2025 Interbull Meeting

Sustainable dairy breeding; reducing methane emissions in the Netherlands and Flanders

Gerben de Jong | 22 June 2025

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Project

Climate-smart cattle breeding

Wageningen University & Research

Contact

Project information

LWV19155 Climate smart cattle breeding

Project code: BO-59-001-005

Status: In progress

Start project: Jan 1, 2020

End project: Dec 31, 2024

Client(s): Ministry of Agriculture, Nature and Food Quality

WAGENINGEN UNIVERSITY & RESEARCH

FrieslandCampina

150 YEARS CRV BETTER COWS > BETTER LIFE

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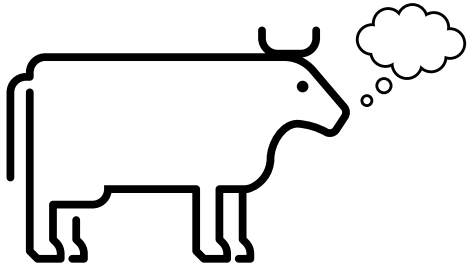
Sniffer

Methane in parts per million air-parts

Since 2019

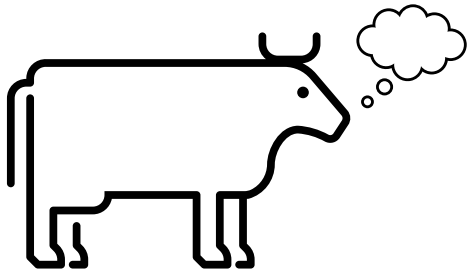


GreenFeed

CRV BV

Methane in grams per day

Since 2022



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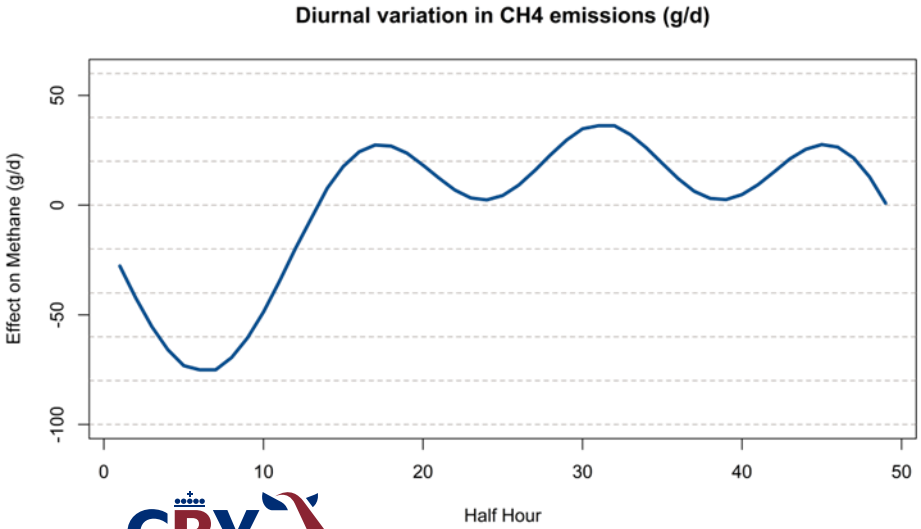
Precorrection on single observations

- correction on diurnal variation[a] for sniffer

  no correction for sniffer unit within herd since there is only one sniffer per herd

- correction on diurnal variation[a] and GreenFeed unit for GreenFeed



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[a]Van Breukelen, A. E., Aldridge, M. N., Veerkamp, R. F., Koning, L., Sebek, L. B., & de Haas, Y. (2023). Heritability and genetic correlations between enteric methane production and concentration recorded by GreenFeed and sniffers on dairy cows. *Journal of Dairy Science*, *106*(6), 4121-4132.

Data

	Sniffer	GreenFeed
week observations	457,036	11,889
cows	14,089	404

Selection criteria:

- herdbook animals
- at least 4 measurements per week observation for sniffer
- at least 3 measurements per week observation for GreenFeed

Data

	Sniffer	GreenFeed
week observations	457,036	11,889
cows	14,089	404
SELECTION CRITERIA		
week observations	226,449	11,824
cows	11,595	397
bulls	1,380	154
farms	89	1

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Model

parity 1 and parity 2:

$$Y1_{ijklmnopr} = HYS_i + DIM_j + AAC_k + HET_m + REC_n + INB_o + A_p + PME_l + Rest_{ijklmnopr}$$

parity 3+ (3 and later):

$$Y2_{ijklmnopr} = HYS_i + DIM_j + PAR_k + HET_m + REC_n + INB_o + A_p + PME_l + Rest_{ijklmnopr}$$

	Y1	: week observation on methane for cows in parity 1 and parity 2;
	Y2	: week observation on methane for cows in parity 3+;
fixed	HYS	: herd x year x season i (for sniffer observations) or farm x year x month i (for GreenFeed observations);
fixed	DIM	: days in lactation j;
fixed	AAC	: age at calving in months k;
fixed	PAR	: parity number k;
covariables	HET	: heterosis effect m;
covariables	REC	: recombination effect n;
covariables	INB	: inbreeding effect o;
random	A	: additive genetic effect of animal p;
random	PME	: permanent environmental effect l;
random	Rest	: residual term r of that which is not explained by Y1ijklmnop and Y2ijklmnop.

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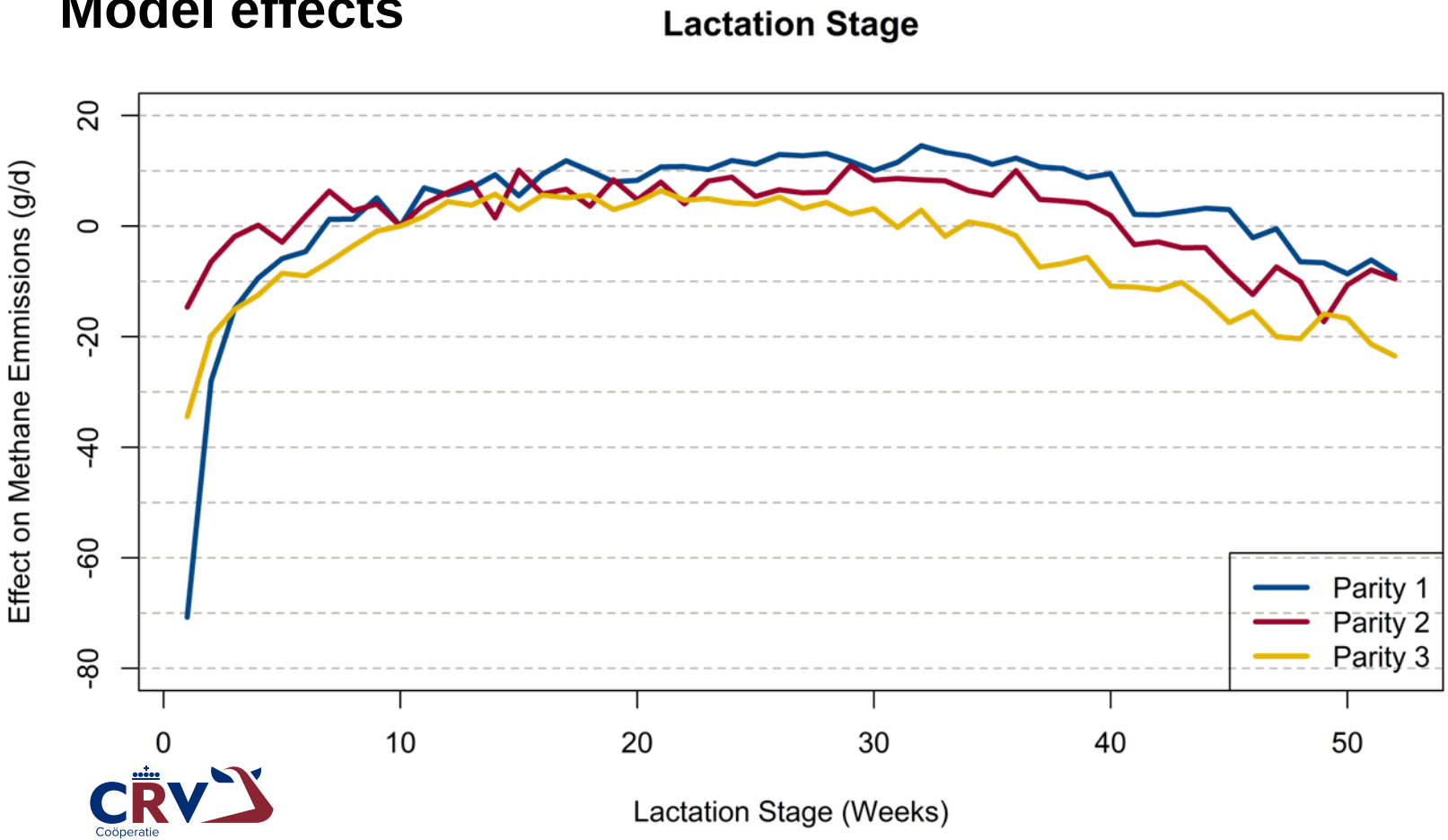
Model effects



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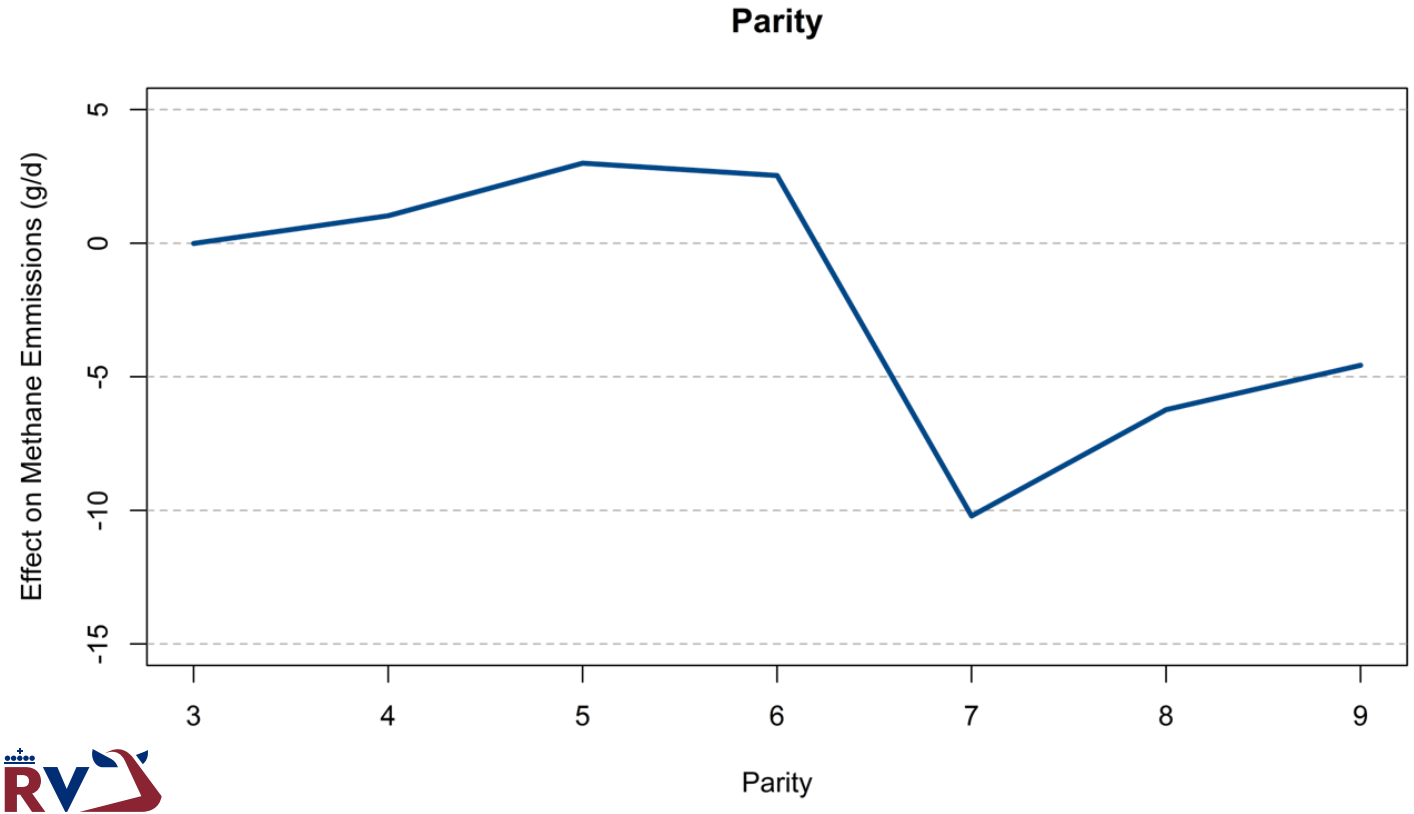
Model effects



Genetic parameters

trait	h^2	r^2
CH4 ppm par.1	0.14	0.49
CH4 ppm par.2	0.14	0.55
CH4 ppm par.3	0.19	0.55
CH4 g/d par.1	0.34	0.60
CH4 g/d par.2	0.37	0.60
CH4 g/d par.3	0.37	0.60

Genetic parameters

	r_g		
trait	**par. 1-2**	**par. 2-3+**	**par. 1-3+**
CH4 ppm	0.74	0.79	0.47
CH4 g/d	0.73	0.69	0.38

r_g CH4 ppm – CH4 g/d = 0.76[a]

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Genetic correlations with other traits

estimated with MACE procedure based on bull EBVs
minimum reliability of 40%

higher CH4 EBV means less CH4 emissions ⚠

trait	CH4 ppm	CH4 g/d
NVI (total merit index)	-0.00	-0.06
milk production	-0.08	-0.39
fat production	-0.28	-0.19
protein production	-0.01	-0.18
longevity	0.12	0.03
udder conformation	-0.08	-0.01
feet & legs	0.02	0.04
fertility index	0.00	0.04
udder health index	0.05	-0.07
claw health	0.01	0.07
feed intake	-0.11	-0.20
body weight	-0.03	-0.09

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Selection index

Increase reliability
5 to 10 percent for genotyped animals

higher CH4 EBV means less CH4 emissions ⚠

Heritabilities, *genetic correlations* and genetic standard deviation of the traits in the selection index.

trait	σ_a	CH4 g/d	milk production	fat production	feed intake	body weight
CH4 g/d (-)	4.5	**0.56**				
milk production (kg)	745	*-0.39*	**0.58**			
fat production (kg)	28	*-0.19*	*0.50*	**0.57**		
feed intake (kg)	1.37	*-0.20*	*0.56*	*0.67*	**0.20**	
body weight (-)	4.5	*-0.09*	*0.05*	*0.15*	*0.41*	**0.60**

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Publication

Overall EBV CH4 g/d with predictors
0.422 x parity 1 + 0.288 x parity 2 + 0.227 x parity 3+

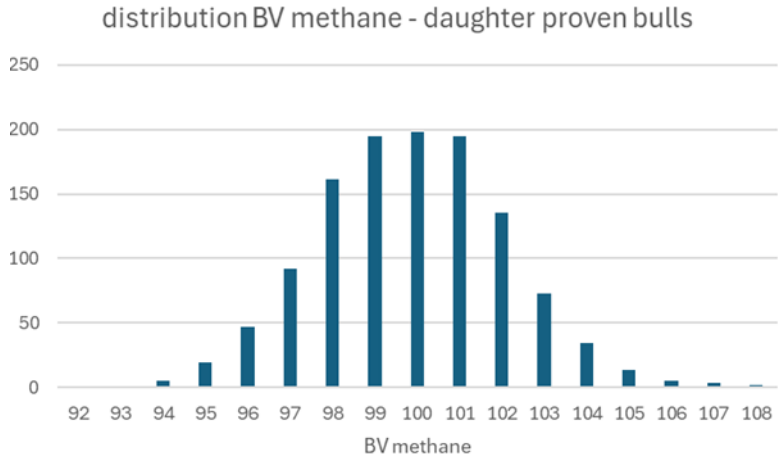
mean EBV = 100 with a SD of 4

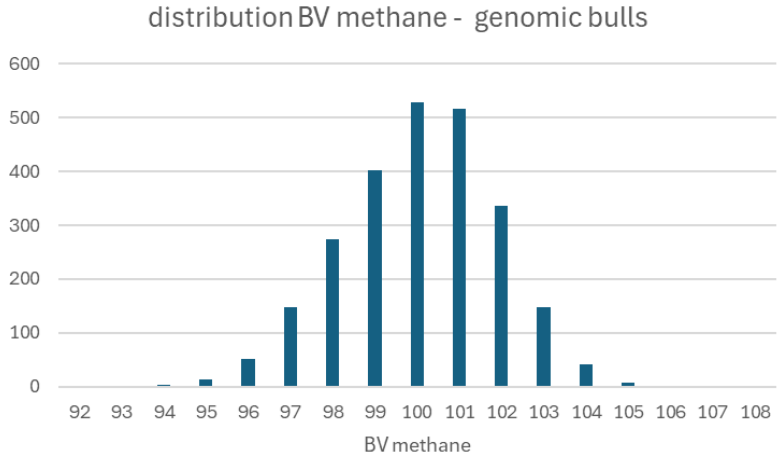
EBV 100 = 435 g/d
1 SD = 36 g/d

only Holstein-Friesian

daughter proven bulls:
- average reliability 46.5% (25 - 83)
- number of daughters is in the range of 1 – 576

genomic bulls:
- average reliability 32.2% (25 – 43)





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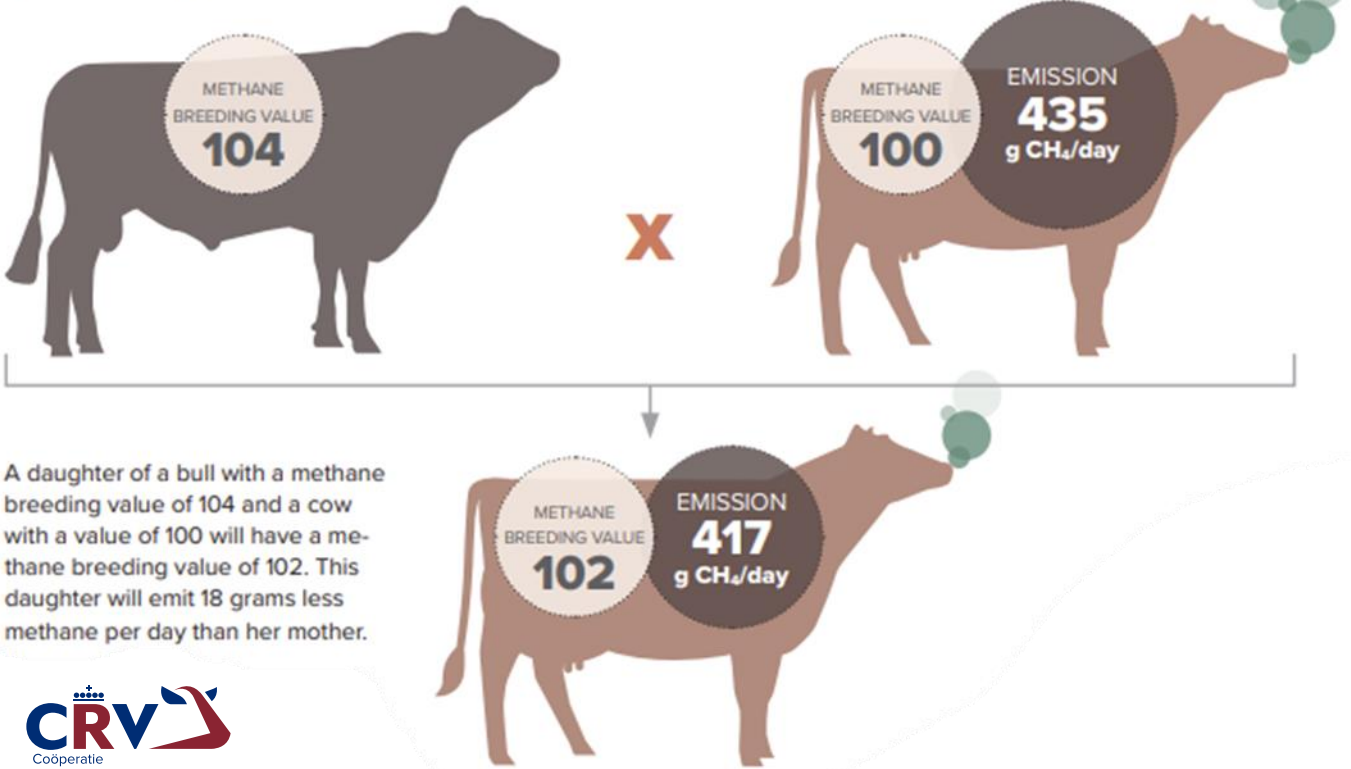
One breeding value point **equals nine grams less methane per day**



A daughter of a bull with a methane breeding value of 104 and a cow with a value of 100 will have a methane breeding value of 102. This daughter will emit 18 grams less methane per day than her mother.

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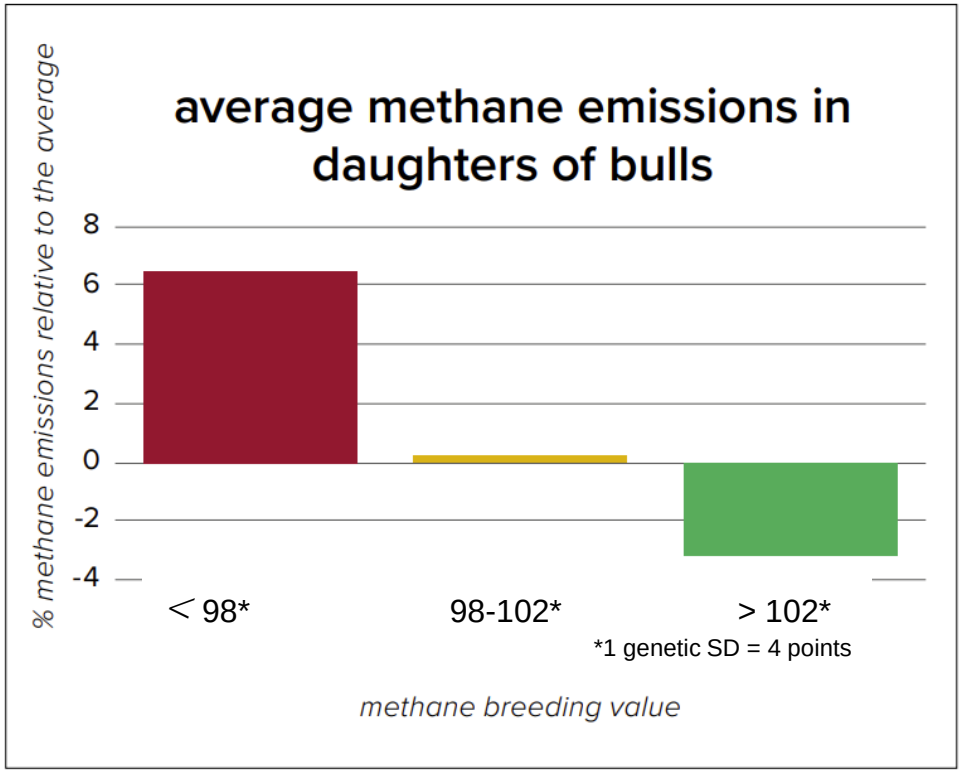
Relation bull EBVs with daughter performance



- Bull BV
- min. 3 daughters
- GreenFeed

Higher breeding values lead to lower methane emissions

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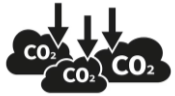
Breeding for methane

Netherlands/Flanders has started large scale data colletion

Methane emissions are heritable and there is a large variation 

No negative effects on cow health 

Slightly negative effect on production traits  → index 

Cheap and simple way of emission reduction 

April 2025 

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