Global Methane Genetics:
a global program to accelerate genetic progress for reduced methane emission

Birgit Gredler-Grandl and R.F. Veerkamp

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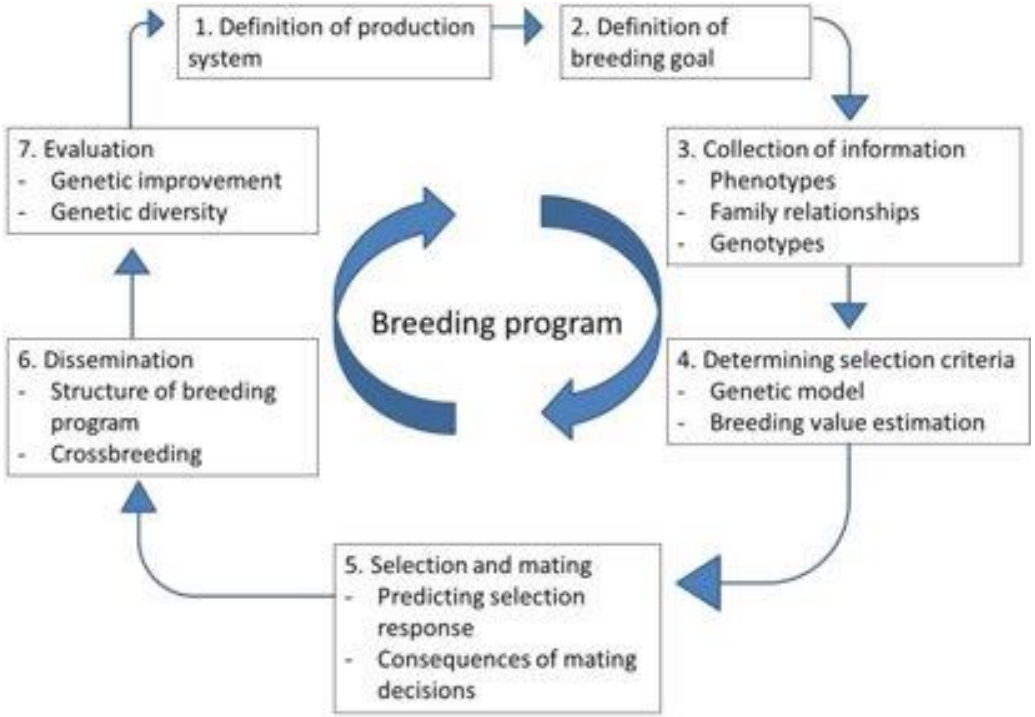
October 15th, 2024

Global Methane Hub

Animal Breeding as mitigation tool



- Clear trait definition
- Low-cost
- Large – scale
- Genetic variation
- Genetic correlation to other index traits

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Recording techniques

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Trait definitions

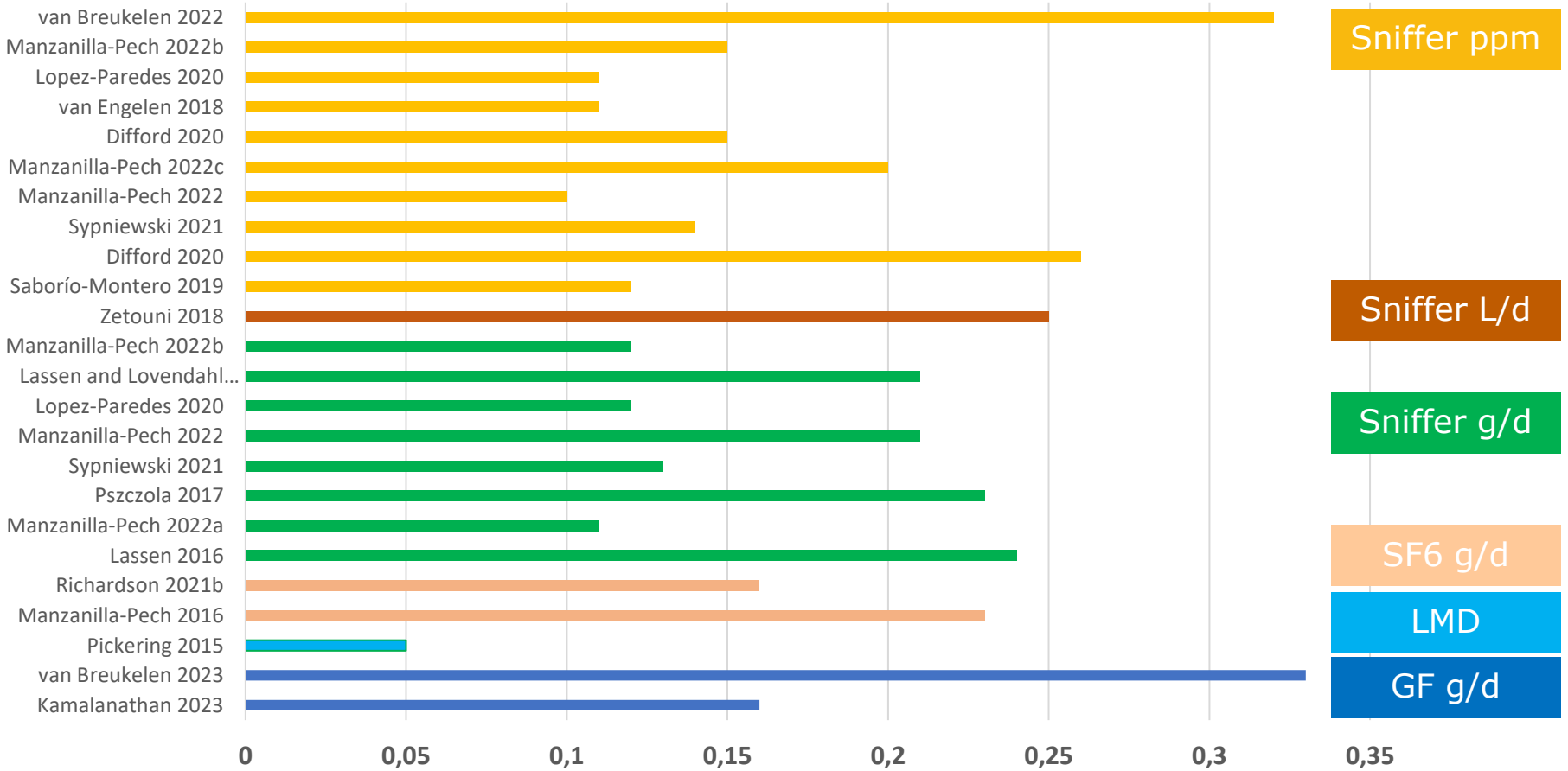
Methane production
g/day
Easy to understand
Climate targets

Methane yield
CH4 per unit of input
Ratio trait
Industry reporting

Methane intensity
CH4 per unit of output
Ratio trait
Industry reporting

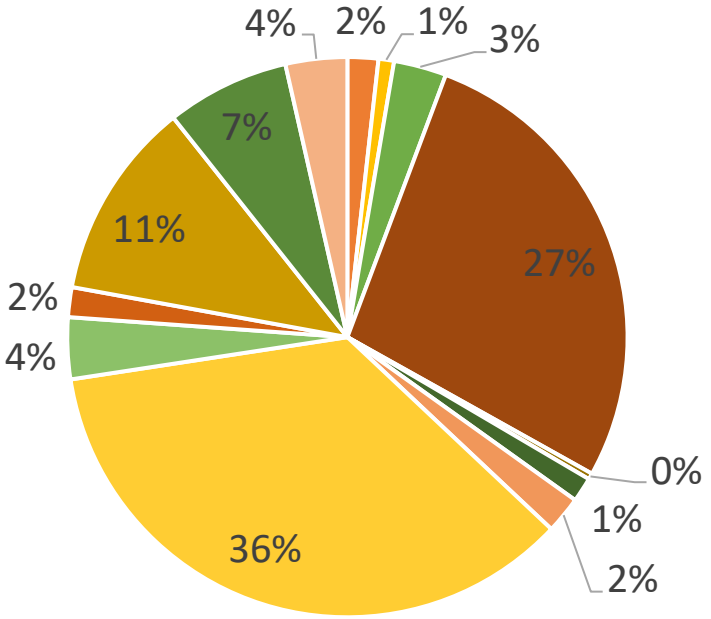
Residual methane
Expected vs observed
Difficult to interpret

Heritability in dairy cattle



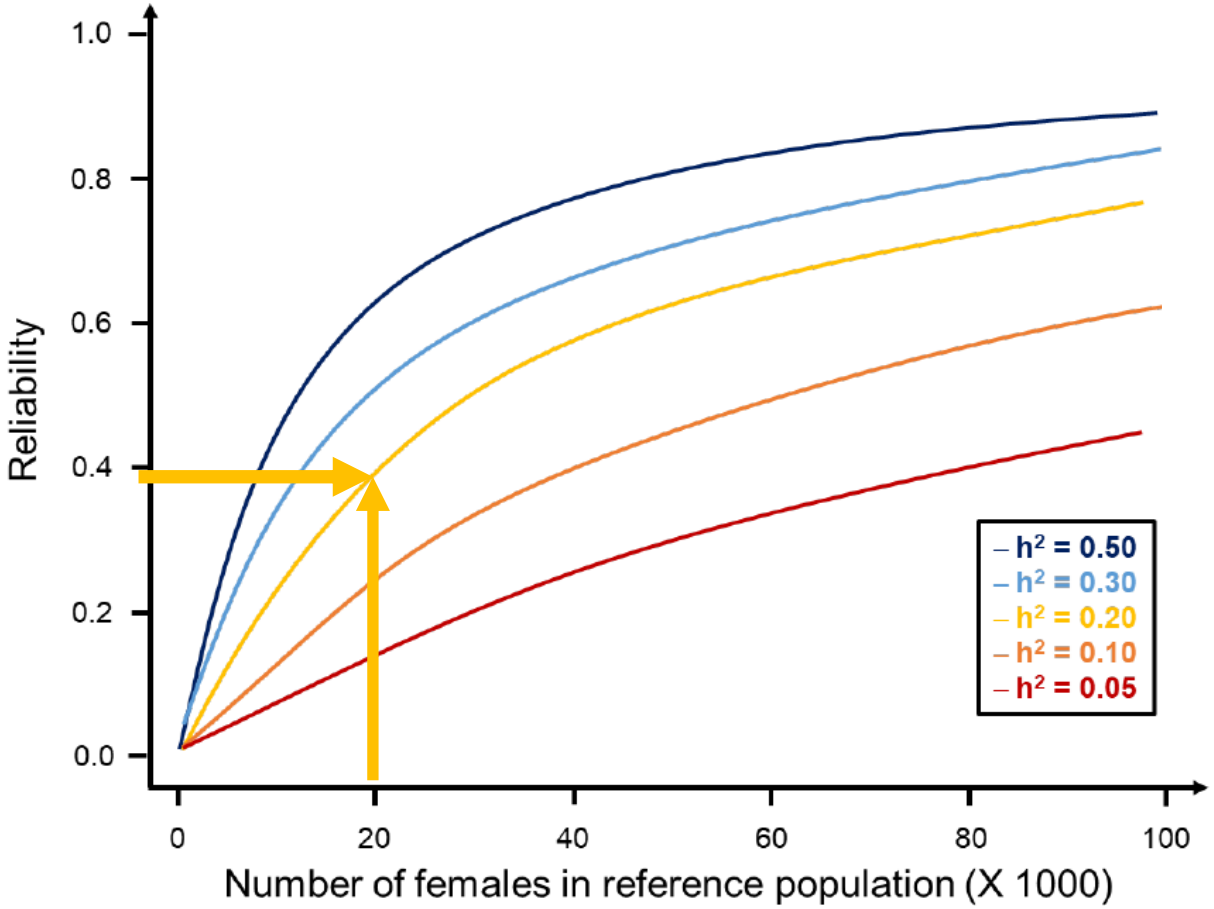
Number of CH_4 phenotyped Holstein cattle

28,114
Holstein cattle



How many cows with phenotypes do we need?

Gonzalez-Recio *et. al.* (2014)



Re-Livestock
RESILIENT FARMING SYSTEMS

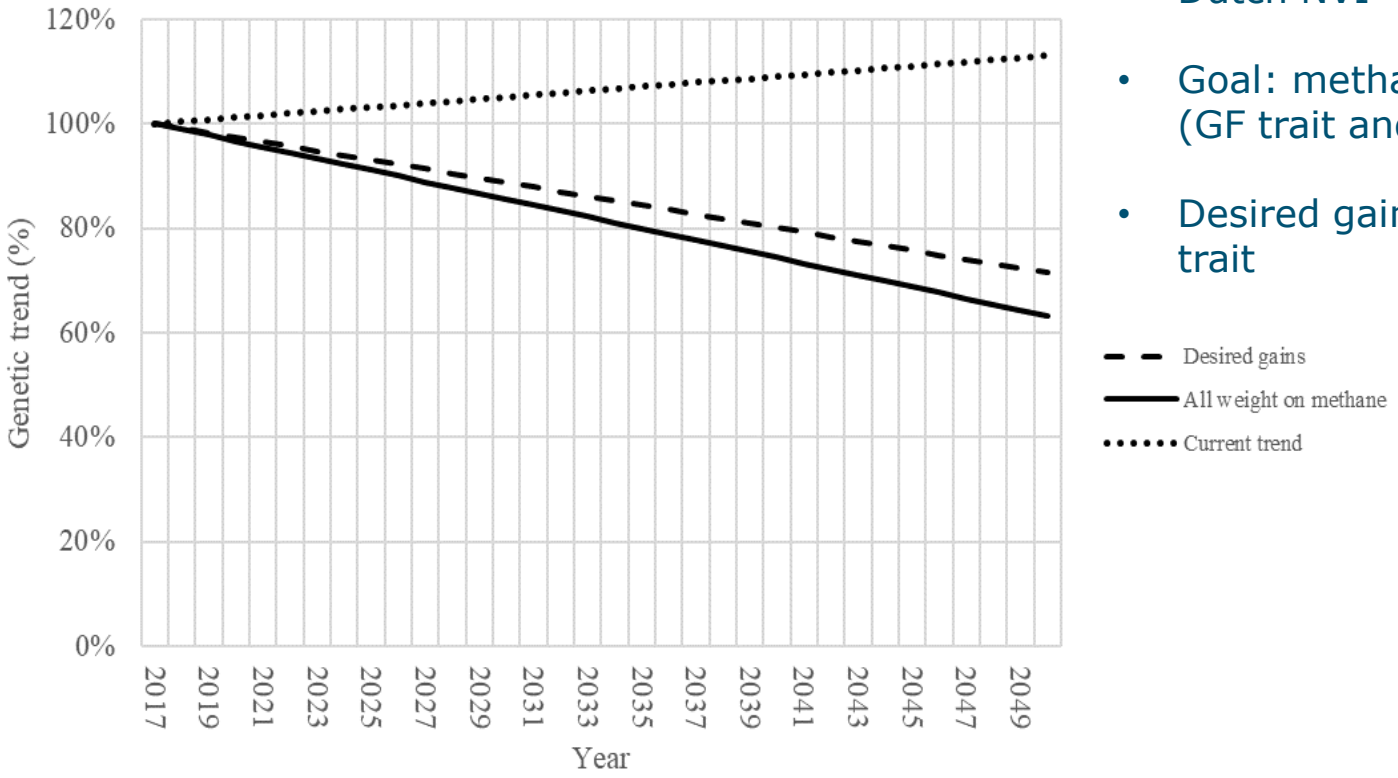
Net Zero Dairy Genome Project

Jennie Pryce, 2024

Are we ready for implementation?

- Indirect selection: **We have already been doing it!**
  - e.g. Carbon sub index (ICBF), Sustainability index (AUS)
- Published breeding values for lower methane emission
  - CAN & ESP (2023)
  - NLD, DK, NO (and others?) 2025
- Direct selection: sustainable – balanced breeding goals:
  - Production
  - Health, fitness, welfare
  - Environment

Impact of genetic selection – genetic progress



- Selection index calculations for Dutch NVI
- Goal: methane production g/d (GF trait and sniffer trait, rg 0.76)
- Desired gain: -12.75 methane trait

PhD thesis
Anouk van Breukelen, 2024

Challenges and needs

- Large reference populations
- International harmonisation & standardisation in trait definition
- Balanced breeding goals
- Adoption of genetics as mitigation tool:
  - Farmers
  - Dairy industry
  - Stakeholder & policy maker
  - Incentive systems

Global Methane Genetics (GMG)

Accelerating Genetic Progress to reduce methane in ruminants

Coordinator: Roel Veerkamp & Birgit Gredler-Grandl
Program for 5 years
Budget: US$ 20-30 million
Close collaboration with Global Methane Hub

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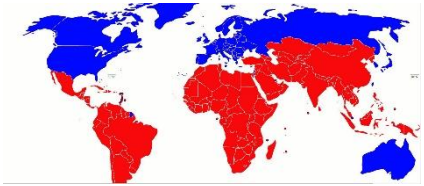
Why? How? What?



- Genetic progress can make a **permanent** and **impressive contribution** to reducing methane output from livestock systems **globally**
- we aim to accelerate genetic progress and to implement breeding strategies for reduced methane emissions in ruminants in the **global North and South**
- To support
  - **sharing of protocols** and **data**,
  - to **expand phenotyping**, **breeding program design**
  - **genetic evaluations**
  - development of **Global Livestock Genetics and Genomics Programs**

Protocols & network building

Data & phenotyping

Implementation: genetic evaluation & breeding program

1) Working Groups

- WG1: Dairy global North
- WG2: Small ruminants
- WG3: Beef global North +
- WG4: Asia
- WG5: Africa
- WG6: South America
- WG7: Buffalo & ruminants

Research & Phenotyping proposals

ICAR THE GLOBAL STANDARD FOR LIVESTOCK DATA

2) Database

- legal
- technical
- organisation

3) Animal breeding research

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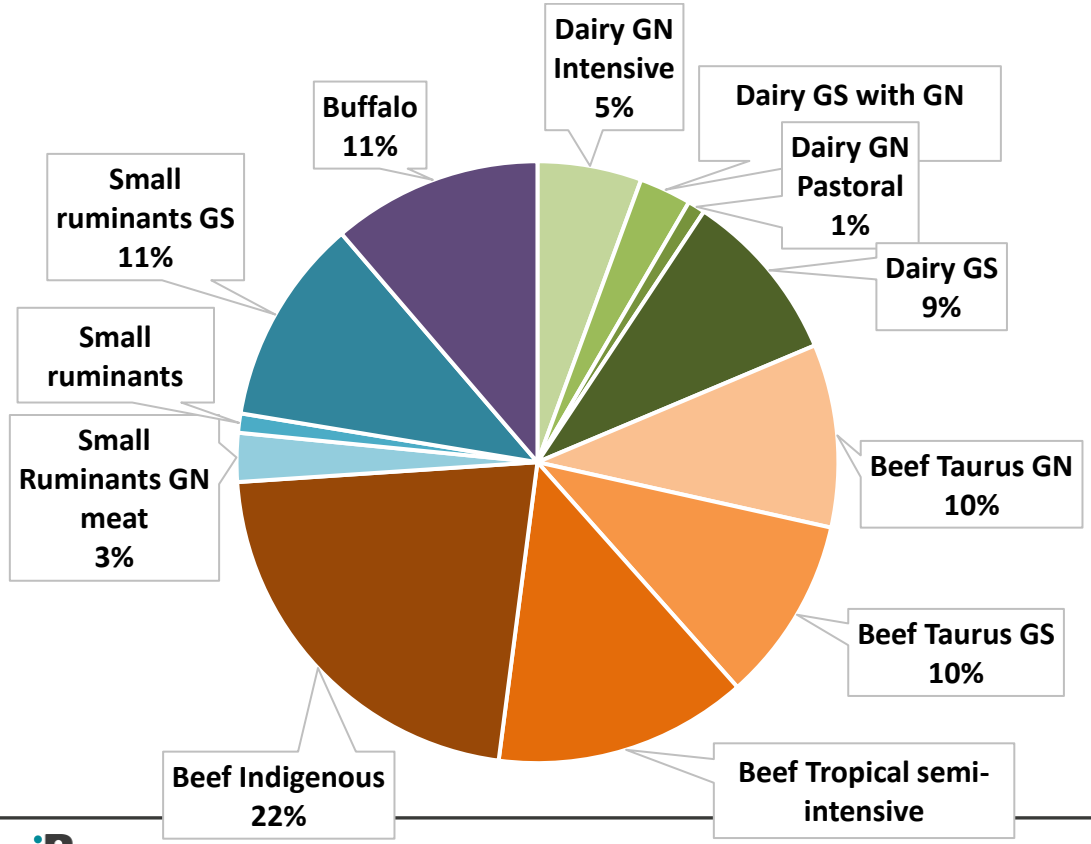
Investment strategy – impact analysis

	Cluster	Description
1	Dairy GN Intensive	Intensive, Holstein-dominated dairy systems in GN
2	Dairy GN Pastoral	Intensive, Holstein and crossbred pastoral dairy systems in GN
3	Dairy GS with GN Influence	GS systems with crossbred herds influenced by GN genetics
4	Dairy GS	GS systems incorporating a diverse range of indigenous breeds
5	Buffalo	Buffalo (milk & meat) predominately in GS
6	Beef Taurus GN	Intensive beef systems based on *Bos taurus* breeds in GN
7	Beef Taurus GS	Intensive and semi intensive beef systems based on Bos taurus breeds in GS
8	Beef Tropical semi-intensive	*Bos indicus* and tropical *Bos taurus* breeds managed in semi intensive systems in both GN and GS
9	Beef Indigenous	GS systems incorporating a diverse range of indigenous breeds
10	Small Ruminants GN meat	Intensive lamb and dual purpose systems in GN
11	Small ruminants GN other	Fibre and milking small ruminant systems in GN
12	Small ruminants GS	GS systems incorporating a diverse range of indigenous breeds

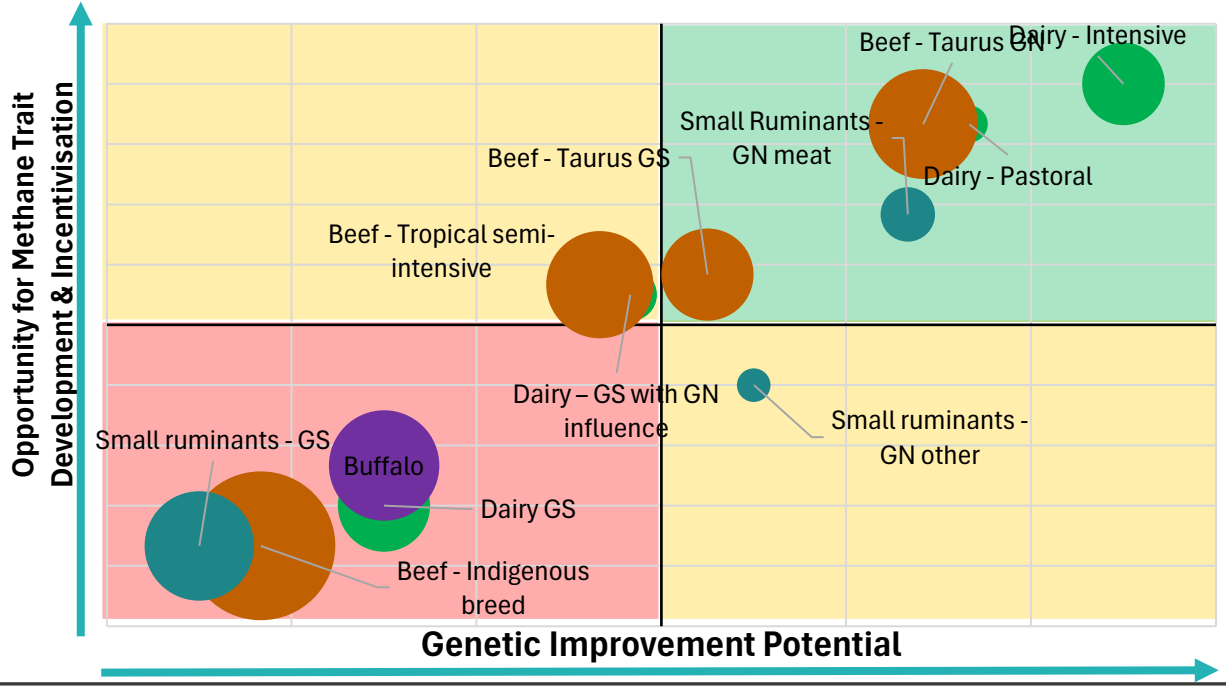
Comparison of e-Methane per group



Livestock Segment	Enteric methane Emissions (kt)
Dairy GN Intensive	5,565
Dairy GN Pastoral	928
Dairy GS with GN Influence	2,783
Dairy GS	9,275
Beef Taurus GN	9,776
Beef Taurus GS	9,888
Beef Tropical semi-intensive	13,548
Beef Indigenous	21,761
Small Ruminants GN meat	2,604
Small ruminants GN other	1,027
Small ruminants GS	11,056
Buffalo	11,217

Impact – Ease Matrix

Genetic improvement potential (Impact) versus **Opportunity for trait development** (Ease)



Impact Criteria

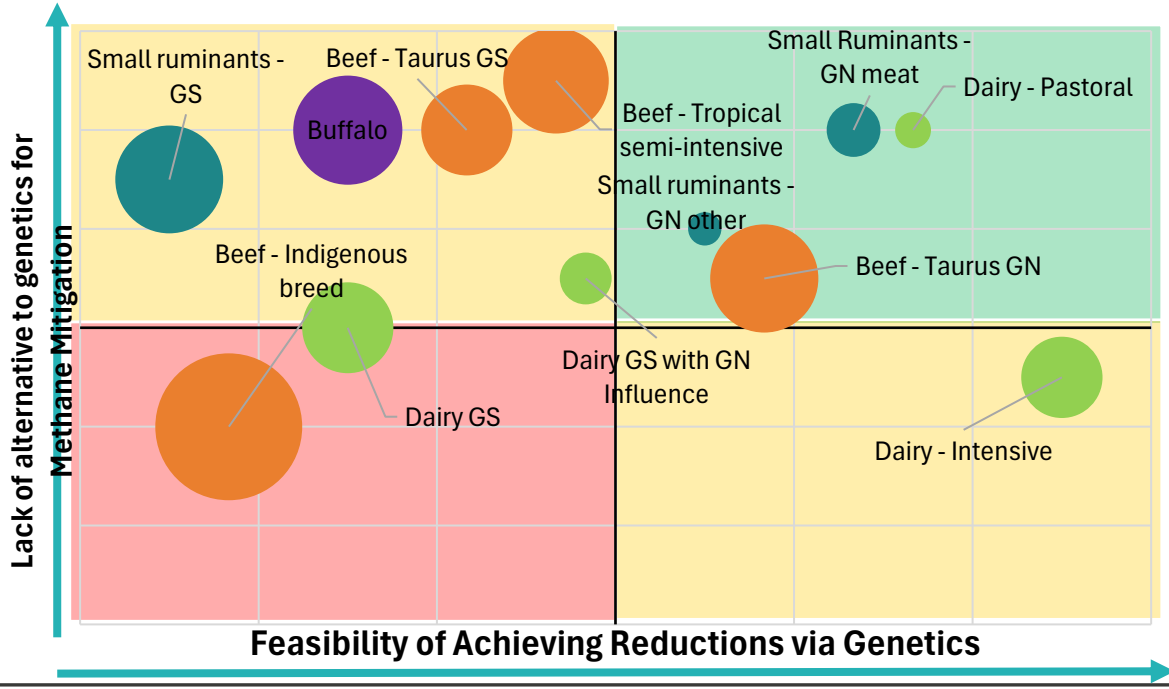
- Structure, alignment and coordination of genetic improvement sector
- Scale of addressable market
- Potential rate of genetic gain

Ease Criteria

- Industry complexity for methane trait development
- Access to infrastructure, research capability and resources
- Capacity to measure and incentivise emission reductions

Feasibility - Alternative Matrix

Feasibility of achieving methane reductions (via genetics) versus **Lack of alternative to genetics for methane reductions**



Feasibility Criteria

- Structure, alignment and coordination of genetic improvement sector
- Scale of addressable market
- Potential rate of genetic gain
- Industry complexity for methane trait development
- Access to infrastructure, research capability and resources
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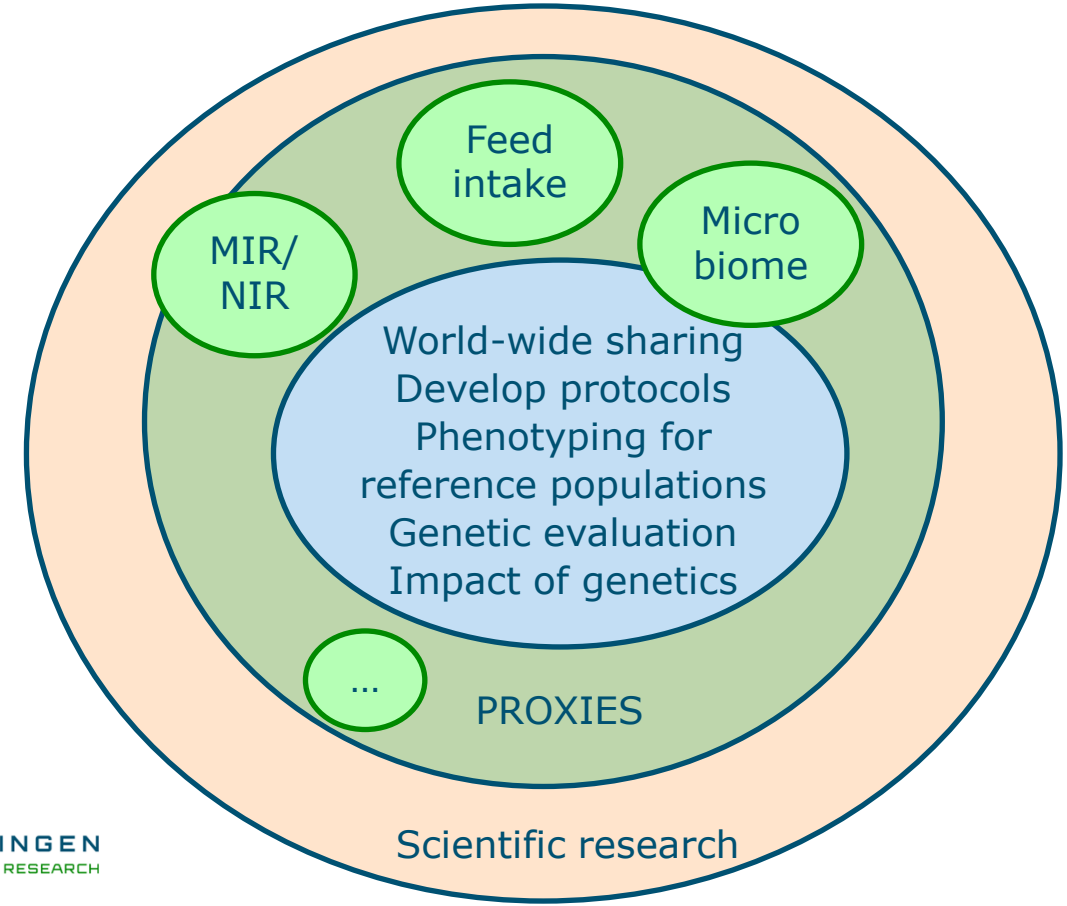
Lack of Alternative Criteria

- Applicability of other interventions
- Management opportunities

Investment of Global Methane Genetics



Invest money in the inner circle

Facilitate networks linking with the two outer circles.

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Focus of GMG – acceleration of genetic progress

Dairy program:
Holstein (~40k)
Jersey (~8k)
(Nordic) Red Breeds
Brown Swiss

South America
Beef & indigenous
(~7k)

Africa
Dairy & beef
~ 9k

India

World-wide sharing
Develop protocols
Phenotyping for
reference populations
Genetic evaluation
Impact of genetics

Microbiome:
Global reference
population
(~9,5k)

Beef:
North America
(~6,000)
Australia, Ireland,
UK, NZ (~18,5k)

Sheep: global reference population
Australia & New Zealand
UK & Ireland
Uruguay (~ 17k)

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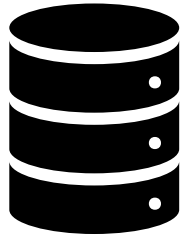
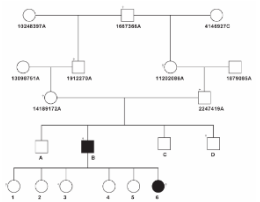
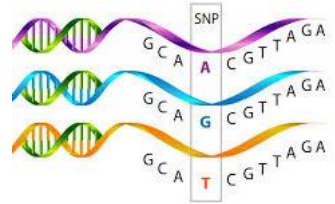
GMG - Database



- Business requirement phase – collaboration ICAR, DataGene, Interbull, Lactanet, and others
- Methane phenotypes (any method), pedigree, genotypes
- Fair share policy – free riders!
- Cow equivalents established by the effective number of records (reliability) in genetic evaluation
- Requirement for all data paid by GMG – background data welcome
- …





Workshops – content driven task force - webinars

- ICAR Feed&Gas working group → icar.org
- Communication plan – incentivization
- Genetic progress in farm- and national credit analysis
- Webinar for policy makers about impact genetic progress
- Recording – pasture based systems
- SOP sniffer/GreenFeed
- SOP portable accumulation chambers
- Recording methane emission in small ruminants
- Microbiome platform/network – global collaboration
- …

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Workshops – content driven task force - webinars

- ICAR Feed&Gas → icar.org
- Ger
- We
- Rec
- SO
- SO
- Rec
- Mic
- …

Mailing list coming soon!

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Thank you for your attention

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