Overview on the Status-Quo & Challenges to Reduce Methane Emissions from Livestock Systems in Africa

Better lives through livestock

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23 May 2024

ICAR Meeting, Bled Slovenia

Role of Livestock in Africa

- Importance of livestock
  - Livelihoods
  - Food security
  - Cultural significance
  - Resilience and adaptation
- Livestock is a significant source of methane (**CH_4**)
  - CH_4 is a greenhouse gas (**GHG**)
    - High Global Warming Potential (84x greater than CO_2 over 20 yrs)
    - Short-Lived Climate Pollutant (short atmospheric lifetime ~12yrs)
  - To meet the 1.5C target, CH_4 must be reduced by **11 to 30%** by 2030 and **24 to 47%** by 2050 compared to 2010 levels

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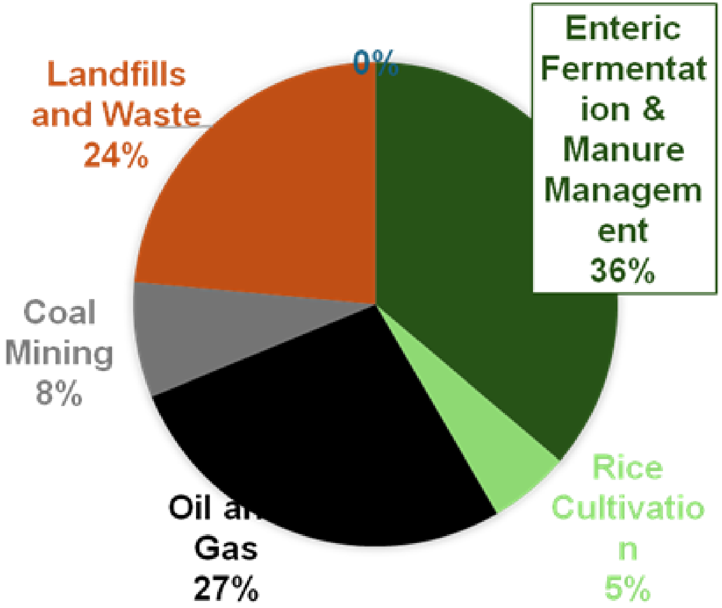
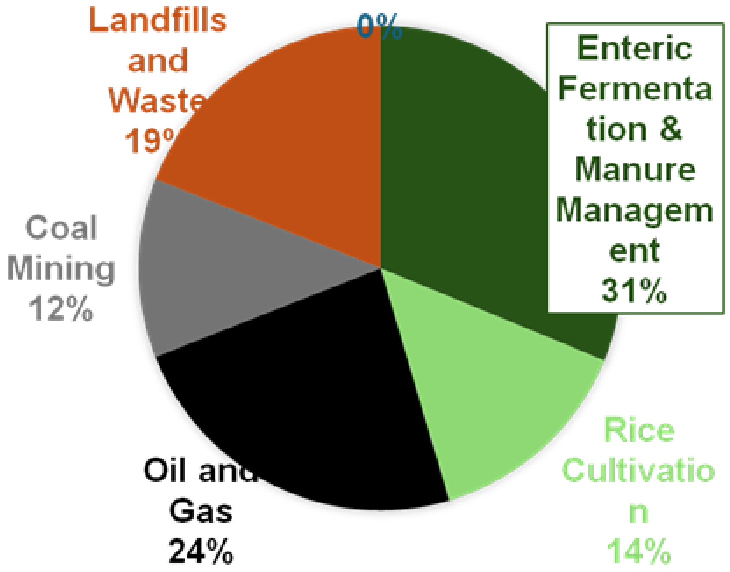
Comparative Analysis of CH_4 Emissions by Sector



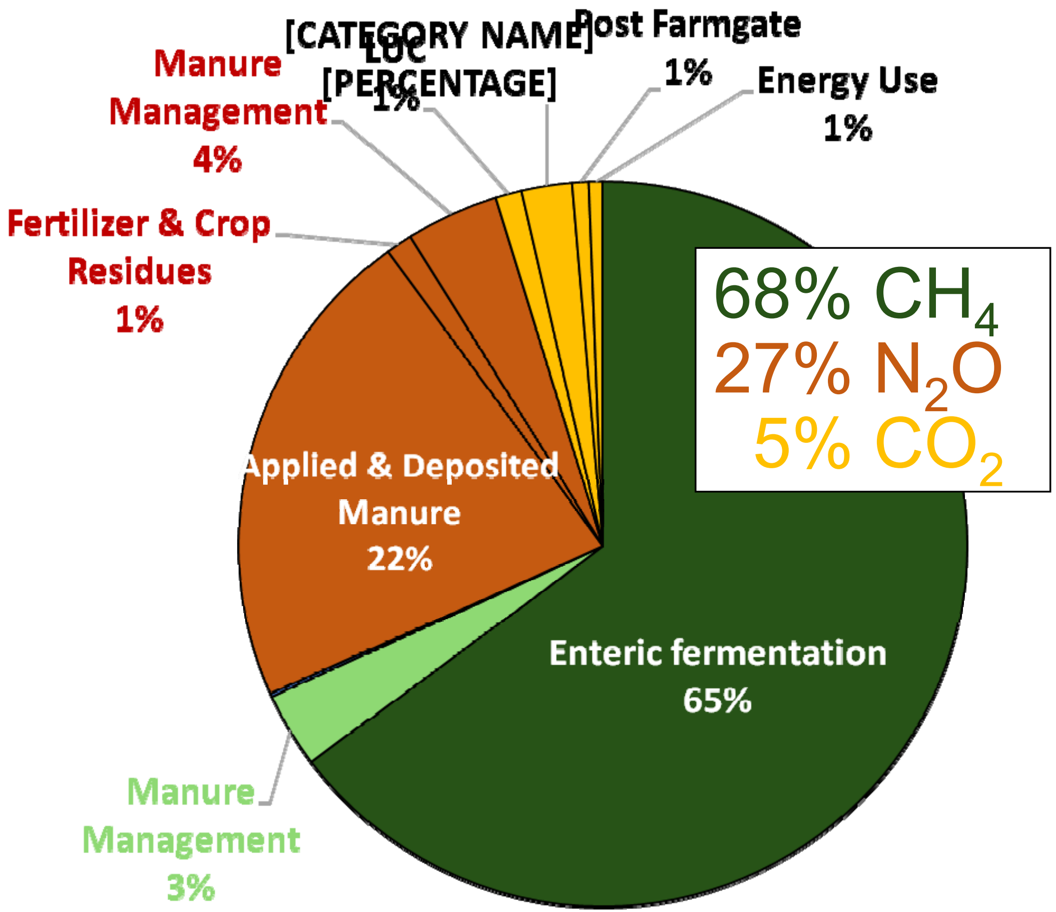
Equatorial and South Africa



Global

Source: Global Methane Assessment

GHG Emissions of Sub-Saharan Livestock Value Chain



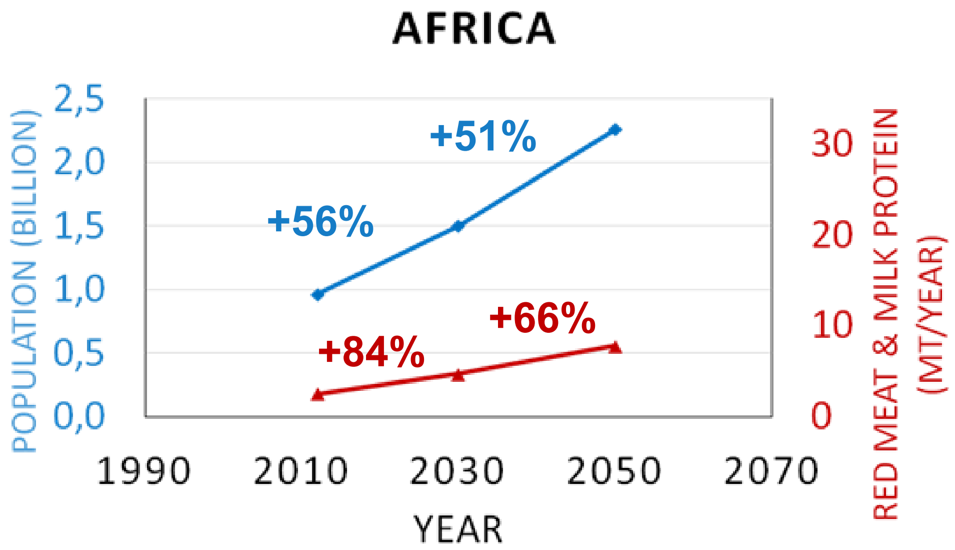
CH_4 Dominates Livestock Emissions:

•68% of total GHG emissions from the livestock value chain.

- 65% from Enteric Fermentation
- 3% from Manure Management

Source: Gleam, 2020

Projected Population Growth and Animal Product Demand



Continent	Red meat & milk protein (g/capita/d)		
	2012	2030	2050
Africa	7.2	8.5	9.4
Europe	28.6	30.3	30.4

- Population growth will increase demand for animal products.
- Per capita consumption of animal protein will remain low compared to Europe.
- Addressing the rising demand for animal protein in Africa is crucial for food security and economic development.

MT: Million metric tons
Source: Modified after Henchion et al., 2021 and FAO.

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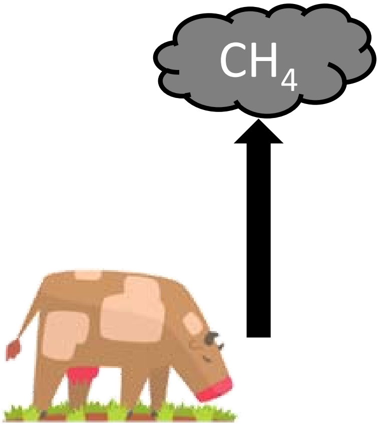
Research on GHG Emissions From Livestock is Limited

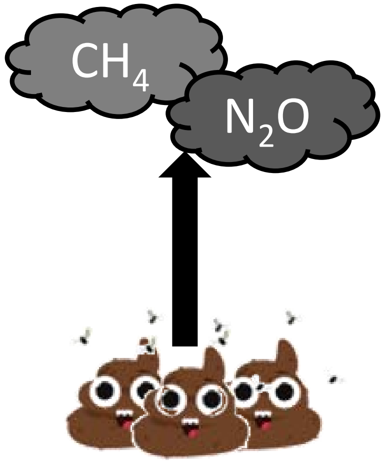
Enteric CH_4 Emissions

- 14 cattle studies
- 6 small ruminant studies



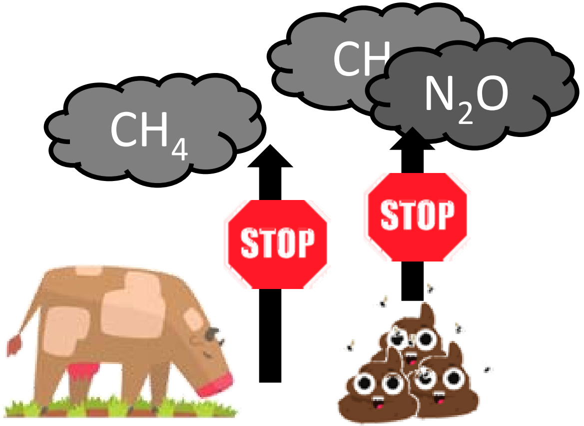
Manure GHG Emissions

- 6 cattle manure studies
- 0 small ruminant studies



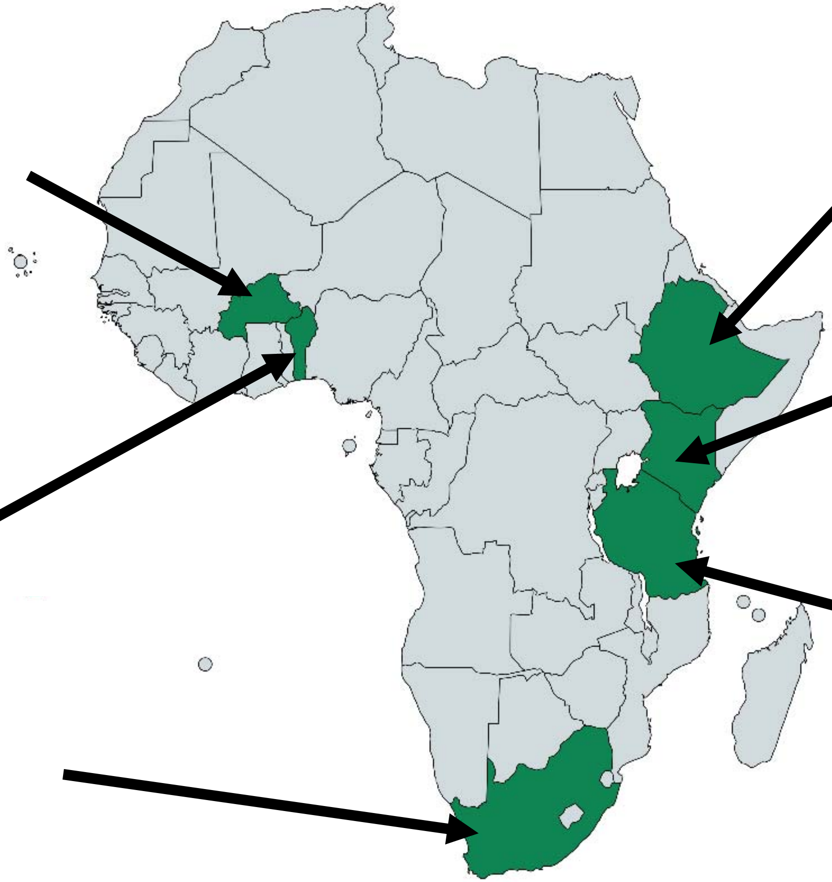
Mitigation

- Enteric emissions:
  5 cattle and 2 sheep studies
- Manure emissions:
  0 studies



Source: Graham et al., 2022

Locations With Equipment to Measure Enteric CH_4



Burkina Faso

- 1 GreenFeed for small ruminants & 1 for cattle

Benin

- 1 GreenFeed for sheep & cattle

South Africa

- Small ruminant chambers
- 3 GreenFeed for cattle
- SF6
- Handheld Methane Detector

Ethiopia

- 1 GreenFeed for cattle

Kenya

- Cattle and small ruminant chambers
- SF6 under development

Tanzania

•Handheld Methane Laser

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Strategies for Reducing Enteric CH_4 Emissions by Feeding System

Zero-grazing production systems	Grazing with feed supplementation	Grazing without feed supplementation
Chemical inhibitors*	Chemical inhibitors*	**Tanniferous forages***
Tanniferous forages*	**Tanniferous forages***	Pasture and pasture management
Electron sinks*	Electron sinks*	**Herd management***
Lipids*	Lipids*	**Low-CH_4 emitting animals***
Concentrate	Concentrate	
Feed, forage & forage management	Low-CH_4 emitting animals*	
Herd management*	**Feed, forage & forage management**	
Low-CH_4 emitting animals*	Pasture and pasture management	
	Herd management*	
	Low-CH_4 emitting animals*	

* Mitigation Strategies that reduce absolute emissions without increasing productivity.
Bold Mitigation Strategies that are relevant across system

Source: Modified Breakthrough Report, 2023.

Feed and Forage Managment

Past efforts: Supplementing cattle with crop co-products

Enteric CH_4 per kg of intake reduced by > 20% rangeland forage and *Panicum maximum* hay was supplemented with cereal and legume co-products

On-going research: The high potential Shrub forage banks to reduce enteric CH_4 (HiFoBREC)

- The use of shrub and tree legumes to reduce enteric CH_4
- Production of emission factors for local GHG inventories

Global Methane Hub

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FACULTE DES SCIENCES AGRONOMIQUES UNIVERSITE D'ABOMEY CALAVI FSA - UAC

ISRA

Source: **Gbenou et al,** Accepted for publication in Archives of Animal Nutrition https://doi.org/10.1080/1745039X.2024.2356326 .

Tanniferours Forages

- Tannins reduce enteric CH_4 by inhibiting methanogens, altering fermentation patterns,…
- Decreases absolute CH_4 by **12%** and CH_4/product by **18%** (Arndt et al., 2022)

Challenges to consider:

- Decreases fiber digestibility by 7% (Arndt et al., 2022)
- Can decrease feed intake, palatability, protein digestion & animal production

On-going efforts: Low-Methane Forages

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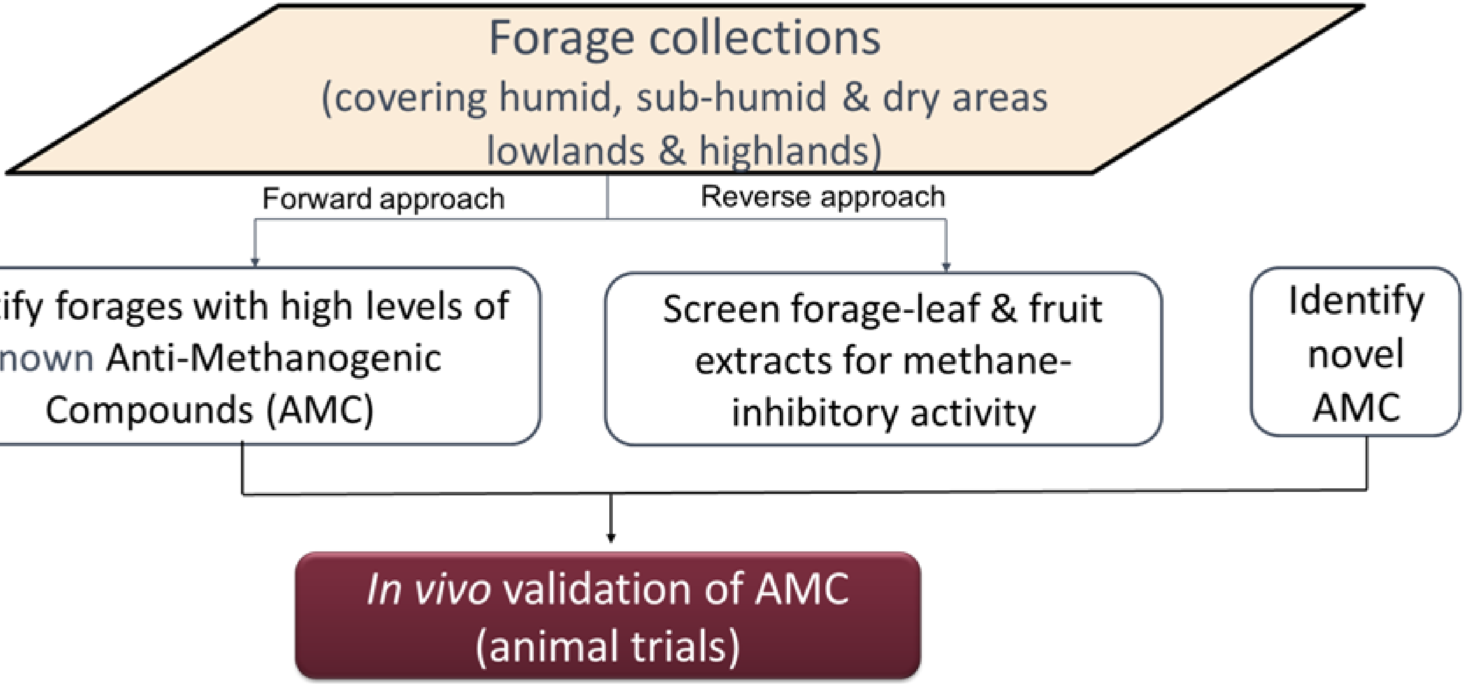
Low-Methane Forages – Project Overview



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Herd Management

- Seasonal breeding
- Animal health
- Feed management
- Grazing management
- Nutritional management

On-going efforts: Matching Livestock Breeds to the Environment

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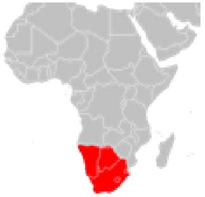
Excellence in Agricultural Research and Development

Matching Livestock Breeds to the Environment



- **Overall CH_4 emissions/animal likely to increased**
- **CH_4/product will be reduced (preliminary suggest by 6-12%)**

Climate Change → Adaptation + Mitigation + Resilience

Adaptation	Mitigation	Resilience
• Use of indigenous breeds • Crossbreeding	• Improved cow-calf efficiency • Selection for alternative measures of efficiency • Crossbreeding	• The effective use of crossbreeding – resilience to variation in climate
➢ Maintain production under climate change	➢ Lower carbon footprint	➢ Recover quickly, bounce back, toughness

Low CH_4 Emitting Animals

- Potential to decrease in CH_4/animal ≤ **15%** (FAO, 2023)

On-going efforts: Enviro-Cow Project (Ethiopia and Tanzania, 3-yr project)

Aim: Address climate challenges in African livestock production

Objective

- Direct Approach: Selection for low CH_4 emitters
- Indirect Approach: Improve animal efficiency
- Goal: Construct selection index for animals with less impact on the environment, better feed utilization and productivity

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ADGG African Dairy Genetic Gains
More productive and profitable dairy cows

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Enviro-Cow Project (Results so far)

Direct approach to reduce enteric CH_4

•CH_4 data collected from 900 cows (230 dairy farms) using Laser CH_4 Detector

•Heritability estimates for CH_4 emissions: ~0.20 (ppm-methane)

→ Indicates genetic variation for direct selection

•Prediction of CH_4 from milk fat%, protein%, and Mid-Infra-Red provides an accuracy of ~0.43

Indirect approach to reduce enteric CH_4

•Selection of animals with low metabolic body weight, as this reduces feed needed for maintenance

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Combination of Mitigation Practices

- One strategy alone will not meet climate targets.

CH_4 must be reduced by **11 to 30%** by 2030 and **24 to 47%** by 2050 compared to 2010 levels

- Combining multiple strategies is crucial for significant mitigation.

<u>Example</u>: Modelled Effect of Climate Smart Livestock (**CSL**) Practices by combining multiple strategies

Definition CSL Practice
1. Increased productivity
2. Increase adaptation and resilience to climate change
3. Reduced GHG emissions

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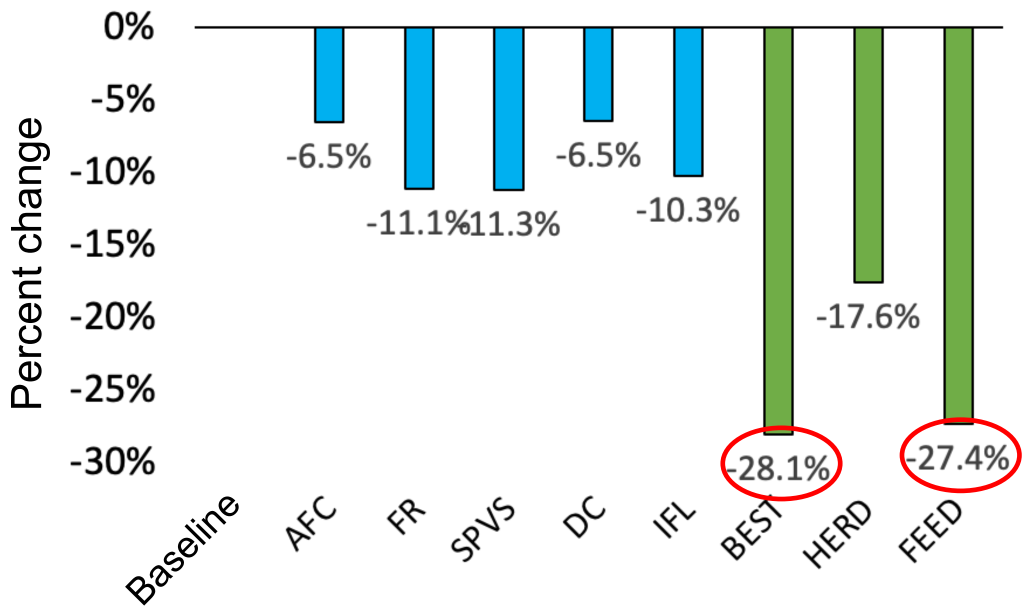
Effect of CSL Practices on Emission per Unit of Product

- Emissions per product decreased with **single** and **multiple mitigation** strategies
- Greater reductions achieved when **multiple mitigation** strategies are applied simultaneously



AFC: Age at first calving

FR: Fertility Rate

SPVS: Sweet Potato Vine Silage

DC: Dairy Concentrate

IFL: Improved Feeding Level

BEST BET: FR + SPVS + IFL

HERD: AFC + FR

FEED: SPVS + DC + IFL

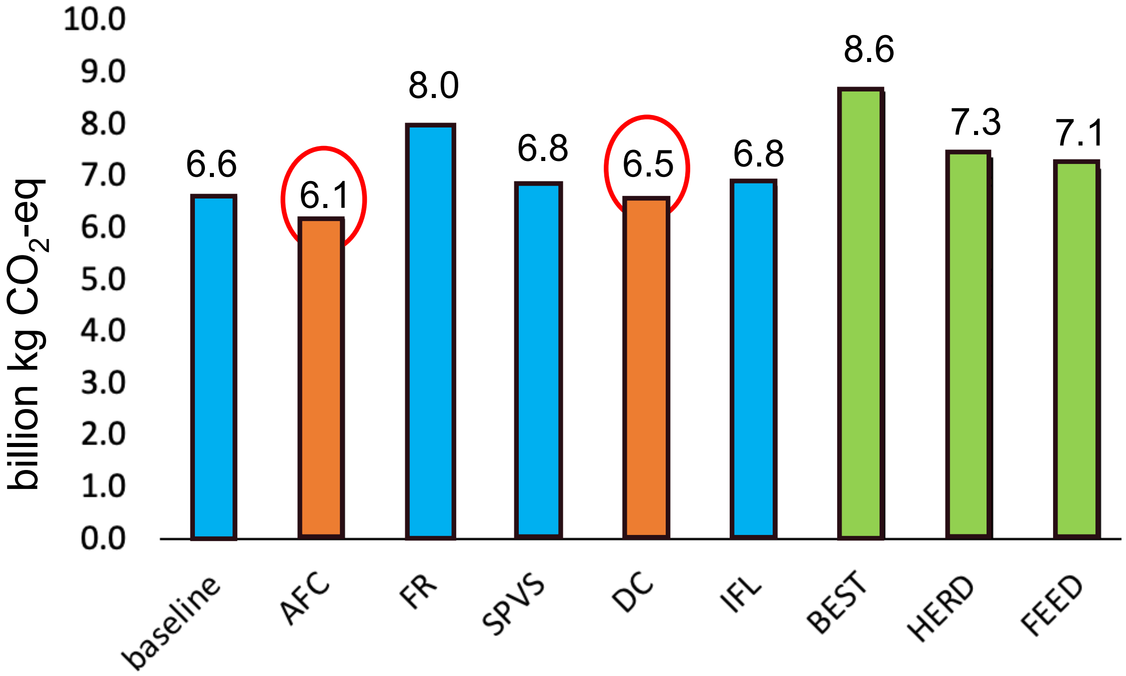
LCSR: Livestock, Climate and System Resilience

Mitigate+: Research for Low-Emission Food Systems

Source: Graham et al. under revision.

Effect of CSL Practices on Absolute Emissions

- Absolute CH_4 went up in all scenarios, except AFC and DC



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Path Forward for CH_4 Reduction in Africa

Study Technical Mitigation Potential

- Determine CH_4 potential of strategies predicted to have high mitigation potential or are applicable across systems
- Test mitigation potential of multiple strategies

Address Practical Mitigation Potential

- Understand strategy acceptance and interest to adopt strategies
- Streamline efforts to align with government interests
- Understand financial implications for livestock keepers and explore solutions

SAVE THE DATE!!!

9th GGAA
2025 · Nairobi, Kenya

International Greenhouse Gas & Animal Agriculture Conference

Date
5 - 9 October, 2025

Website
https://ggaaconference.org/

Thank you very much for your attention!

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