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Project breed4green



Definition of direct and indirect selection traits for efficiency and greenhouse gas emissions (i.e., methane)

Fleckvieh cows

The potential of residual feed and energy intake as direct selection traits for Fleckvieh cows

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Definition of RFI and REI



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RFI = act. feed intake – pred. feed intake

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REI = act. energy intake – pred. energy intake

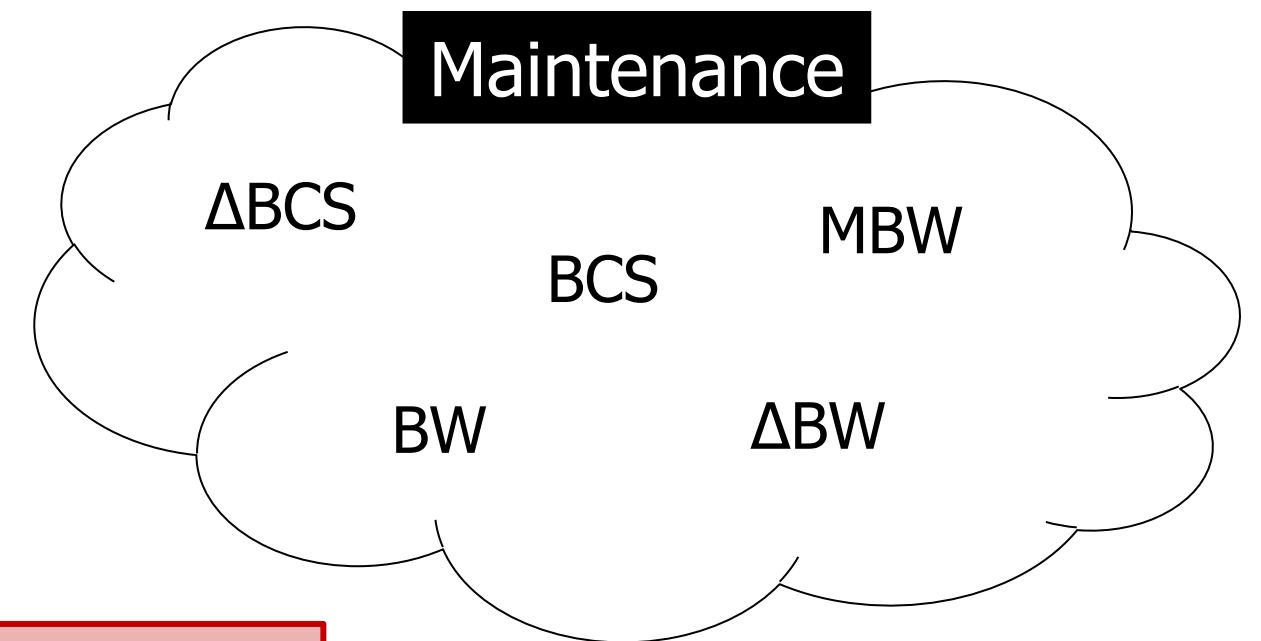
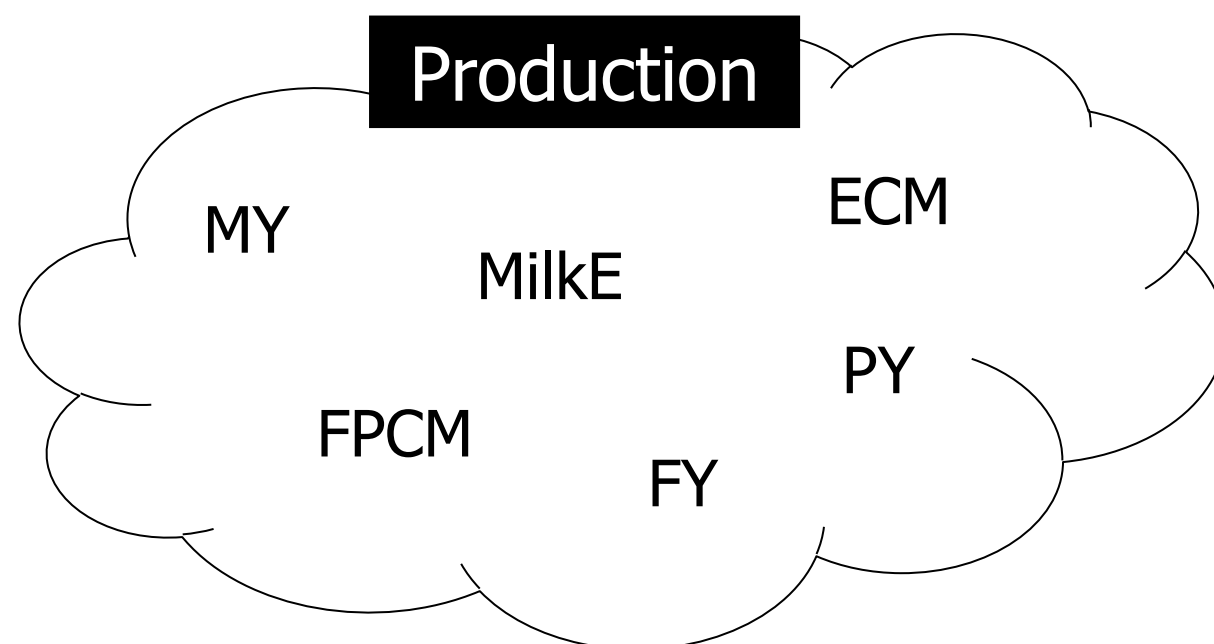


Interpretation

< 0

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regression model with **energy sinks**



AIM

- Develop models for RFI & REI
- Compare the different models

CONNOR 2015; MARTIN ET AL. 2021

Data collection and analyses

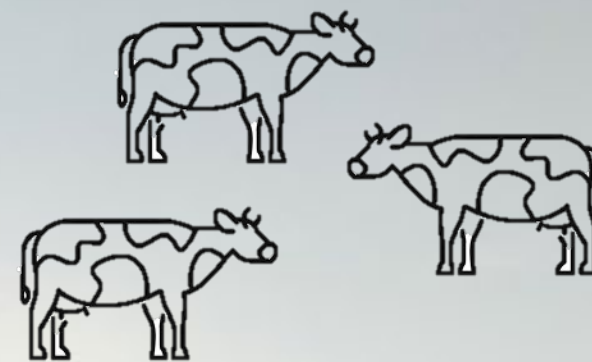


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research farm in Raumberg-Gumpenstein



19 Fleckvieh cows



68 lactations



16,297 observations

2013-2021

- **feed/energy intake** daily
- **milk yield** daily
- **milk solids** daily
- **body weight** weekly
- **body condition score** monthly

Software: R (version 4.1.1)

Models



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Production		Maintenance	Other	R ²	RFI	REI
Milke		MBW + BCS	DIM + Parity		0.421	0.445
		+ ΔBW + ΔBCS			0.477	0.537
FY + PY		MBW + BCS	DIM + Parity		0.482	0.524
		+ ΔBW + ΔBCS			0.512	0.576

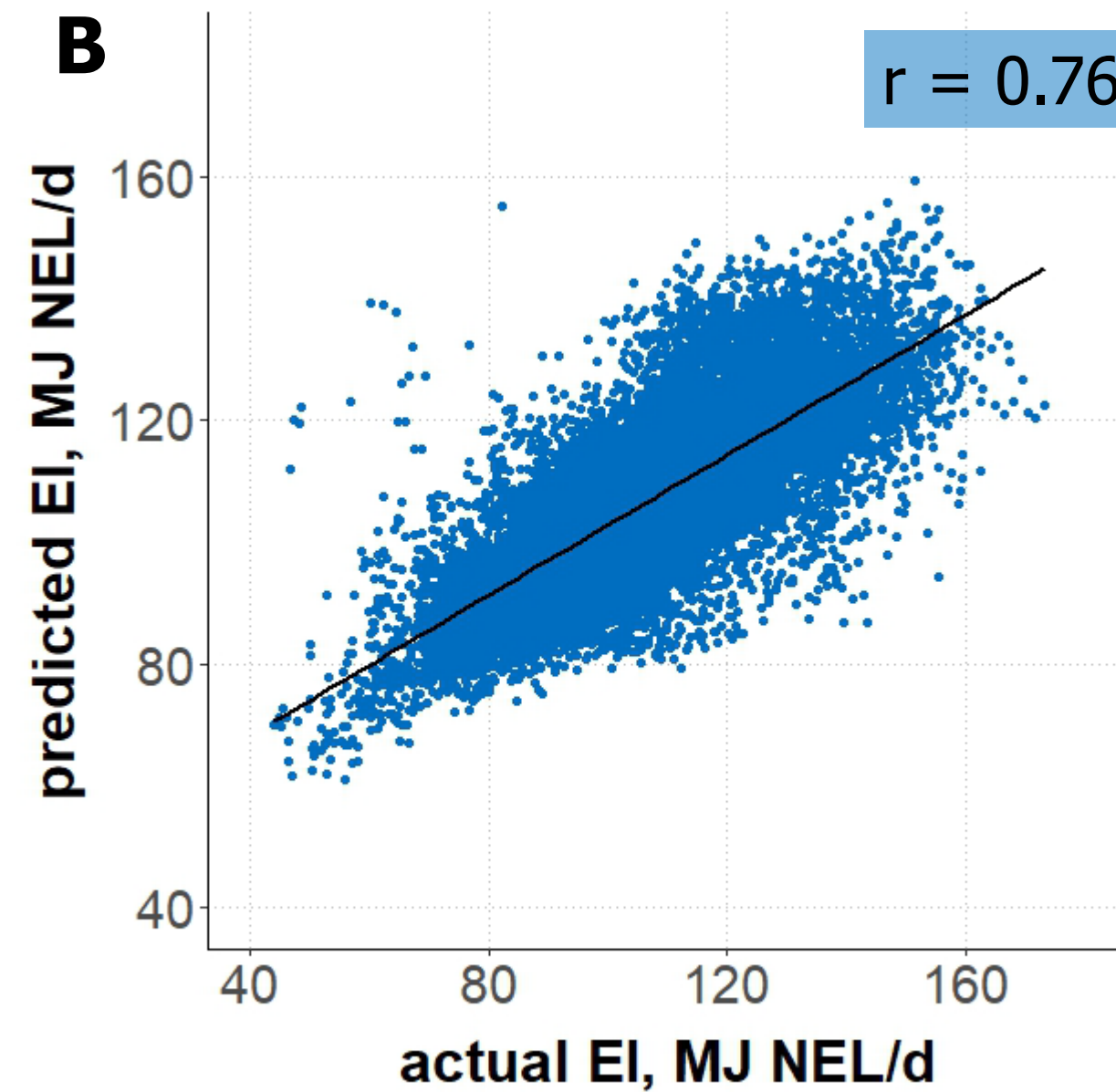
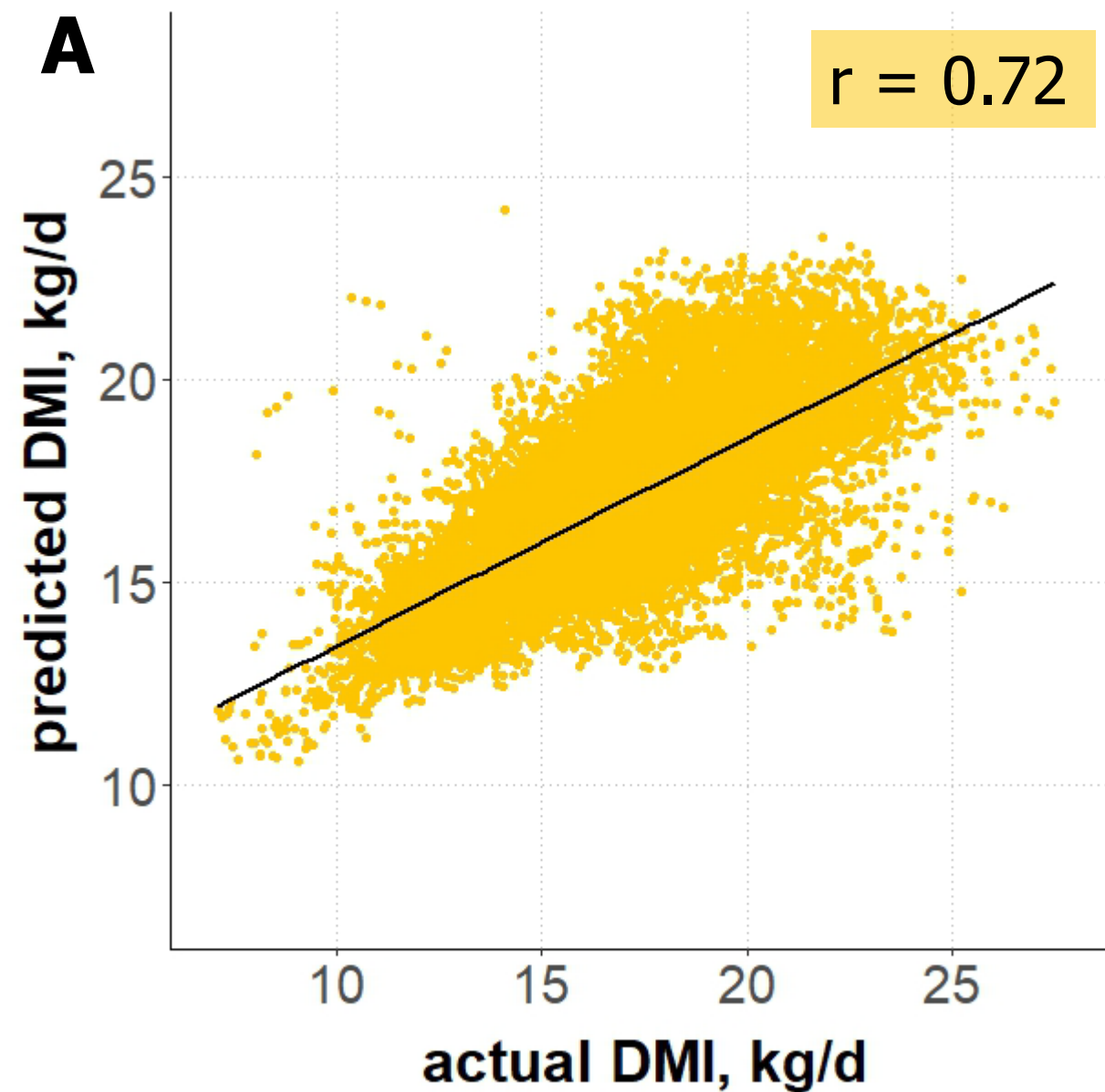
R² for RFI & REI in literature:
0.59 – 0.93 (FISCHER ET AL. 2018)

Comparison predicted vs. actual DMI (or EI)



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DMI (or EI) $\sim$ FY + PY + MBW + Δ BW + BCS + Δ BCS + DIM + Parity + RFI (or REI)



Correlations in literature: 0.84

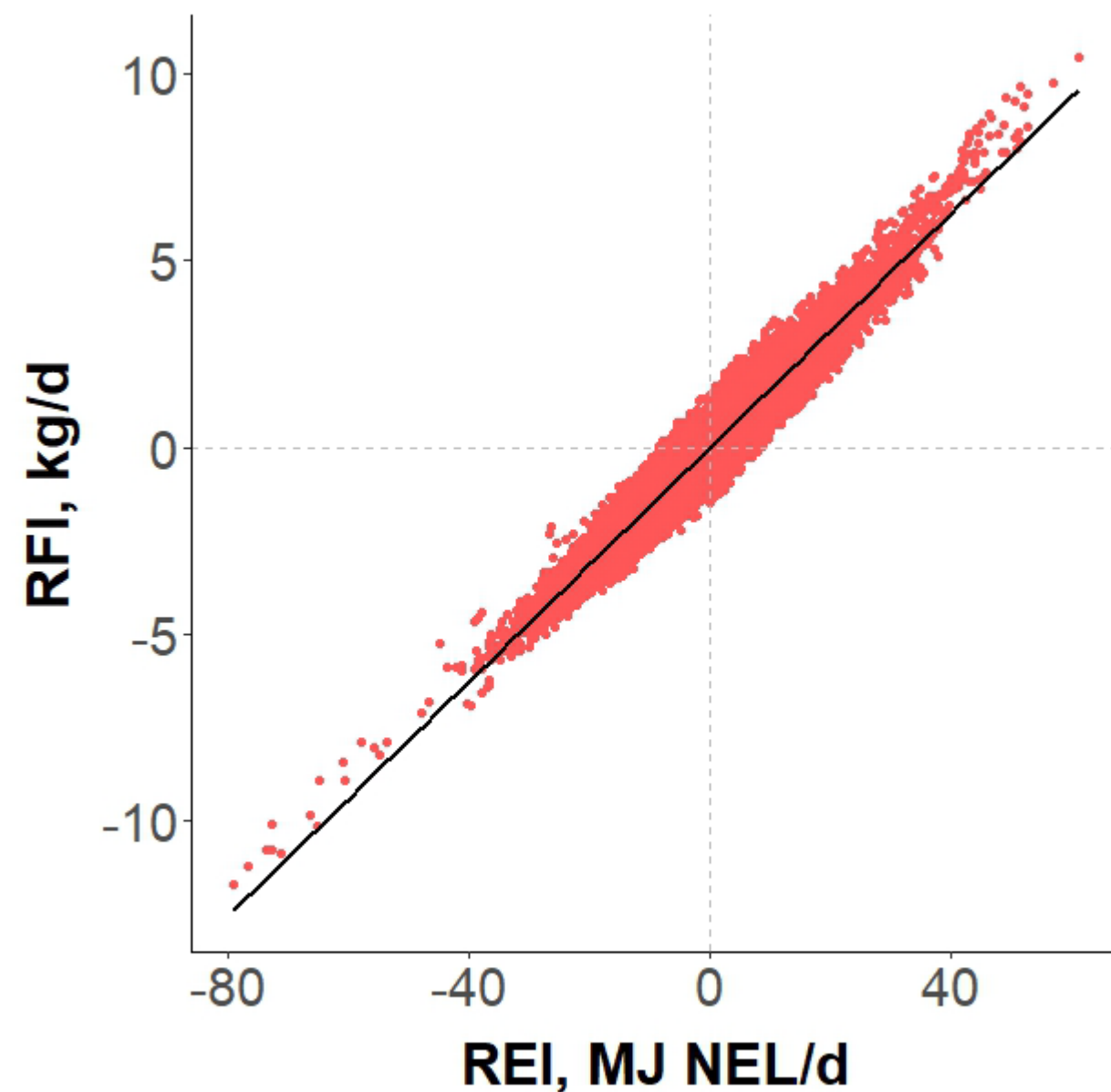
(YAO ET AL. 2013)

Comparison RFI vs. REI



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DMI (or EI) $\sim$ FY + PY + MBW + Δ BW + BCS + Δ BCS + DIM + Parity + RFI (or REI)



Spearman's rank correlation: 0.963

→ only minimal re-ranking

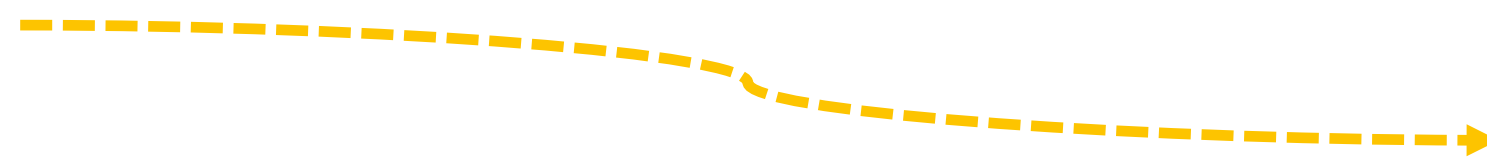
Further considerations



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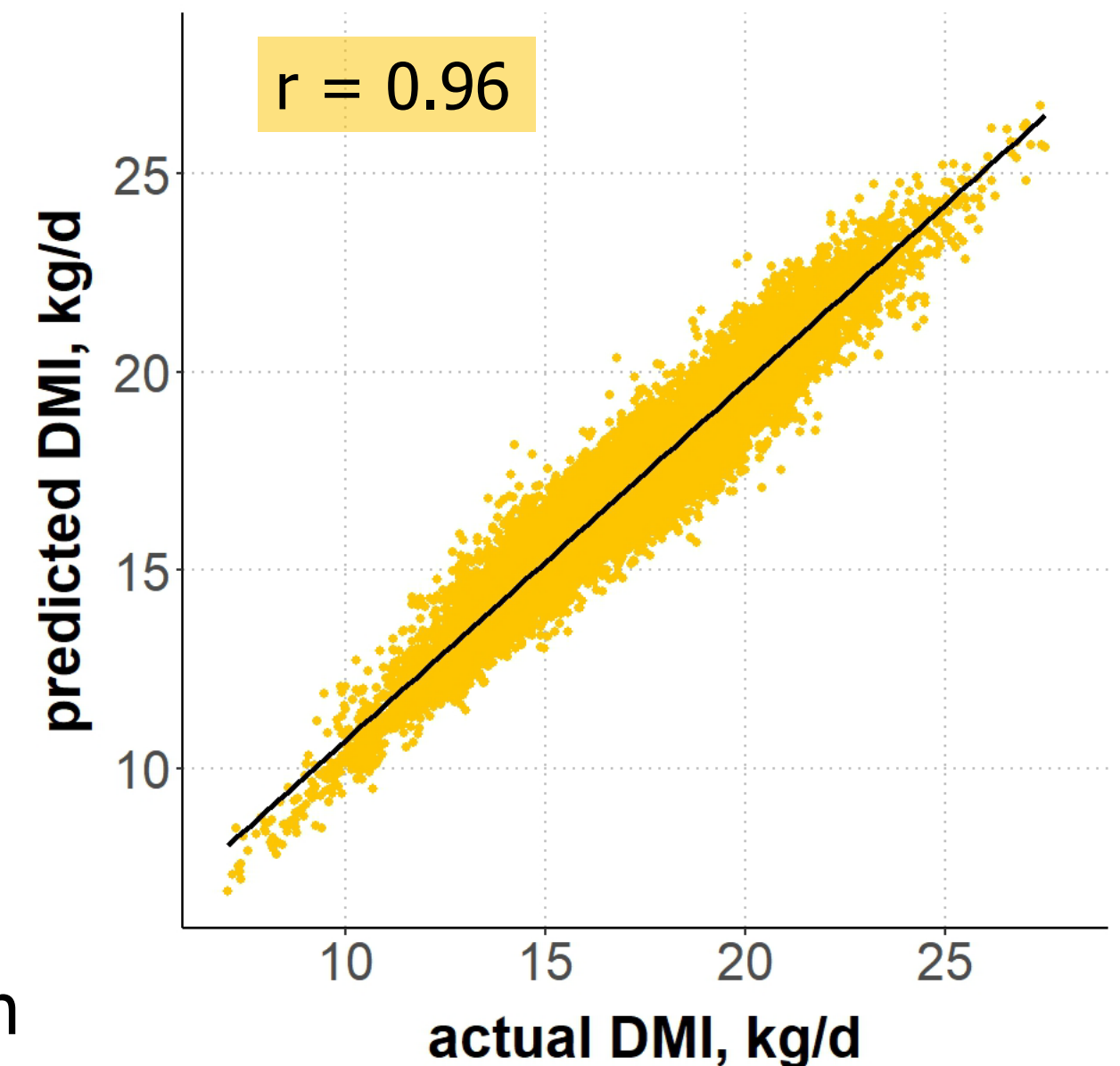
Model improvement through...

- nesting within lactation?
- adding a random animal effect?
- fitting the model to a specific lactation stage only?
- machine learning?



Limitations

- Overfitting?
- Less residual variability with better model fit
- The best model may not be the best for MIR spectra prediction





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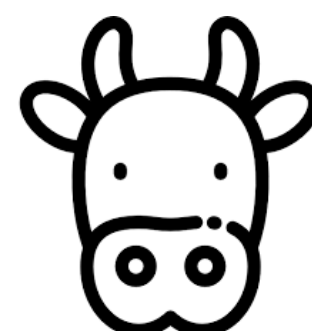
Thank you for your attention!



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Landwirtschaft



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 **Federal Ministry**
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References



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Connor, E. E. (2015): Invited review: improving feed efficiency in dairy production: challenges and possibilities. In *Animal* 9 (3), pp. 395–408. DOI: 10.1017/S1751731114002997.

Fischer, A.; Friggens, N. C.; Berry, D. P.; Faverdin, P. (2018): Isolating the cow-specific part of residual energy intake in lactating dairy cows using random regressions. In *Animal : an international journal of animal bioscience* 12 (7), pp. 1396–1404. DOI: 10.1017/S1751731117003214.

Martin, P., Ducrocq, V., Faverdin, P., Friggens, N. C. (2021): Invited review: Disentangling residual feed intake-Insights and approaches to make it more fit for purpose in the modern context. In *J. Dairy Sci.* 104 (6), pp. 6329–6342. DOI: 10.3168/jds.2020-19844.

Yao, C.; Spurlock, D. M.; Armentano, L. E.; Page, C. D.; VandeHaar, M. J.; Bickhart, D. M.; Weigel, K. A. (2013): Random Forests approach for identifying additive and epistatic single nucleotide polymorphisms associated with residual feed intake in dairy cattle. In *J. Dairy Sci.* 96 (10), pp. 6716–6729. DOI: 10.3168/jds.2012-6237.