Fertility and health traits correlations with methane emissions

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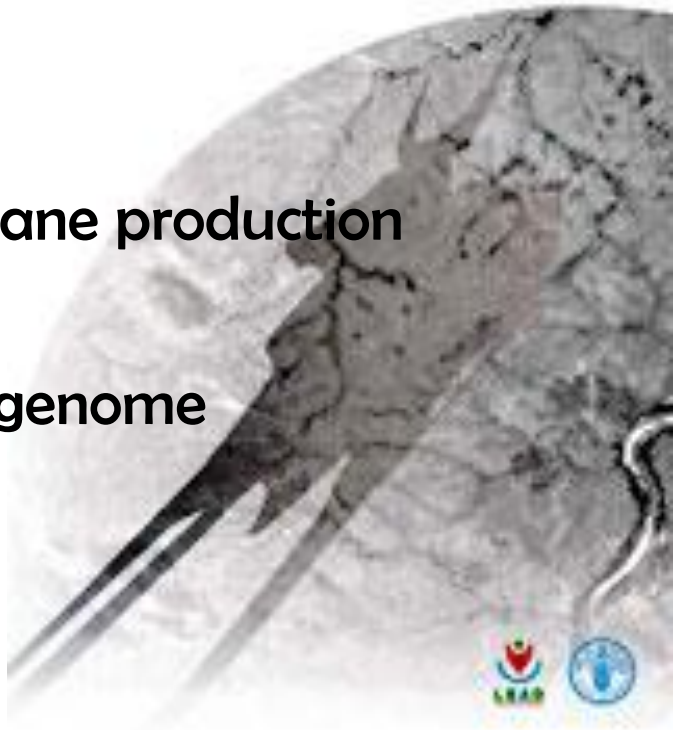
METHAGENE

Methane

- Mitigation strategies

- Livestock accounts for 40% of methane production
- 87% comes from the rumen
- From grazing behavior to animal's genome



Challenges

- Phenotype
- Measuring techniques
- Costly and difficult for large scale

- Methane and Milk Yield
- Methane and Feed Intake

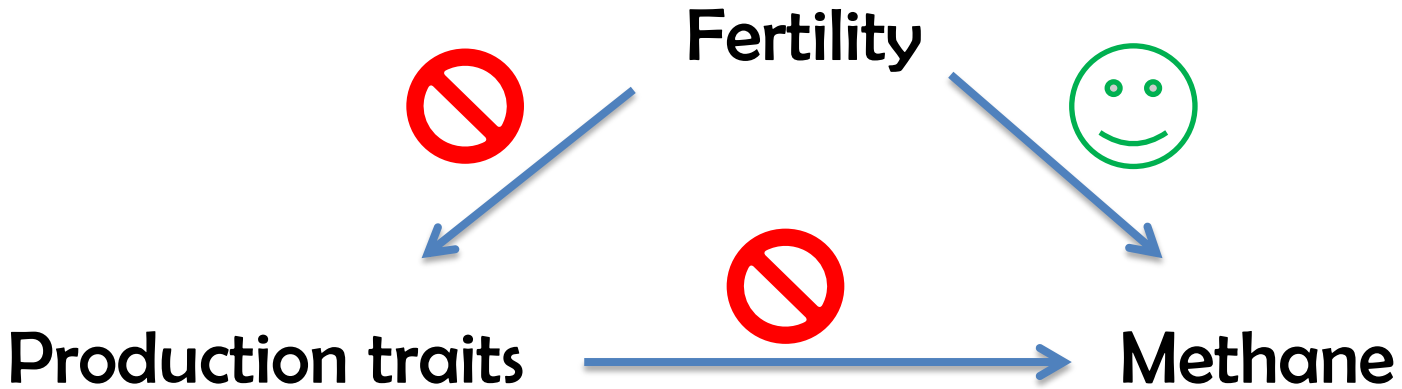
Missing pieces

- Methane's relationship with traits of economic interest
- Fertility and health
  - Low heritabilities
  - Selection
- Total Merit Index

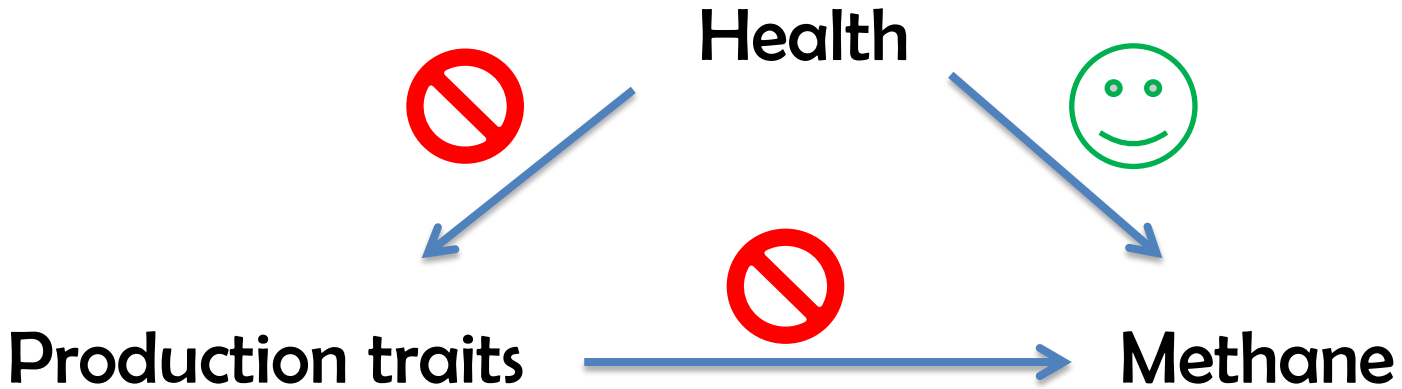
Objective

Estimate the genetic correlations between fertility and health traits and methane emissions in Danish Holstein cattle

Hypothesis



Hypothesis



Methods

- Data on ~ 10.000 Danish Holstein cows
  - 11 commercial herds
  - ~ 1.500 with individual methane measurements
- Fertility
  - Interval between calving to first insemination
  - Interval between first and last insemination
  - Number of inseminations
- Health
  - Udder health
  - Other diseases

→ 0 – 1 Traits
0 = No incidence
1 = Incidence

Methods

- Fourier transform infrared (Gasmet DX-4000)
  - Methane measured during milking

MADSEN CO_2 RATIO METHOD

$CH4/CO_2 \times 180 \times 24 \times HPU$

  - Information on milk production, live weight and days carried calf to predict CO_2 production

$$HPU = 5.6 \times LW^{0.75} + 22 \times FPCM + 1.6 \times 10^{-5} \times DCC$$

Methods

- Bivariate linear models (DMU)

Fertility = herd + lactation + year/month calving + animal + e

Health = herd + lactation + year/month calving + animal + e

Results

Descriptive Statistics				
TRAITS	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM
Methane	380.4	60.3	247.0	714.0
Calving to First	77.0	39.4	4.0	359.0
First to Last	50.2	70.9	0	341.0
Number of Inseminations	2.20	1.62	1	14
Udder Health	0.43	0.50	0	1
Other diseases	0.26	0.44	0	1

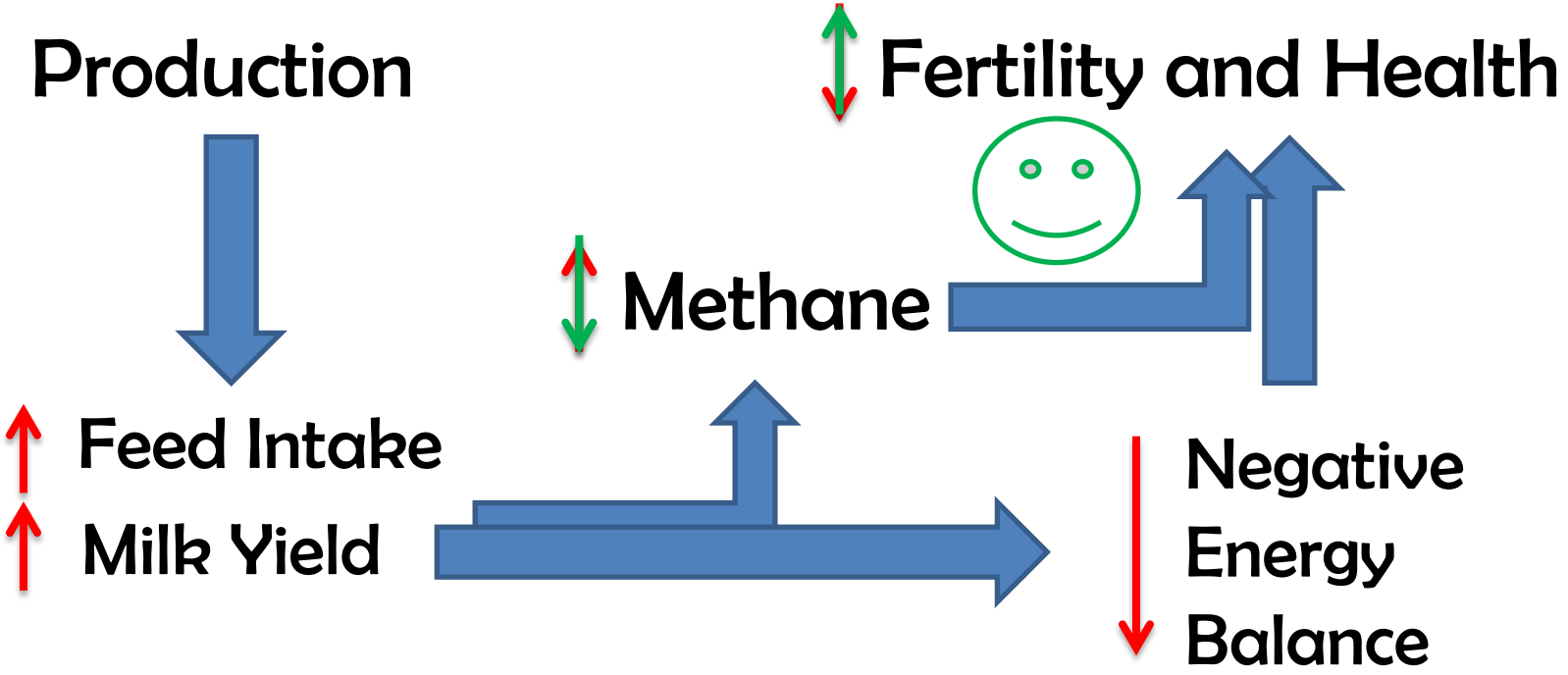
Results

Heritability estimates	
TRAITS	h^2
Methane	0.33 (0.07)
Calving to First Insemination	0.09 (0.02)
First to Last Insemination	0.04 (0.01)
Number of Inseminations	0.02 (0.01)
Udder Health	0.05 (0.01)
Other Diseases	0.05 (0.01)

Results

Genetic correlations estimates		
	Methane	
TRAITS	r_g	SE
Calving to First Insemination	0.34	0.15
First to Last Insemination	0.16	0.22
Number of Inseminations	-0.10	0.27
Udder Health	0.33	0.20
Other Diseases	0.12	0.20

Discussion


Production
Fertility and Health
Methane
Feed Intake
Milk Yield
Negative Energy Balance

Conclusion

Selection for lower methane production could help improve fertility and health traits in dairy cattle.

Thank you!