TEAGASC RESEARCH INSIGHTS
LEADING RESEARCH FOR TOMORROW'S AGRI-FOOD SYSTEMS

Development of novel technologies to reduce methane emissions from Irish agricultural systems

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Teagasc Research Insights

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Agriculture and Food Development Authority

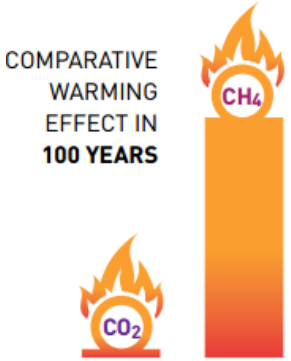
Overview

- Methane emissions
- Strategies to reduce methane emissions
- Feed additives - ‘Meth-Abate’ Project
- Early life intervention

Methane emissions

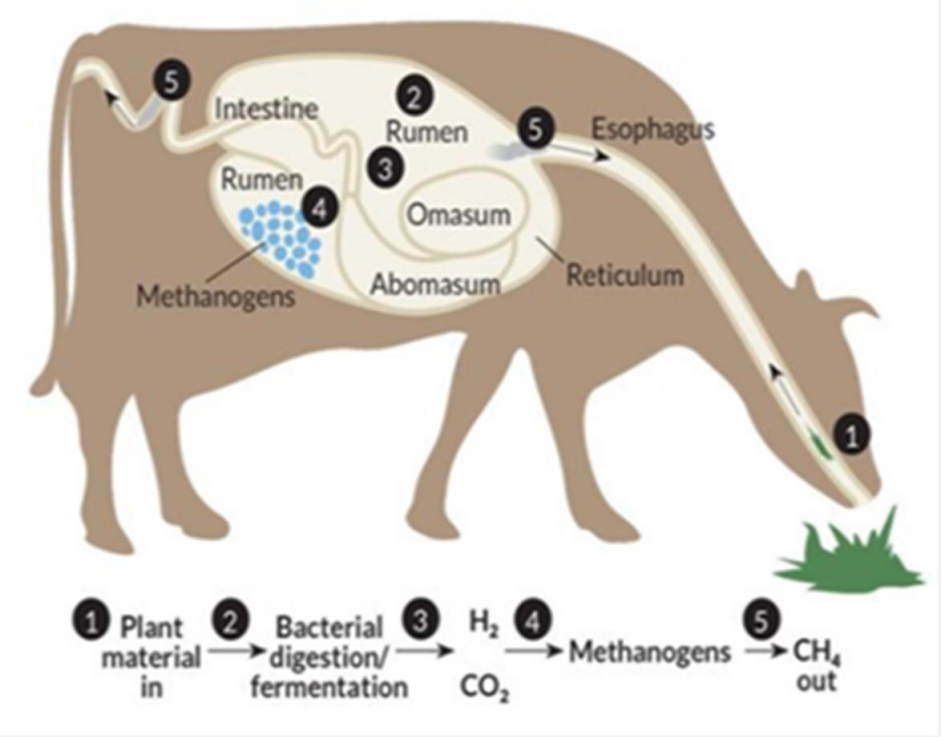
- **Agriculture** is responsible for 32.7% of Ireland's Greenhouse Gas (GHG) emissions
- Sources of methane from **Irish agriculture**:
  - Enteric fermentation (feed digestion) - 56.2%
  - Stored slurries & manures - 9.6%

Reducing methane will be key to meeting targets on climate change



How is enteric methane produced?

- **Methanogenesis in the rumen during feed digestion**



$$CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$$

Inefficiency: 2–12% loss of feed energy for the animal

Measuring Enteric Methane Output

Respiration chamber

SF_6 tracer

GreenFeed system

So how are we going to reduce methane emissions from agriculture in Ireland?

Improved management practices

Teagasc Marginal Abatement Cost Curve (2021-2030)

- Improved farm management – methane abatement estimated to be 1.85 Mt CO2e per year
- Cost negative strategies ~ 10% reduction in total GHG emissions
  - Extending length of grazing season
  - Increasing dairy cow genetic merit via the Economic Breeding Index
  - Optimising age at first calving
  - Increasing the daily live weight gain
  - Optimising the calving and lambing rate
  - Lower age at which an animal is slaughtered
  - Improved waste management

'METH-ABATE'
DAFM-RSF 2019R479

Development and validation of novel technologies to reduce methane emissions from Irish pasture based beef, dairy and lamb production systems

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afbi Agri-Food & Biosciences Institute

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METH-ABATE - Development of novel farm ready technologies to reduce methane emissions from Irish pasture based beef, dairy and lamb production systems

- **Feed additives** to mitigate methane emissions – monitoring their effects on animal productivity (cattle and sheep)
  - 3-NOP (Bovaer), seaweeds, oils, halides, yucca extracts, olive feed

- Encapsulation for **slow release** options at pasture

- **Nutritional and toxicological** composition of meat and milk - to confirm **consumer safety – no residues**

- **Farm level cost effectiveness** will be evaluated - **national farm survey**

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Additives evaluated *in vitro* Rumen Simulation Technique

- Plant/oil extracts
- Olive by-products
- Short-lived reactive oxygen halide species

- Seaweeds
  - *Alaria esculenta* (B)
  - *Himanthalia elongate* (B)
  - *Fucus vesiculosus* (B)
  - *Fucus serratus* (B)
  - *Bifurcaria bifurcate* (B)
  - *Ascophyllum nodosum* (B)
  - *Pelvetia canaliculata* (B)
  - *Asparagopsis taxiformis* (R)
  - *Palmaria palmata*(R)
  - *Chrondus crispus* (R)
  - *Ulva intestinalis* (G)

- Seaweed extracts

GlasPort Bio

The Olive Feed Corporation
Premium Feed made from the worlds best olives

Inform Nutrition Ireland

SEASOLUTIONS

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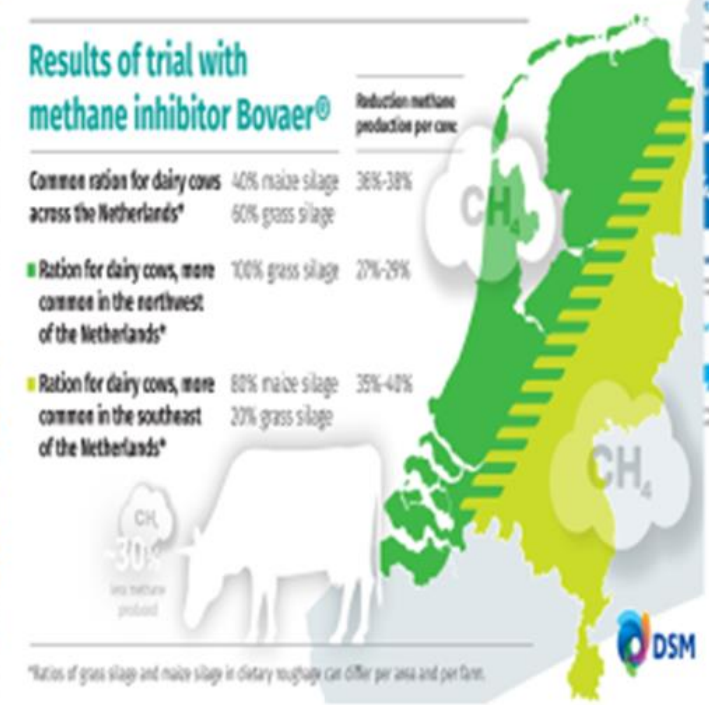
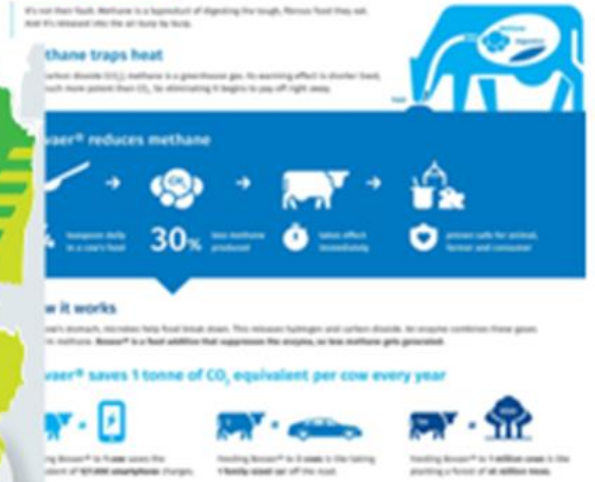
3-NOP (Bovaer)





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European Food Safety Authority

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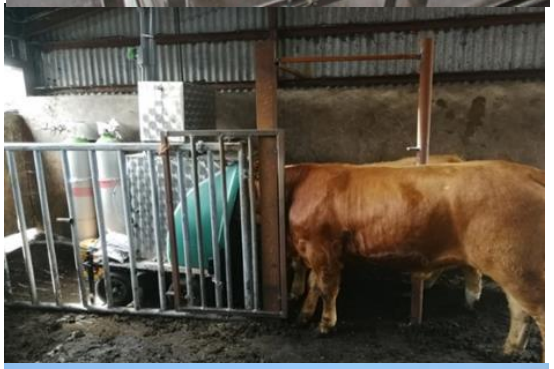
Irish animal trials

- **Sheep:** commenced May 2021
  - Agolin, Mootral, oils, halides, seaweed, seaweed extract
- **Beef:** commencing 2022
  - *Ad lib* grass silage + concentrates
  - Treatments: Control, 3-NOP, plus most promising additives from sheep study
- **Dairy:** commencing 2022
  - Grazed swards (Grass + clover)
  - Treatments: Control, slow-release 3-NOP and most promising additive from sheep study



Early life – the window of opportunity?

FEMS Microbiology Ecology, 96, 2020, fiz203

doi: 10.1093/femsec/fiz203
Advance Access Publication Date: 9 January 2020
Research Article

RESEARCH ARTICLE

Investigating temporal microbial dynamics in the rumen of beef calves raised on two farms during early life

Eóin O'Hara[1,2], David A. Kenny[1,3], Emily McGovern[1,3,‡], Colin J. Byrne[1,3,†], Matthew S. McCabe[1], Le Luo Guan[2] and Sinéad M. Waters[1,4,*]

Early life intervention

- **First month of life** presents a time-frame during which the rumen microbiome becomes established
- Lasting effects on rumen functionality including methanogenesis, which can extend into later life
- **Meale et al. (2021)** - Early-life administration (oral dose) of dairy calves with 3-NOP from birth-to-14 weeks of life
- Reduction in methane emissions, which persisted to 12 months of age
- Cumulative reduction of circa 150 kg of CO2eq per head in these cattle during the first year of life

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Take home message

- Methane is a potent agricultural GHG
- Promising feed additives being assessed under a systematic approach, for methane mitigation potential
- Potential for early life intervention

Thank you for your attention