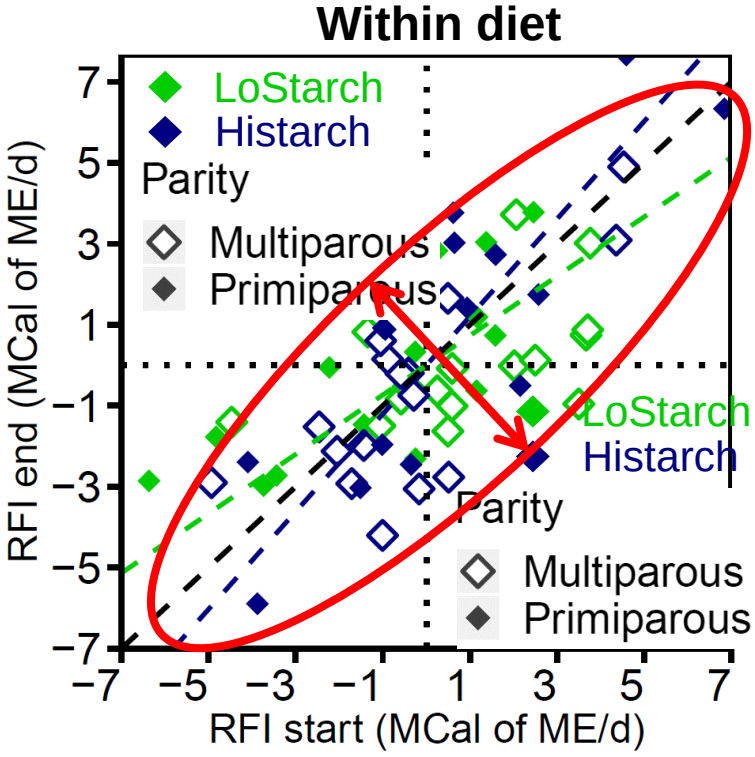


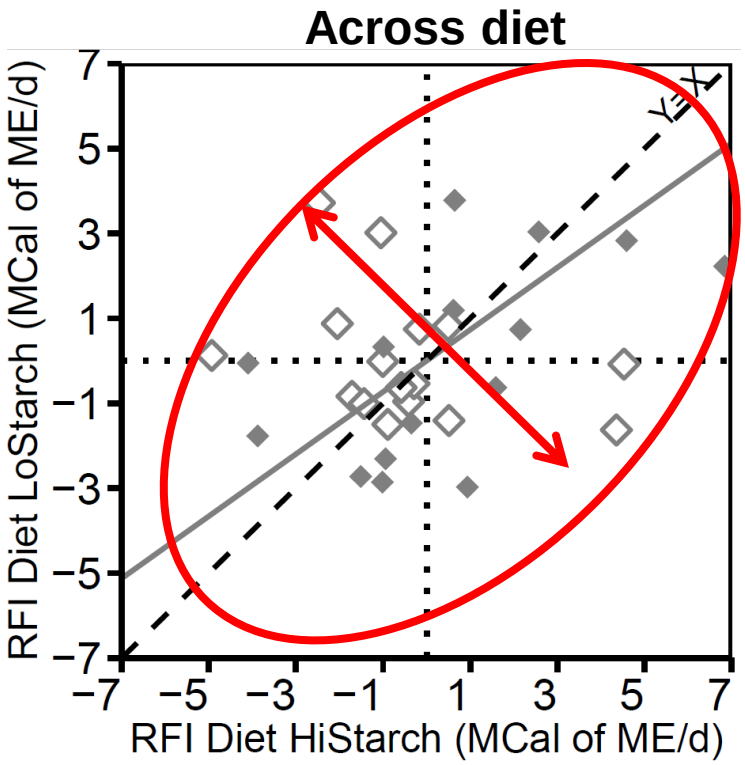


RFI is **less repeatable across** diets

# Results

*Compare within and across diets*

| | Within diet | | Across diets |
|---|---|---|---|
| | HiStarch | LoStarch | |
| r | 0.68 | 0.74 | **0.40** |
| SD *(Mcal of ME/d)* | 2.01 | 1.43 | **2.09** |


| | Within diet | Across diets |
|---|---|---|
| Maintained | 67.7% | **45.2%** |
| Change by 1 class | 29.0% | **41.9%** |
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| | Within diet | | Across diets |
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- **Less than half** of cows **maintained** their class
- **1.7 times more** cows **changing class** than within diet!

# Conclusion

- Feed efficiency is **repeatable within diet** across time
- Feed efficiency is **less repeatable** when **changing diets**
- The **most and least efficient** cows on high starch diet are **not necessarily the same** on low starch diet

➔**To be considered for selection ?**


*Amelie.fischer@inra.fr*
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**Why are some cows not able to maintain their efficiency ?**


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*Thank you for your attention*


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