Assessing Breeding Strategies to Mitigate Methane Emissions in Danish Dairy Cows

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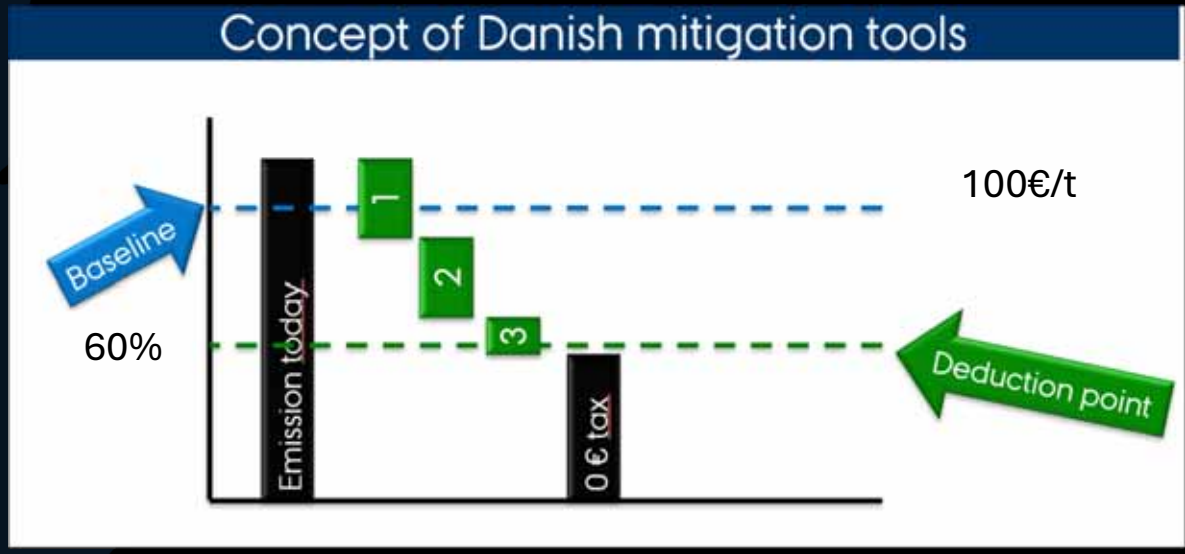
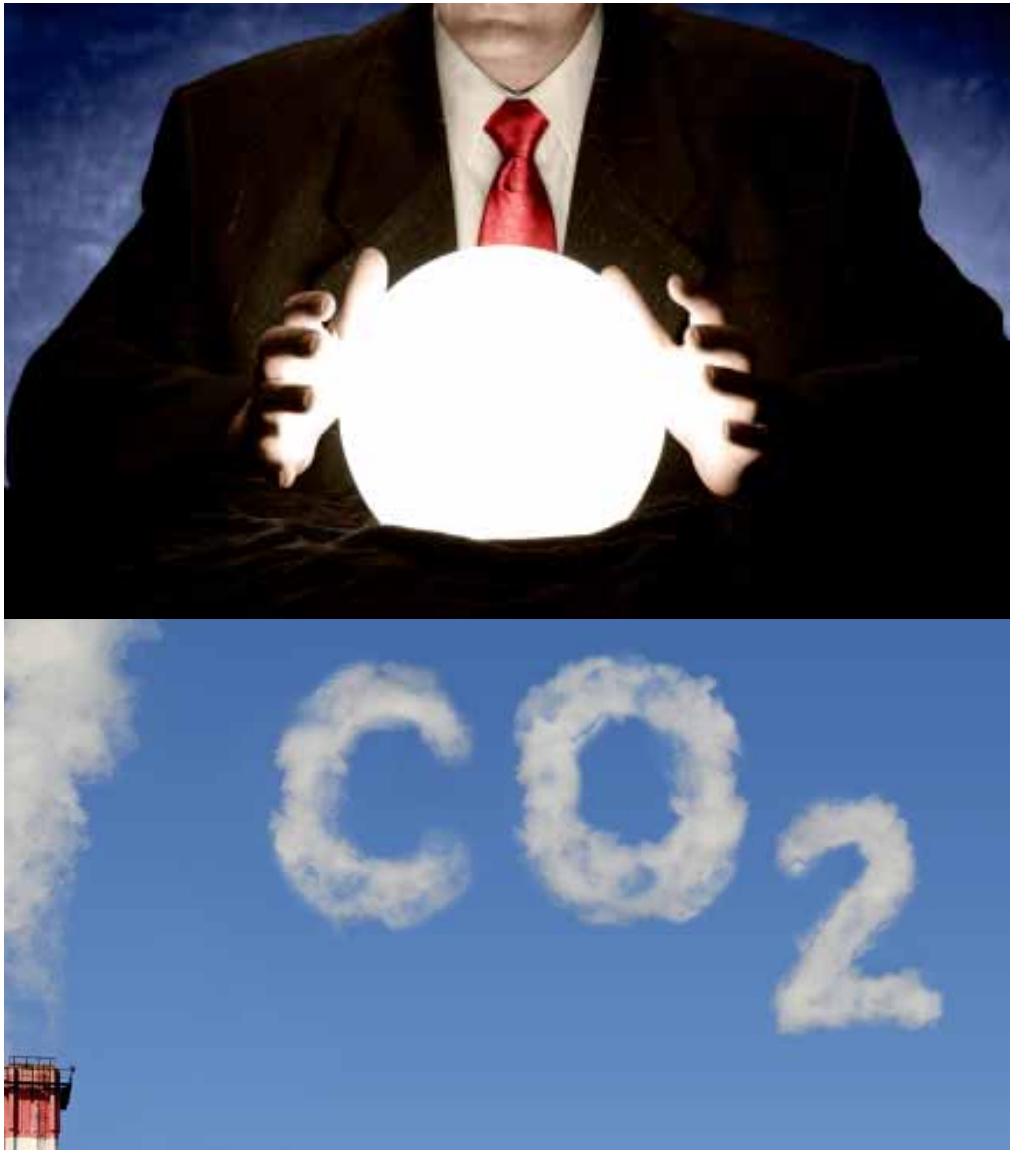
Worlds first climate tax on livestock



Breeding goal should reflect future conditions

- ~ 5 yrs from decision to result
- How will the tax be implemented?
- Selective breeding currently not approved mitigating tool
- How are other traits affected (e.g. welfare traits)?



AIM

quantify expected reduction in methane emissions and associated changes in NTM traits when selecting for:

a) different methane emission traits

b) different levels of tax

Traits

Slagboom et al., 2020; Manzanilla-Pech et al., 2022

Trait	Definition	h^2	Accuracy	EV's (€ / genetic SD)
Milk	Standardized milk production	0.44	0.85	159
Mastitis	Udder health	0.07	0.70	71
Fertility	Female fertility index trait	0.08	0.70	105
MeP	Absolute production g/day	0.21		
MeI	CO_2-eq/kg milk	0.18	0.70 for all methane traits	0 to −500 for all methane traits
MeR	Methane production adjusted for production and feed level	0.16		

Genetic correlations between traits

Trait	fert	mastitis	MeP	MeI	MeR
Milk	-0.40	-0.35	0.60	-0.54	-0.04
Fertility		0.30	-0.27	-0.03	-0.08
Mastitis			-0.32	-0.10	0.08
MeP				0.20	0.72
MeI					0.73

Simulation setup

Top100 selected as donors based on GEBV

Born calves: 10

2,000 bull calves **genotyped**

8,000 heifers **genotyped**

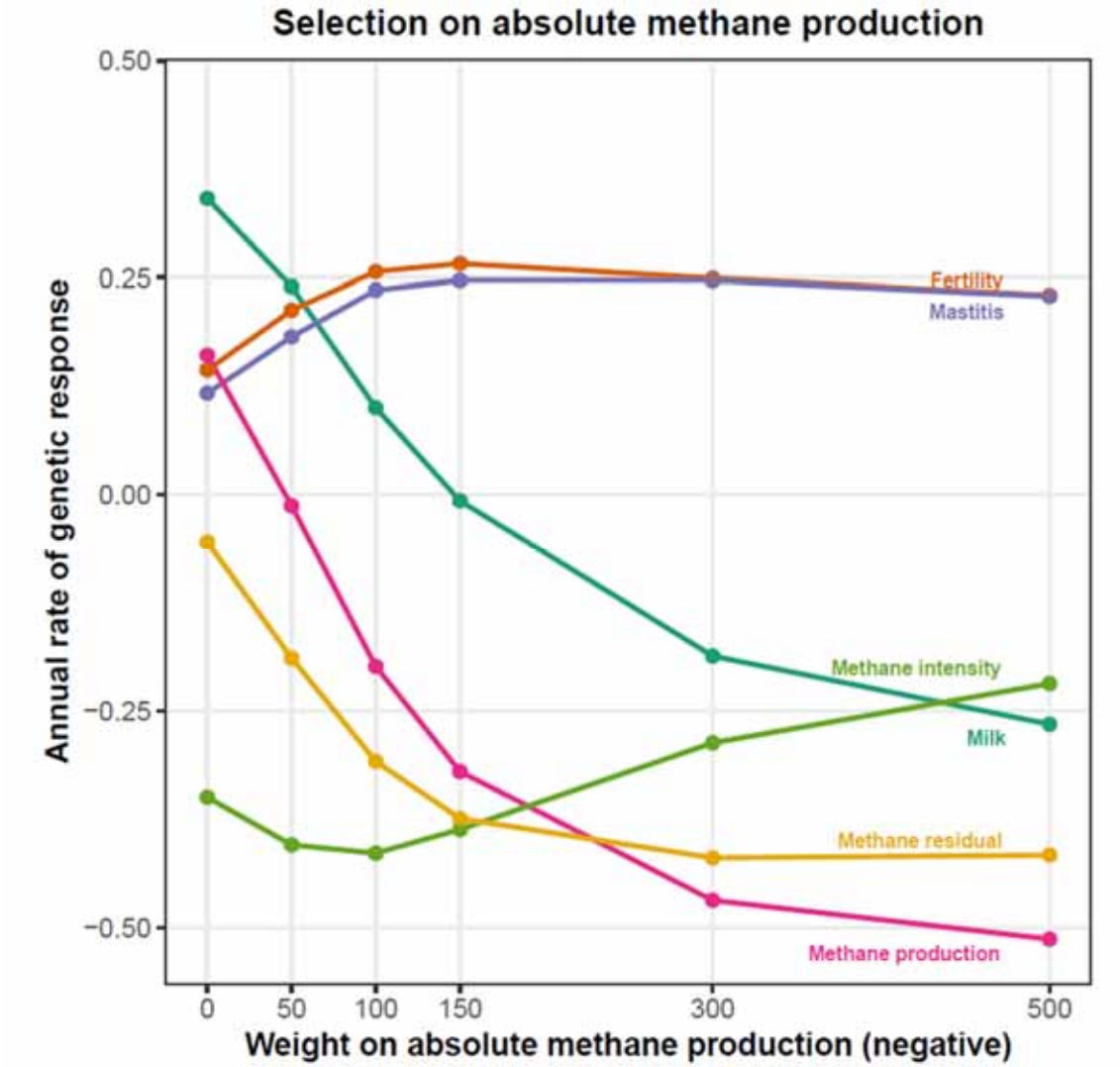
Top 100 Young bulls selected by GEBV

20,000 cows in100 herds (breeding nucleus)

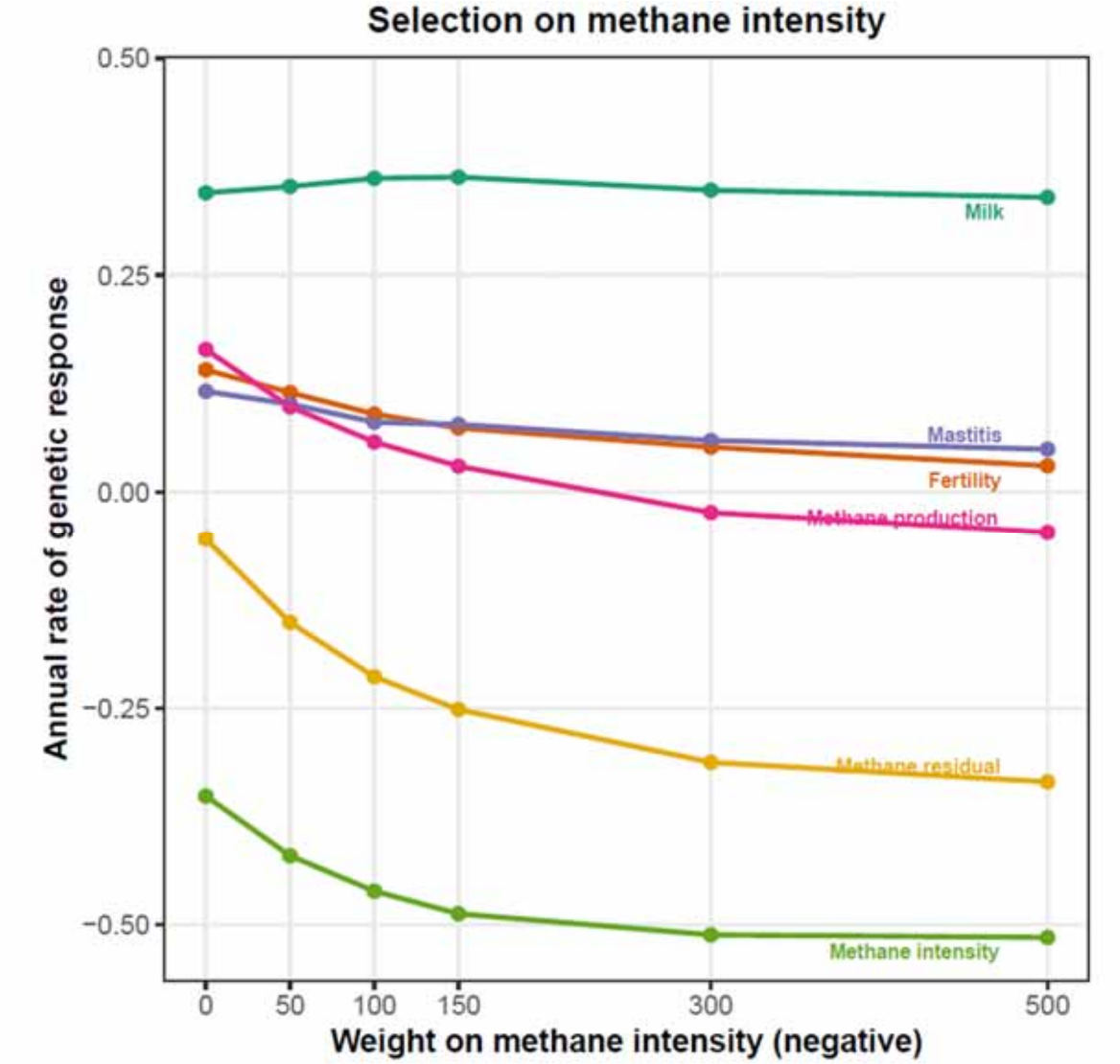
Simulations

- Stochastic simulations using ADAM software (Pedersen et al., 2009)
- 30 replicates
- 15 years
- Included 1 methane trait at a time and varied EV
- Other methane traits as correlated response

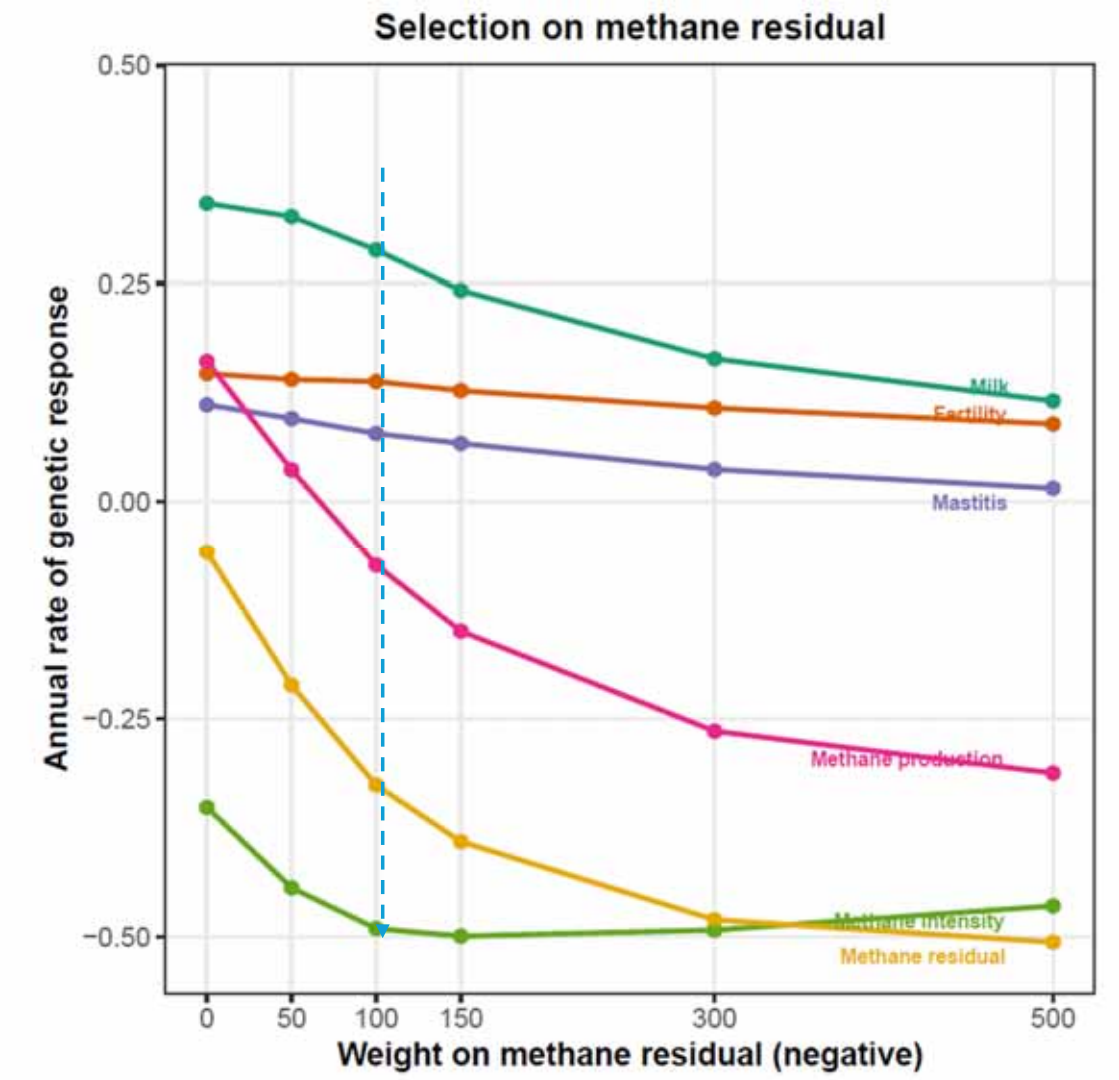
What happens when we select on absolute methane?



Selection on methane intensity



Selection on methane residual



Conclusions

Residual Methane reduces methane with less penalty on other traits

A desired gain approach may be needed to derive the economic values based on industry preferences