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Tasmanian Institute of Agriculture



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Methane Emissions Case Study

Problem-Solving for a More Sustainable Livestock Industry

Resource developed by R. Borojevic* & B. Deans[^] (2024)

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Background

Domesticated ruminant livestock

(including cows, sheep & goats) have been key part of our diets for millennia & will continue to underpin feeding our growing population. They have a unique ability to convert plants that we can't eat into food, fibre and other products. However, in doing so there are several greenhouse gasses that are produced. The main gas of concern is enteric **methane**, which is created mostly inside the 1st stomach (rumen) through digestion of feed.

Greenhouse gases (GHGs) contribute to global warming, with the two main GHGs carbon dioxide (CO₂), & methane (CH₄) as well as nitrous oxide (N₂O).

Relative warming effects

Compared to CO₂, methane has a significantly stronger global warming effect when compared to CO₂ (around 28 times higher than that of CO₂).

However, methane has a relatively shorter lifespan of around 10-13 years,¹ after which it ultimately breaks down to CO₂ in the atmosphere. This CO₂ can then be **absorbed by plants via photosynthesis** and stored as carbon in plants. Overall, this forms a cycle of carbon amongst living organisms.

Methane Emission Sources

There are several sources of methane (CH₄) emissions, including:

- **Fossil fuels** (including from the process of extracting fossil fuels from the earth);
- **Ruminant livestock** (cows, sheep, and goats) from the digestion of feed (particularly those with high levels of fibre such as grass).

In addition to the above sources, other lesser sources include from wetlands & food waste.

From Pasture to Food & Fibre

Pastures (grass, legumes & other feed crops) are feed sources that ruminants can digest, whereas humans are unable to. This is important, as people can grow pastures in many locations globally that we cannot grow crops for direct human consumption. Pasture types also includes both **native grasslands & improved pastures** (planted by humans).

Ruminants can also eat byproducts as feed sources, examples include the highly fibrous leftover stalks from grain crops or leftover hulls from almonds to produce food & fibre.

Image: A cow having a drink on the way to being milked at TIA's Dairy Research Facility at Elliott, Northwest Tasmania, where livestock trials on emissions reduction are being conducted. (Credit: J. Hills)

LIVESTOCK EMISSIONS

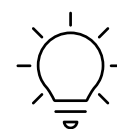
Livestock emissions is a **developing field of research** & our understanding at local, national & global levels are continually developing.

The following **short video** explains how methane from livestock sources contributes to climate warming differently when compared to other emission sources:

- [Suggested video](#) (5 min) (CLEAR Centre, UC Davis)²
- More information on the **biogenic carbon cycle** can be found via this [UC Davis CLEAR article](#).³

By-products for many uses

In addition to providing milk, meat & wool, livestock also produce a range of by-products that are developed across the value chain. These include:



- Blood & bone fertiliser
- Gelatine (e.g., ice cream)
- Leather
- Chinese medicine
- Beauty products
- Pet food

For more information, contact the authors: *R. Borojevic: rohan.borojevic@utas.edu.au (Industry Engagement Lead, TIA); ^ B. Deans: Bianca.Deans@utas.edu.au (Education & Work Integrated Learning Officer, TIA).

References: 1. IPCC (2023). Szopa, S., V. Naik, B. Adhikary, P. Artaxo, T. Berntsen, W.D. Collins, S. Fuzzi, L. Gallardo, A. Kiendler-Scharr, Z. Klimont, H. Liao, N. Unger, and P. Zanis, 2021: Short-Lived Climate Forcers. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 835-6. 2. CLEAR Centre, UC Davis (2020). [Why methane from cattle warms the climate differently than CO2 from fossil fuels](#). 3. CLEAR Centre, UC Davis (2020). [Rethinking Methane](#).



Above: University of Tasmania Agricultural Science students monitor lucerne pasture.

The Challenge & Potential Solutions

Under increasing pressure to become more sustainable, international supply chains & governments set bold targets to reduce emissions associated with livestock products, as well as ingredients along the value chain.

The challenge – it's complex!

To achieve these bold reductions, we will need to alter production systems. However, in doing so we don't want to negatively impact several interconnected factors such as: farm financial viability, animal health, welfare and production or food safety. Some reduction practices are higher risk for this than others.

How we might get there?

To substantially reduce emissions directly from our livestock, we will likely need to use a **range of different methods** in combination, such as:

- **Breeding more efficient animals** that produce more from the feed they eat
- **Growing healthier animals** that are more productive
- **Improving animal fertility & breeding strategies** so that animals using resources are those contributing to production
- **Increasing the digestibility** of the animal's diet to increase production
- **Using a specialised feed additive** that reduces methane produced

Feed Additives: a Deeper Dive⁴

There are different **ways that feed additives work** in the cow's anaerobic first stomach (the rumen) to reduce emissions.

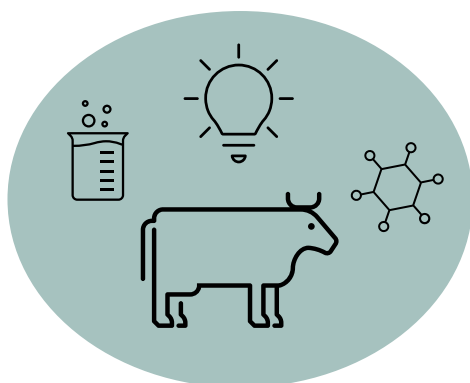
They are generally classed into two categories, based on the **'mode' of action**:

1. Inhibitors

Inhibitor products have the potential to reduce reasonably high amounts of methane. However, removal of hydrogen gas (H₂) is essential, as its accumulation in the rumen can impact biological functions that are essential for maintaining a healthy rumen ecosystem.

2. Rumen modifiers

Rumen modifiers often result in favourable changes in the rumen environment. In addition to decreasing methane, they may also improve animal productivity & health.



Methane-Reducing Additives

A range of emission-reducing agents are currently being researched include:

Inhibitors

- **Bromoform** (from *Asparagopsis* seaweed, or synthesised)
- **3-nitroxypropanol** (3NOP Bovaer®)

Rumen Modifiers

- **Agolin Ruminant®** (plant extracts)
- **Polygain™** (Polyphenols from sugar cane & blend of other active ingredients)
- **Tannins, flavonoids, saponins, and essential oils**
- **Biochar**

In addition to these examples, there are many others that are at various stages in the research & development pipeline.

Balancing Act

As mentioned, there is a need to maintain the **financial viability** of a farm operation. As it costs money to buy feed additives, plus any additional labour or infrastructure costs associated with this strategy, a balance needs to be struck between **financial cost & benefit**.

Monitoring Impacts: A key step to produce a win-win is through measuring impacts on emissions over time that can be quantified. By demonstrating reduction of emissions, this can have several benefits for producers including: maintenance of market access, potential premiums (value of a product), or the ability to generate a credit (known in Australia as an Australian Carbon Credit Unit, or ACCU) that can be traded.

However, there is **no 'double dipping'**! Once an ACCU is traded, it cannot be used by the creator of the ACCU as an emissions offset.

Some food for thought!

Reference: 4. CLEAR Centre, UC Davis (2021). [How can cattle feed additives reduce greenhouse gas emissions?](#)

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