



geno



Norwegian University of Life Sciences
Faculty of Biosciences

Measuring methane emission in young Norwegian Red bulls

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Breeding for better **lives**

ICAR Workshop: T 1hz | yl #huk #huhsz1 #ukp #k | h# 1 {ohul #t pzzpu,
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GreenFeed

- Geno has GreenFeed (www.c-lockinc.com) equipment for CH₄ recording for individual cows at 15 commercial dairy farms
- One GF unit at Geno's performance test station for young bulls in Øyer

Breeding program for Norwegian Red

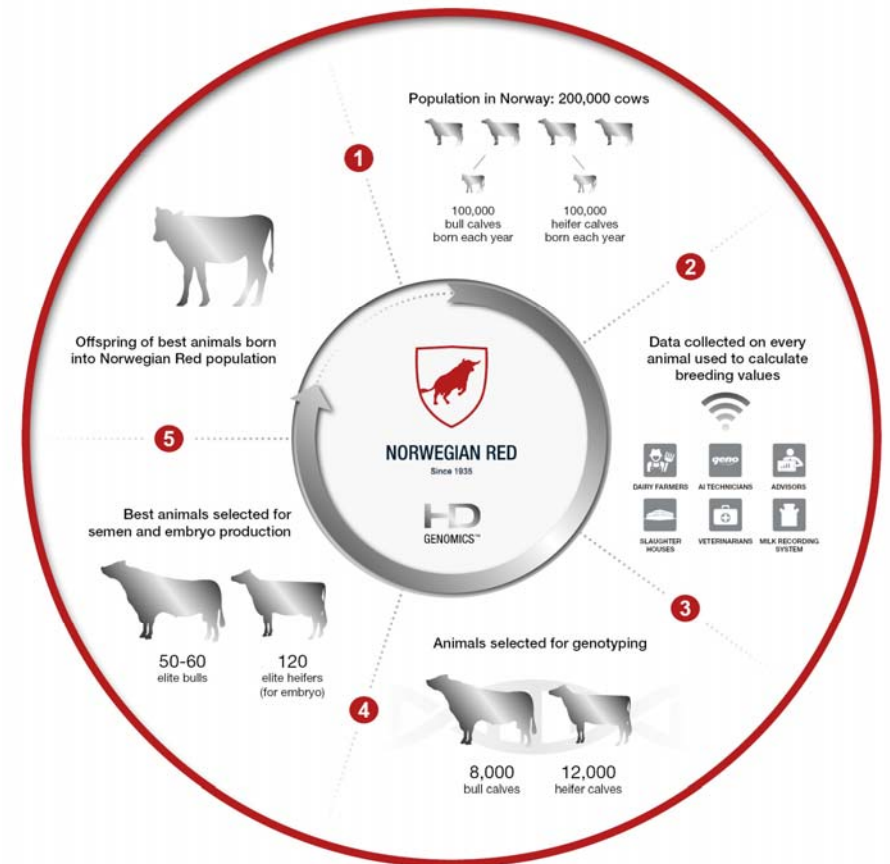
Recruiting AI bulls:

100.000 bull NR calves born per year

8.000 best of these are genotyped

Geno buys around 150 bull calves each year

50-60 selected as AI sires per year



Measuring methane on Young bulls at Geno test station

- ≈ 150 bull calves to test station each year
- Arrive 3-4 mo old
- Pens with ≈10 bulls
- Measure methane last month before leaving test station (at 11-12 mo old)
 - On average 40 days with methane data
- Phenotype data on both selected AI bulls and non-selected



Measuring methane emission in young Norwegian Red bulls

CH4 data from September 2020 to April 2023

- 214 young Norwegian Red bulls
- 76 141 CH4 records (GF visits)

•GF visits per bull: From 1 to 798, mean 356

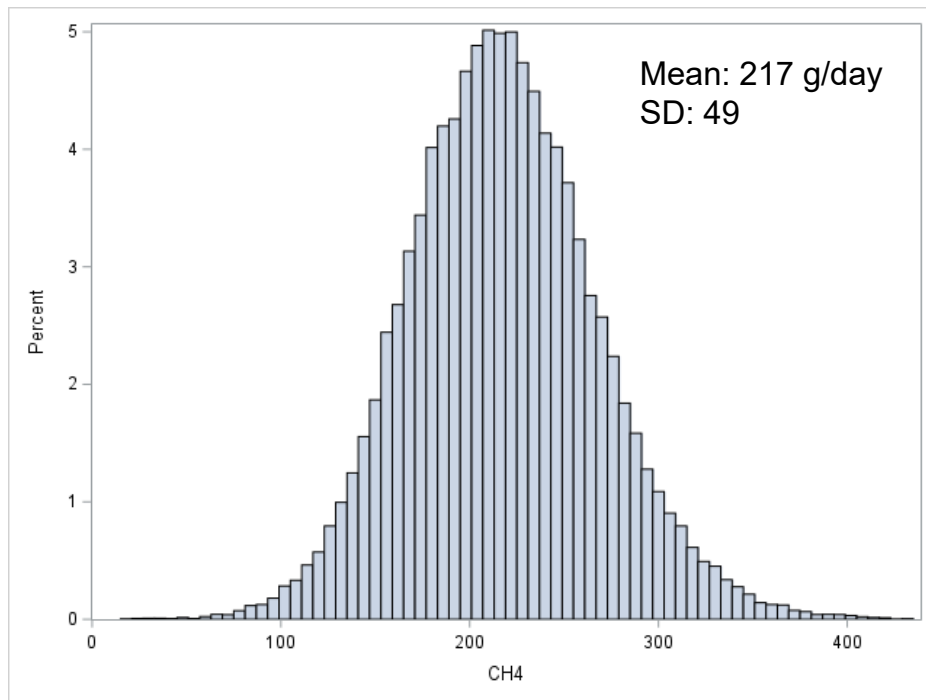
- Mean CH4 (g/day) per bull from 153 to 287

•978 testdays

- Visits per day 1 til 115, mean 77



Methane emission young Norwegian Red bulls

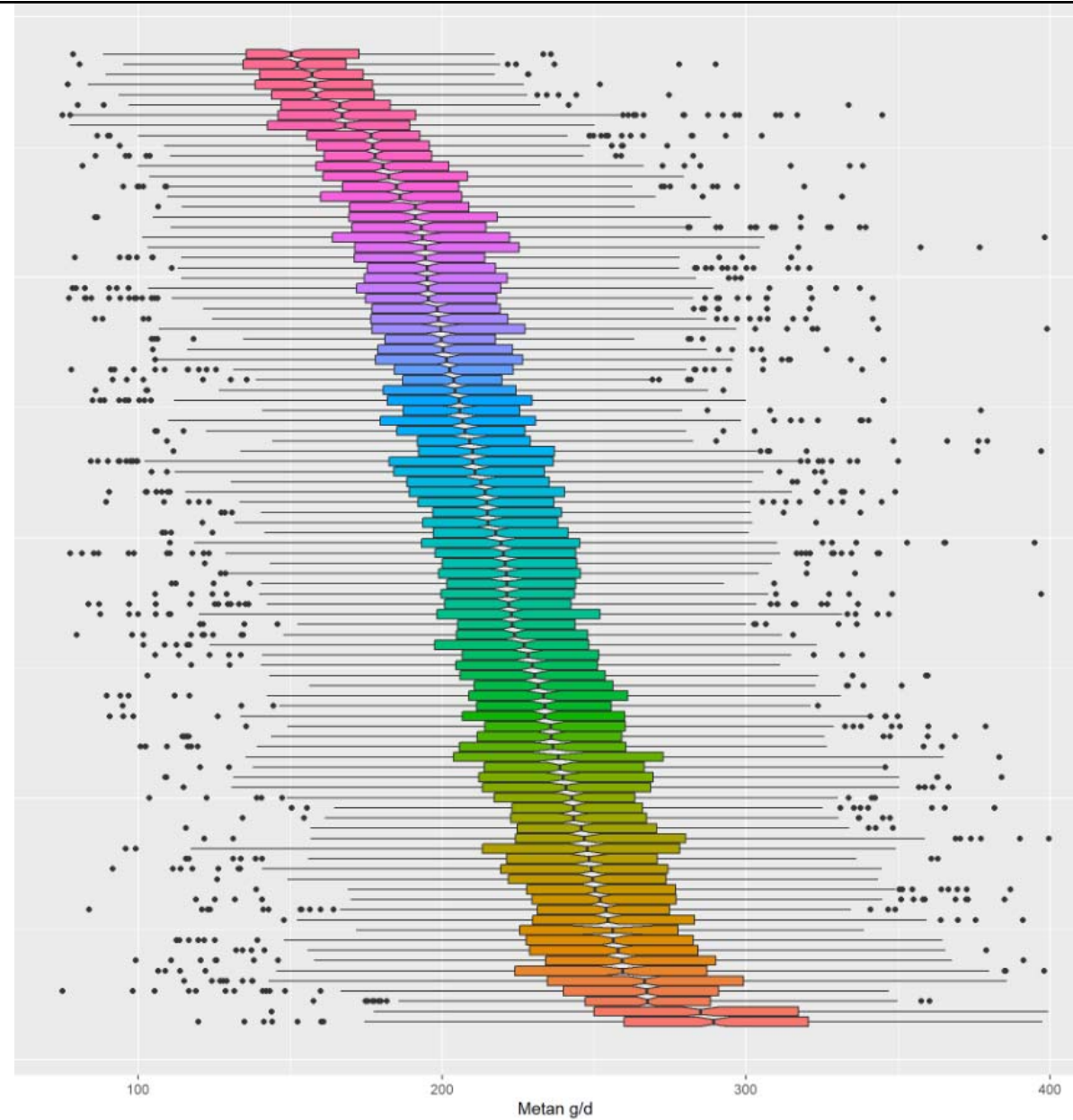


Distribution of CH4 records (g/day)

Variation in methane emission within and between bulls

(From master thesis Ida Wøyen Hamfjord, NMBU 2022)

Boxplot of methane records per bull, sorted by increasing median value



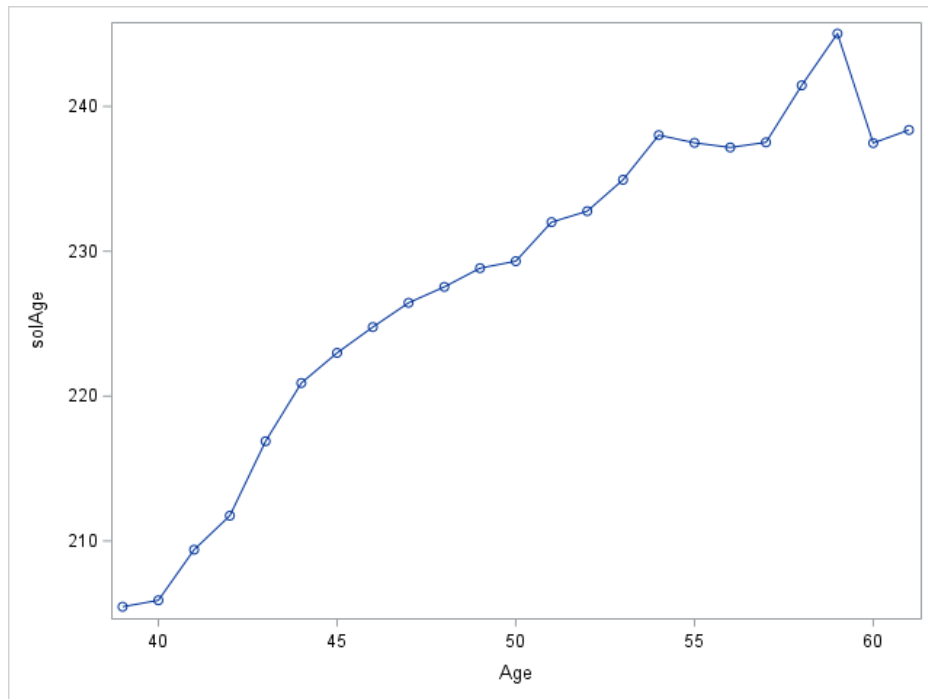
Estimating heritability

- Data edits:
 - Bulls > 10 CH4 measures
 - Testdays > 10 CH4 measures
- Final data : 76 094 observasjoner
- Traits:
 - CH4 g/day (per visit)
 - CH4 mean per bull per day (8713 rec)
- Estimating variance components using DMU
- Linear animal repeatability model:
$$\text{CH4} = \text{age} + \text{group-testday} + \text{pe} + \text{animal} + e$$
- Fixed effects of age in weeks (23 classes) and group-testday (964 days)
- Random effects of permanent environment (pe) and animal
- Pedigree file: 4233 animals

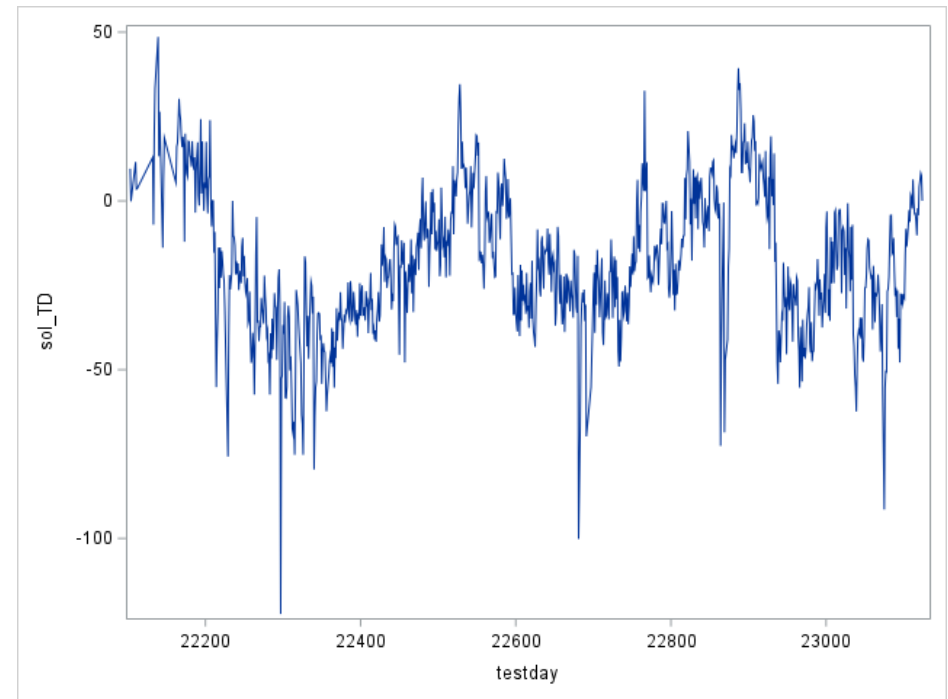
Estimated heritability

	CH4 per visit			CH4 mean per day	
Variance component	Estimate	Standard error		Estimate	Standard error
pe	153	194		141	188
animal	532	216		538	211
residual	1479	8		278	5
Heritability	0.24	0.10		0.56	0.20
Repeatability	0.32			0.71	

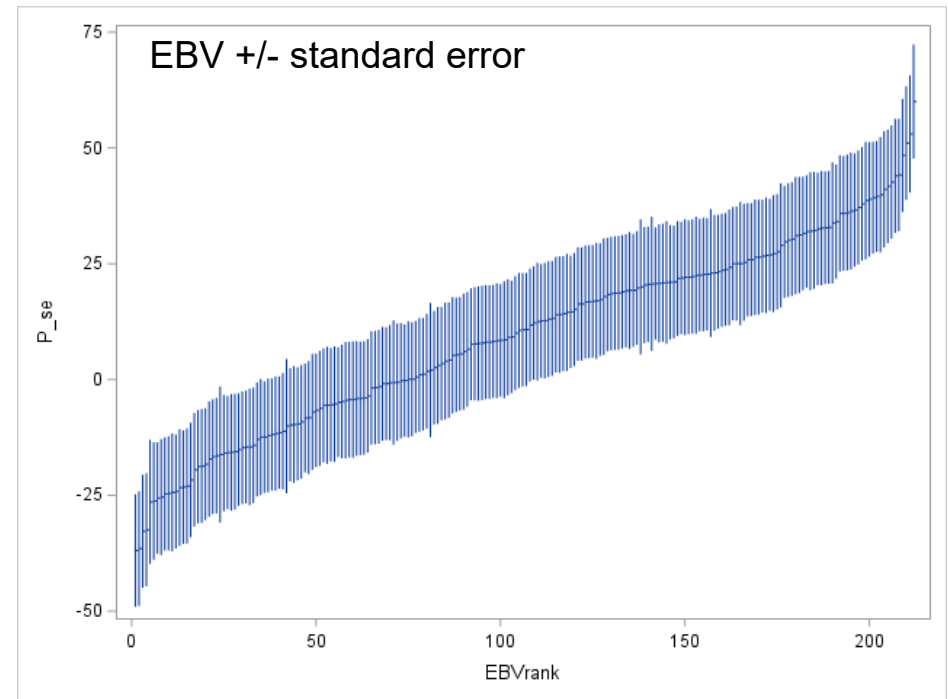
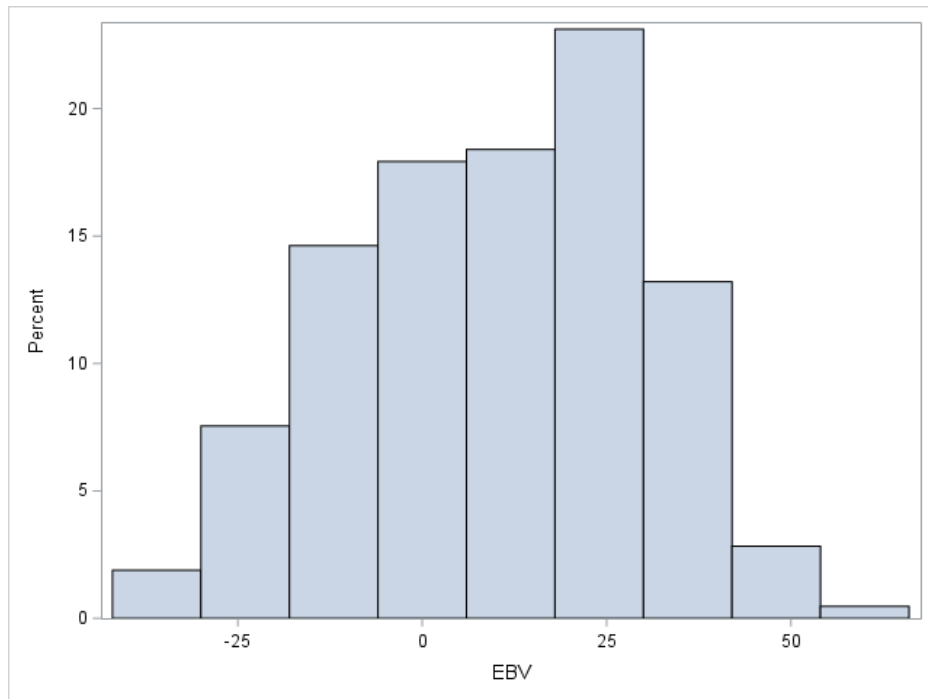
Effects of age and group-testday



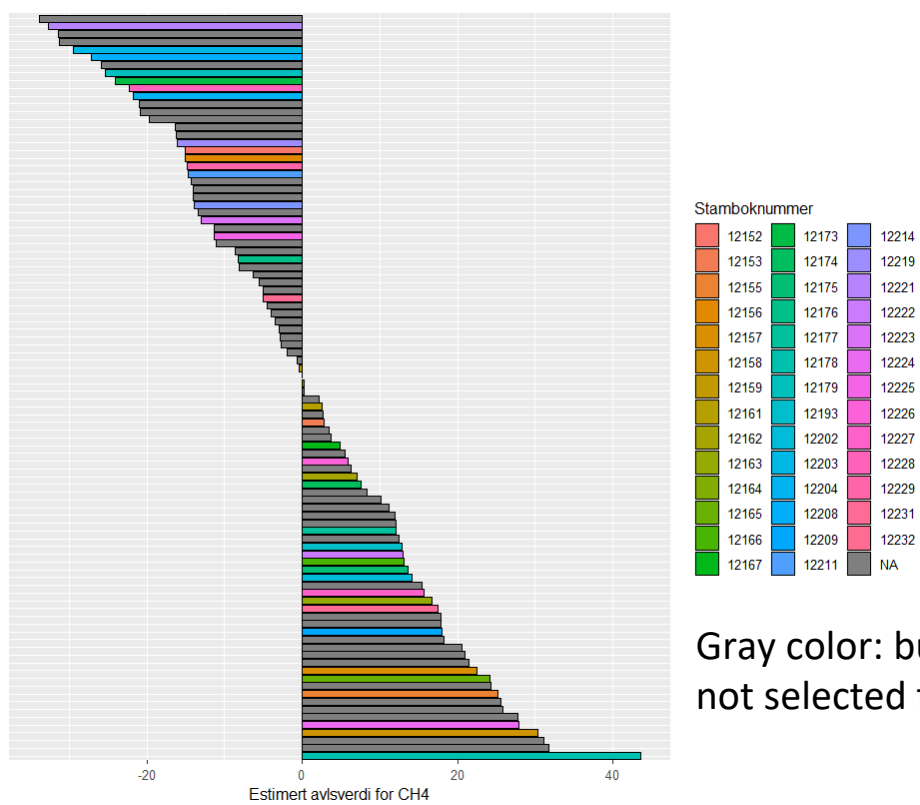
Fixed effect solutions



Breeding values for bulls with CH4 phenotype



Breeding values for methane emission young Norwegian Red bulls



- From master thesis Ida Wøyen Hamfjord, NMBU 2022
- EBV for 96 bulls with CH4 phenotype in 2020 and 2021

Results so far:

- Promising
- Good CH4 data from GreenFeed
- Genetic variation for CH4 in NR
- Breeding for lower CH4 emission is feasible



Further research:

- Trait definition CH4
- Accuracy of genomic breeding values
- Genetic associations to other important traits
 - Feed efficiency, milk yield, health and fertility...
- Merging methane and feed efficiency projects

- How to breed a feed efficient, climate friendly cow?

We aim to balance climate effects, feed efficiency, production, health and fertility in a sustainable breeding goal for Norwegian Red

