Clearing the air between methane and commercial beef cattle in Ireland

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AgTech - it's in our DNA

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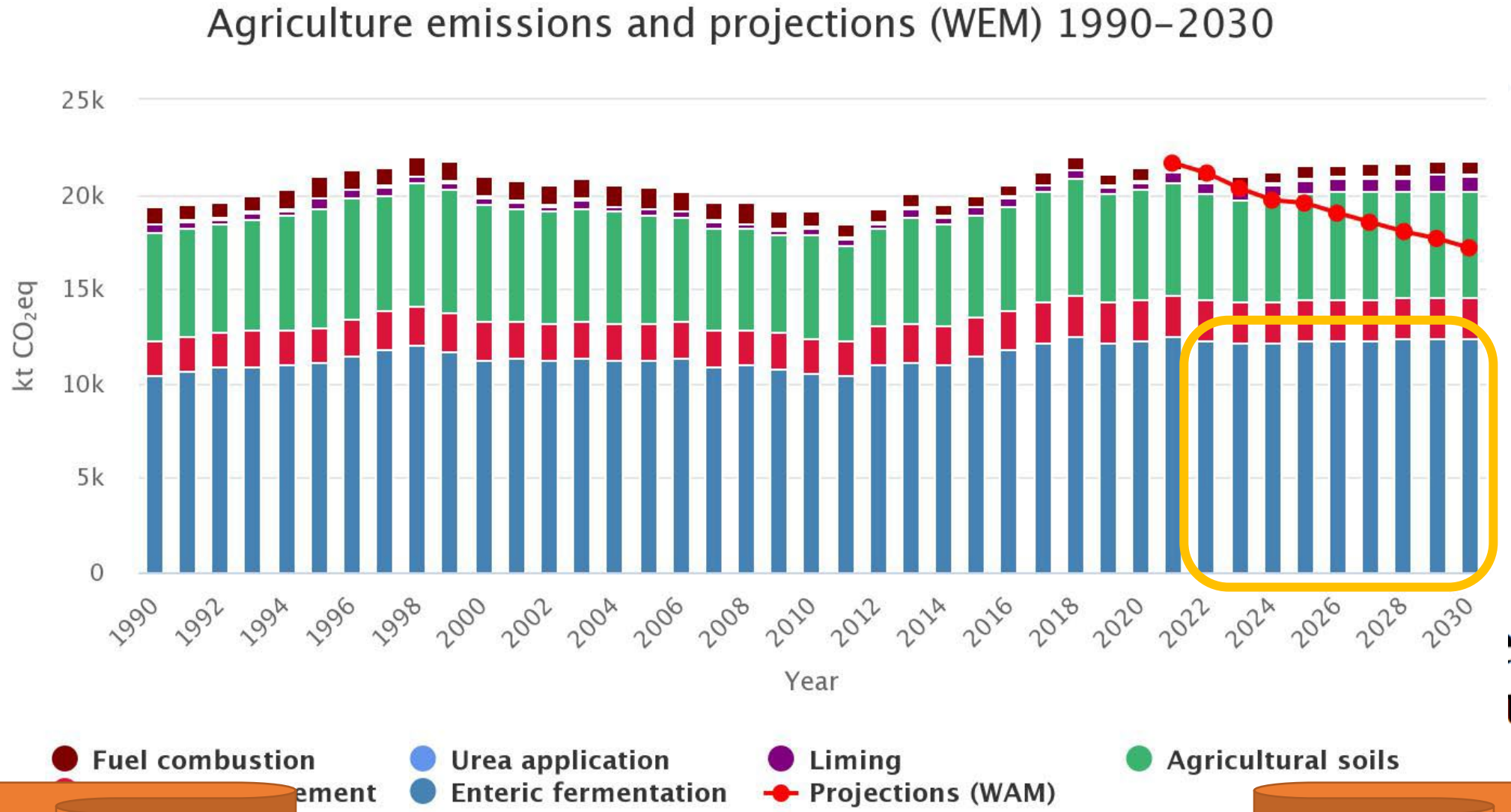

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1.9%
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needs to

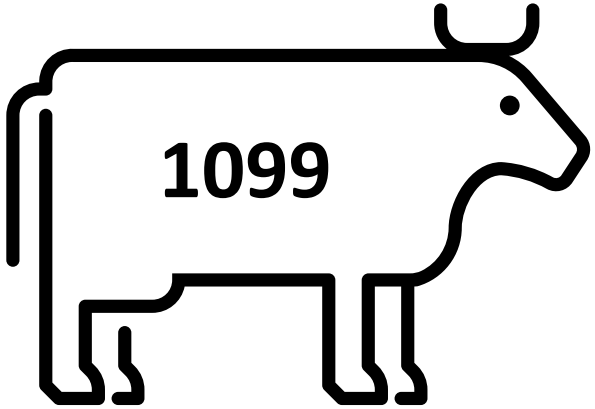
Can animal breeding offer a potential mitigation strategy?

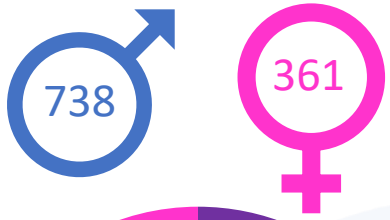
Methane Measurement

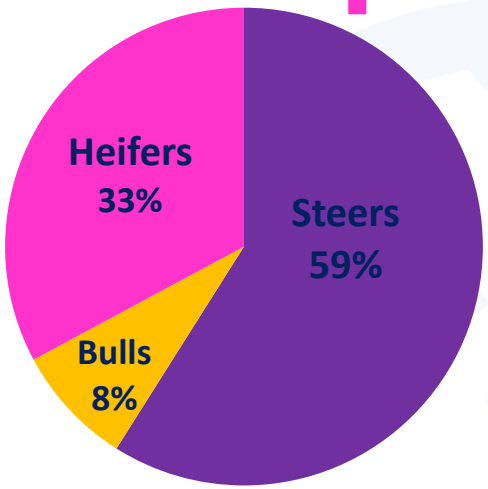
- 10 GreenFeed Machines
- Gas flux measurement
- CH_4 and CO_2
- Bait feed dropped
  - Every 30 seconds
- Aim: Keep animal at GF for 2-3 mins

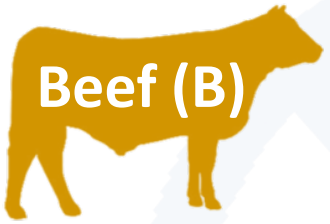
Grams/ day

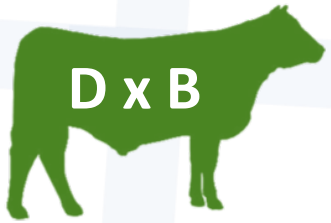
Data available







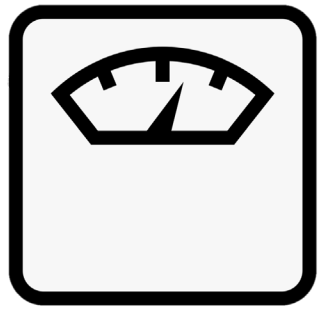




Genotypes

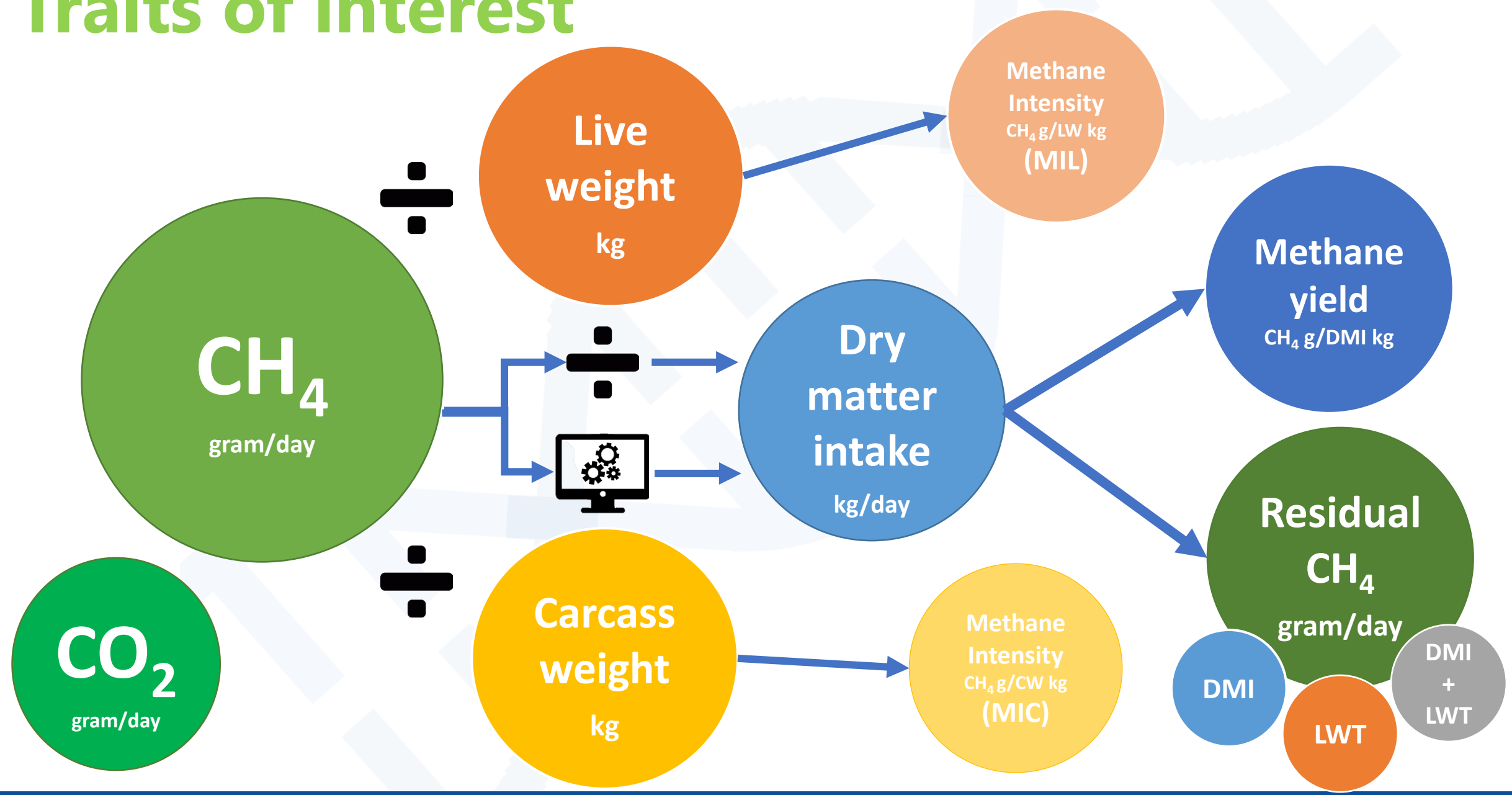
Feed Intake

Live weight

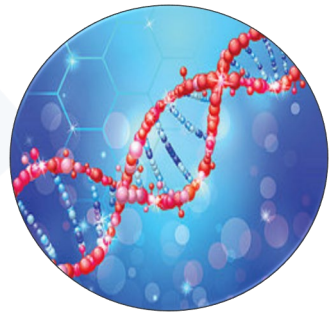


Muscle scan data
Carcass data

Traits of interest



Data analysis



Phenotypic analysis

- Diurnal pattern from GreenFeed
- Repeatability
- Correlations

Why?

- Establish minimum requirement for measurement for CH_4
  - Maximise throughput
  - Minimise cost
- Stabilise parameter estimates

Genetic analysis

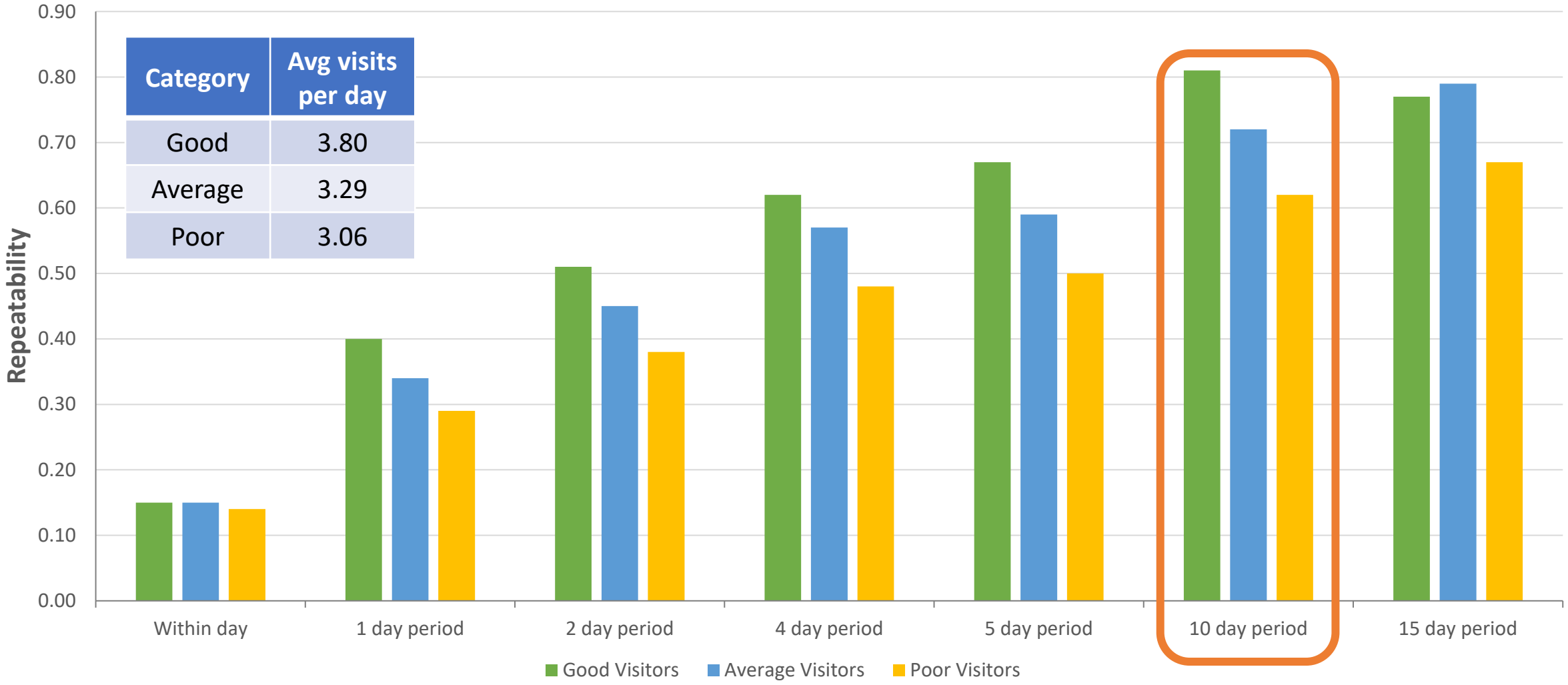
- Estimate genetic parameters
- CH_4 and Residual CH_4 (DMI+LW)
- Across breed model
- Impact of averaging period
- Prototype (G)EBVs

Why?

- Calculate (G)EBVs
- Ultimately: include trait in breeding goal
  - What could that look like?

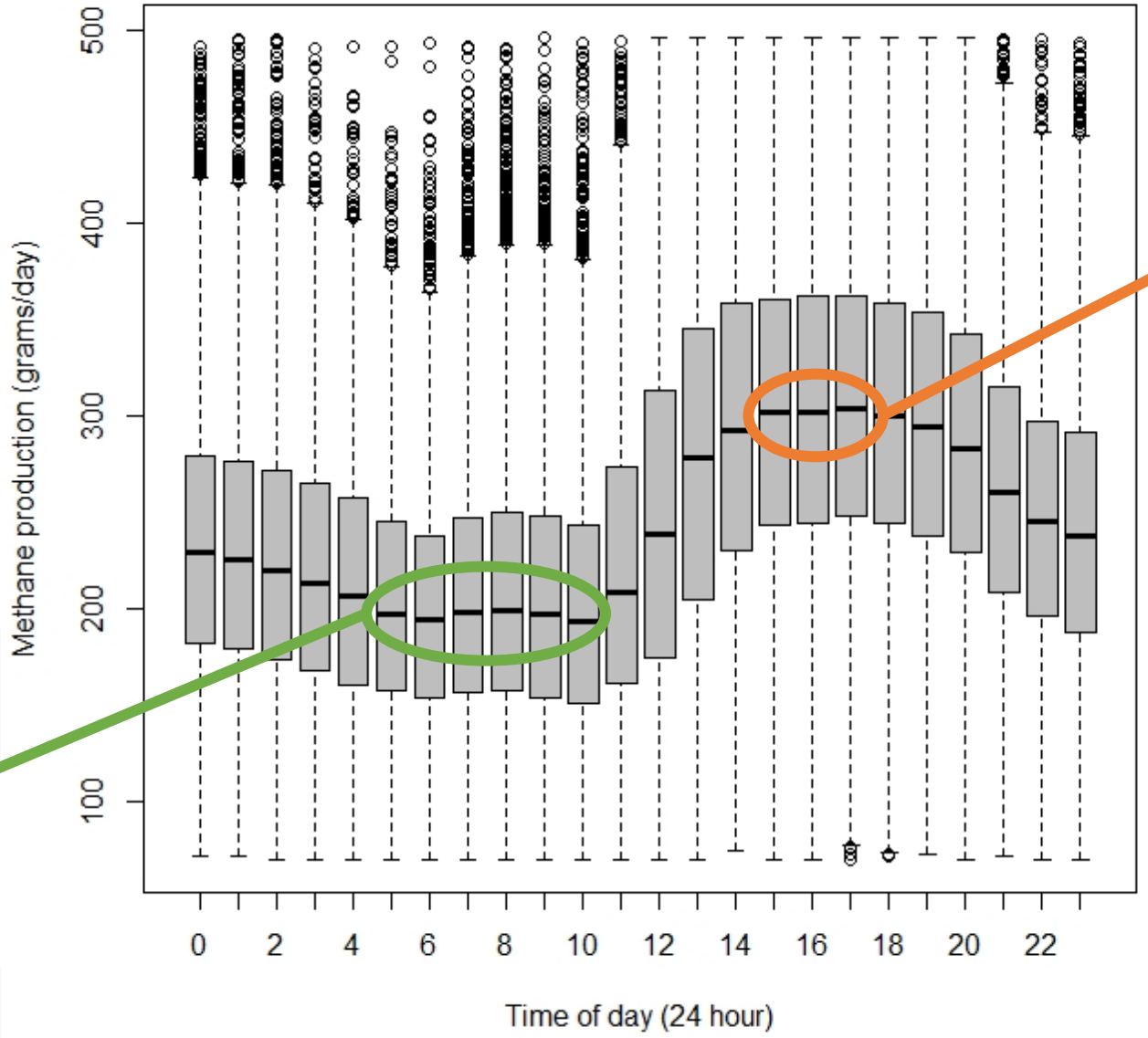
Phenotypic CH_4 Repeatability

Category	Avg visits per day
Good	3.80
Average	3.29
Poor	3.06



Good levels of repeatability (>0.6) – 10-day test period may be sufficient

Diurnal CH_4 Pattern

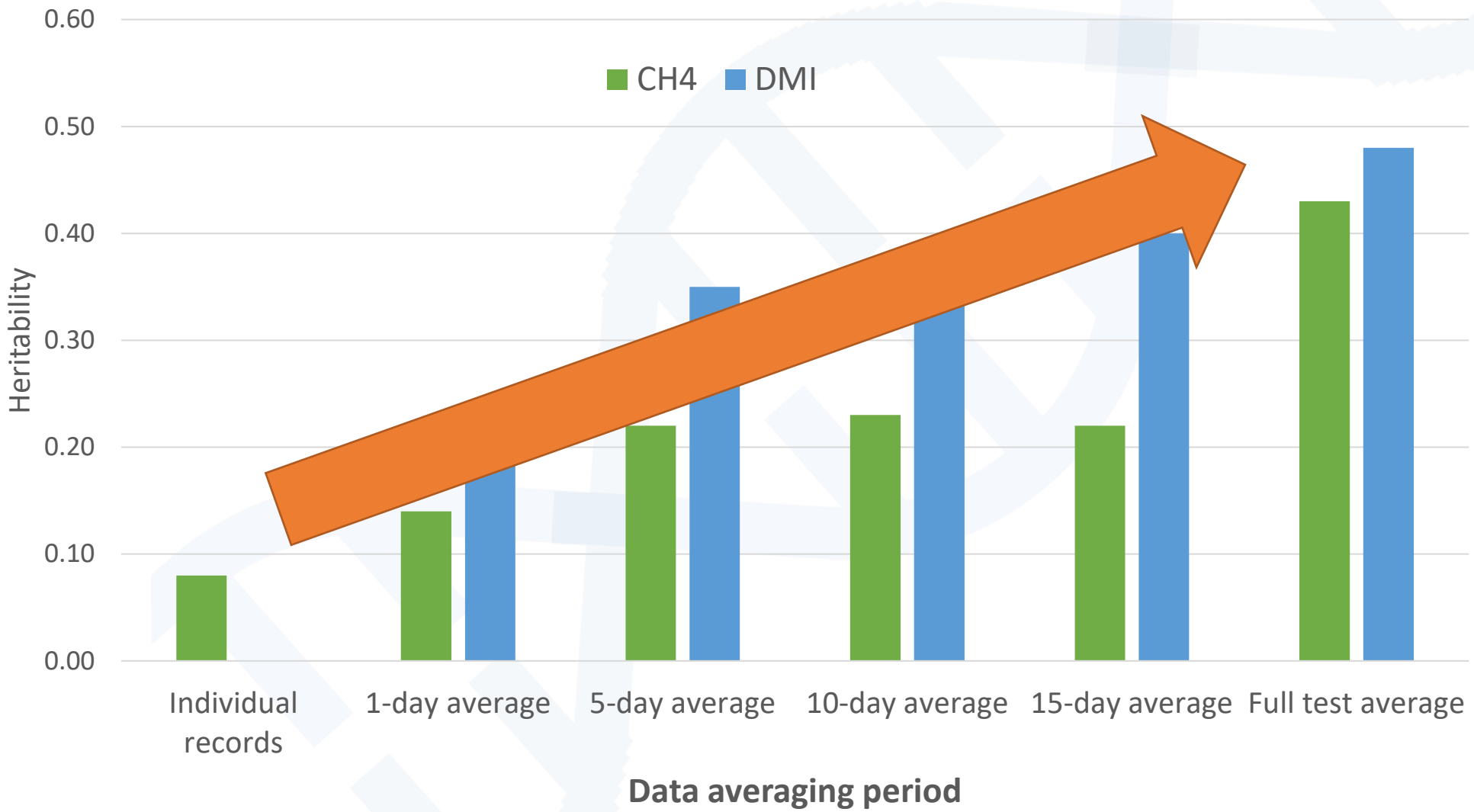


302g/day

204g/day

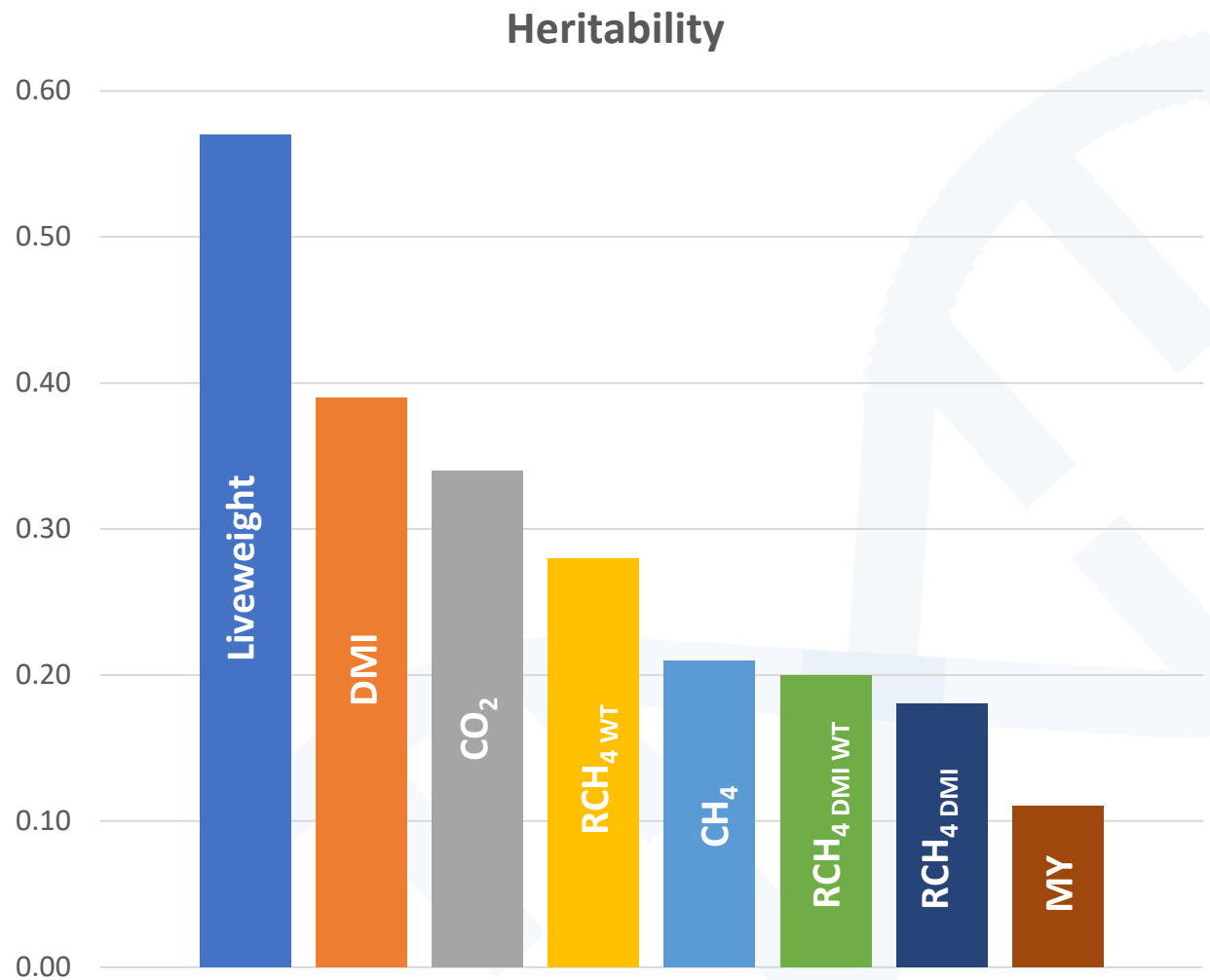
Suggests a need to adjust for **time-of-day** of recording

Trait definition: Impact on heritability



Longer average period reduces residual variance = Higher heritability

Heritability, Phenotypic and Genetic correlations

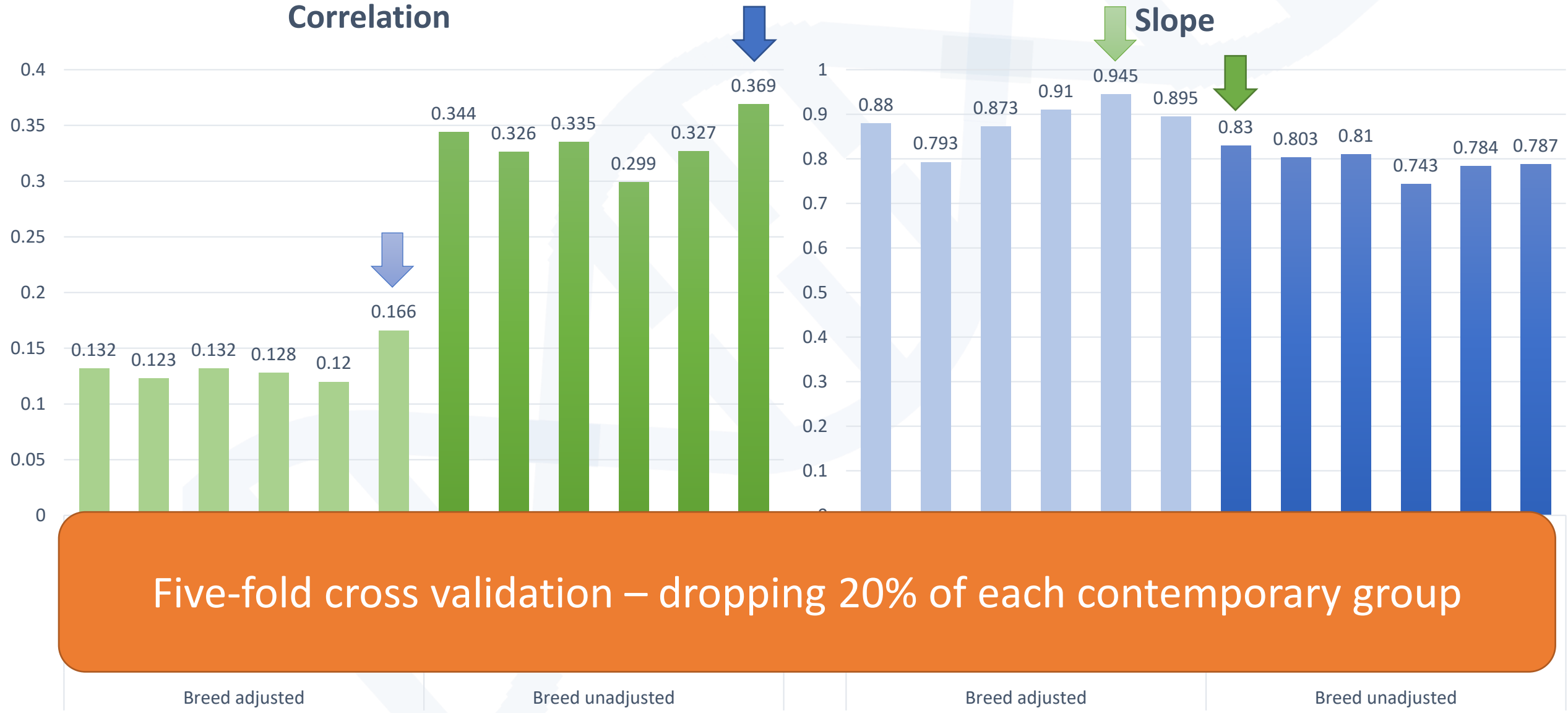


* Calculated from 10 – day average

Phenotypic correlations							
	CH_4	CO_2	DMI	MY	MIL	MIC	RCH_4 DMIWT
CO_2	0.61						
DMI	0.31	0.57					
MY	0.56	0.07[a]	-0.49				
MIL	0.86	0.31	0.03[a]	0.65			
MIC	0.84	0.32	0.07	0.61	0.97		
RCH_4 DMIWT	0.63	0.27	-0.01[a]	0.50	0.62	0.60	
LW	0.30	0.61	0.58	-0.15	-0.21	-0.18	-0.04[a]

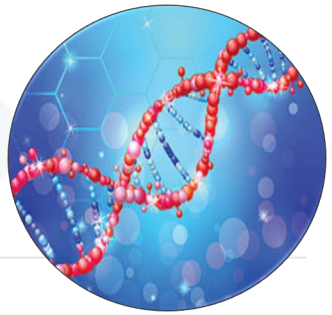
[a] = Not significantly different from zero (p-value ≥0.05).

CH_4 Validation of EBVs



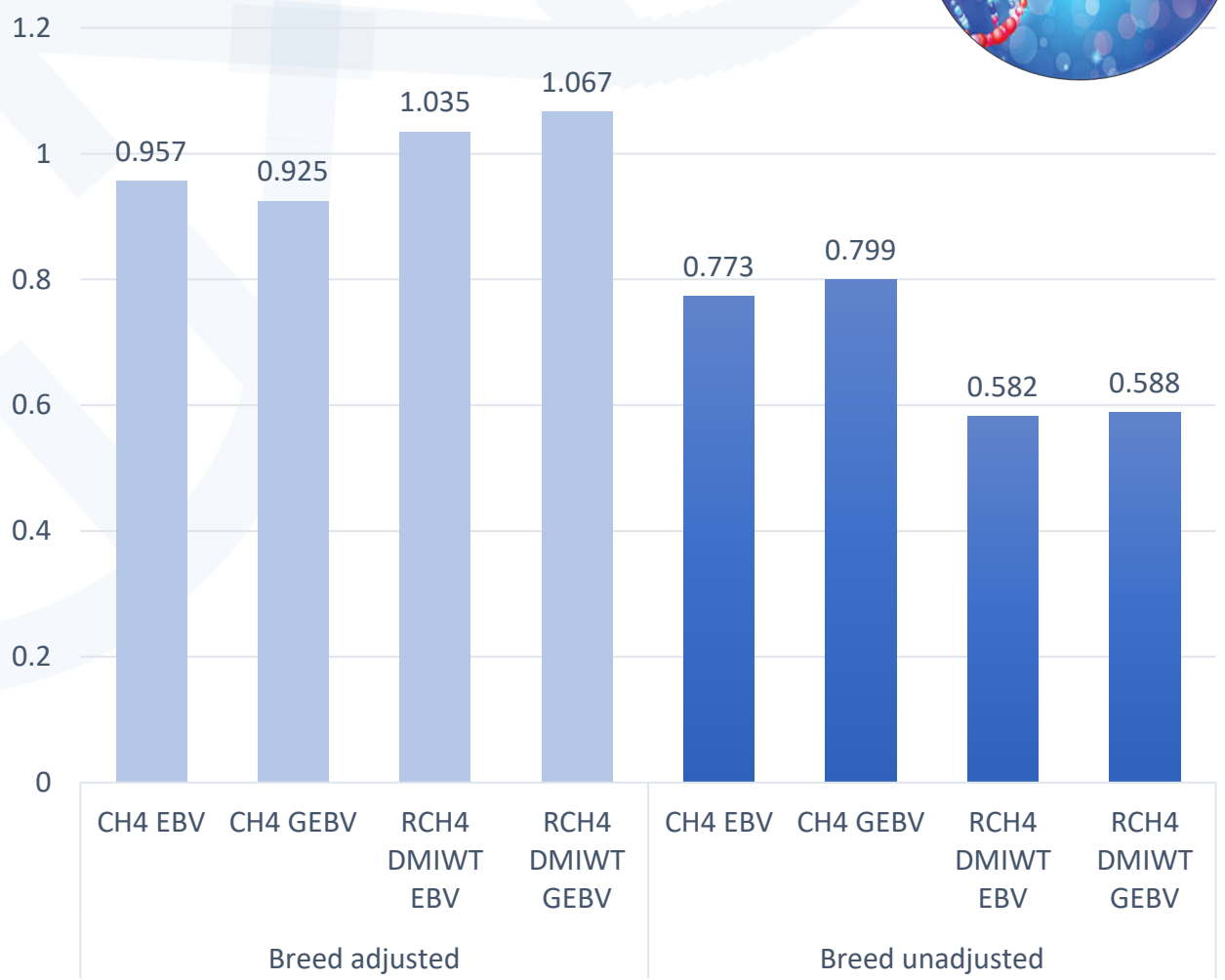
Five-fold cross validation – dropping 20% of each contemporary group

Validation: EBV v GEBV



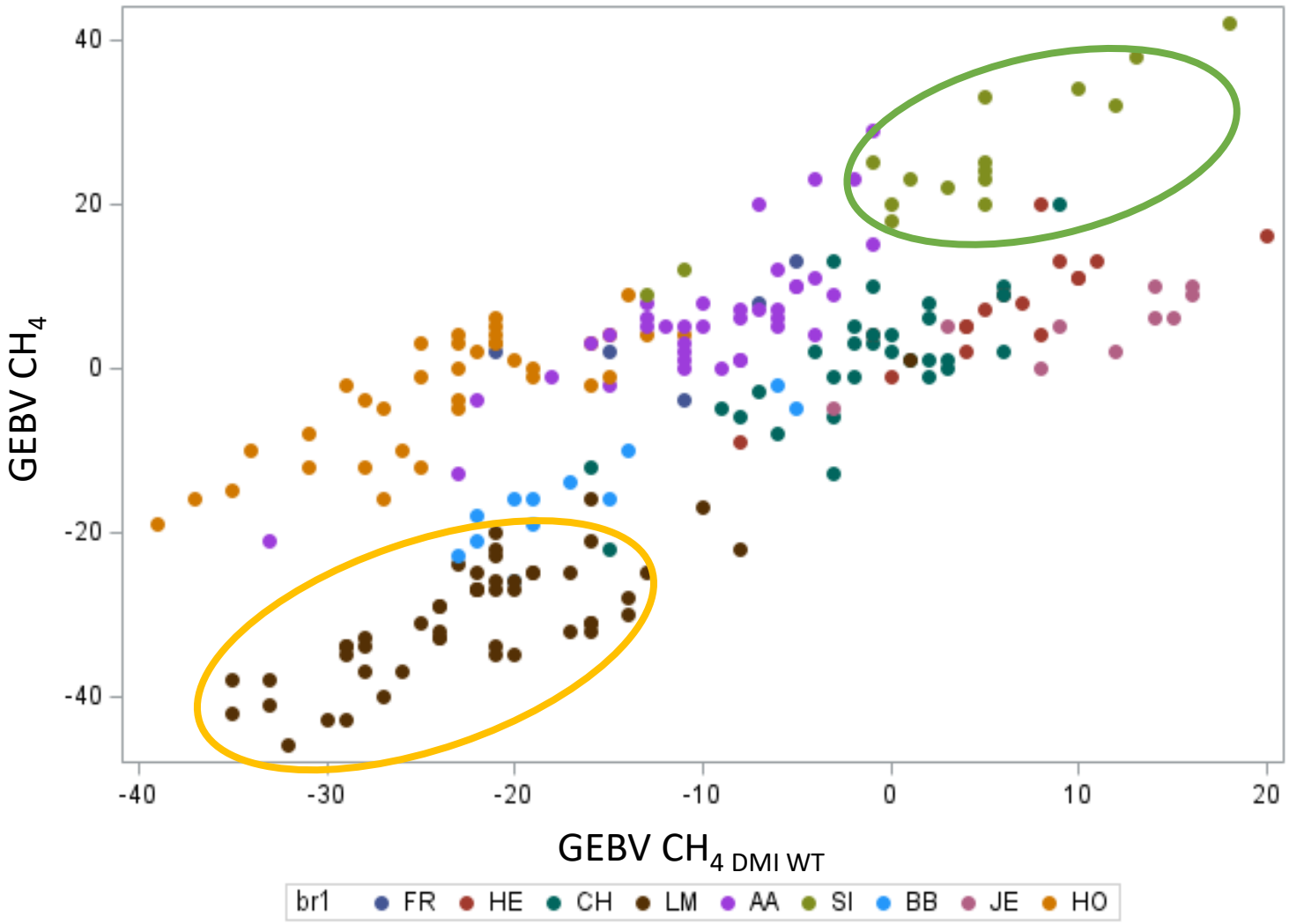
Correlation

Slope



CH_4 GEBV with breed looks most promising!

CH_4 v CH_{4DMIWT}: Sires with progeny



Breed	No. of Sires	GEBV CH_4	Std	GEBV CH_4 DMI WT	Std
LM	51	-30	8	-22	7
BB	12	-16	7	-17	6
HO	36	-3	7	-24	7
CH	30	1	8	-1	6
FR	5	4	6	-12	6
JE	10	5	5	10	6
AA	38	6	9	-10	6
HE	16	7	7	6	6
SI	16	25	9	4	8

Correlation of 0.73 between GEBV CH_4 and GEBV $RCH_{4\ DMI\ WT}$

Conclusions

- Increased averaging period – higher heritability
  - Estimates largely in line with literature
- CH_4 positively, moderately correlated with DMI and LW
- GEBVs improving prediction over EBVs
- What's next?
  - Scale up recording
  - Additional data collection – grass-based systems, cow records
  - Continue validation
  - Aim to publish latest methane EBVs by end of 2022
  - Esta

Heritable, genetic variance and breed effects, we can breed for reduced enteric methane!

Acknowledgements

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