10 Steps

Reducing the carbon footprint of **Tasmanian dairy**

10

Keep learning – New Technologies and potential solutions

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> **More food will be eaten in the next 50 years in the world than for all of humanity combined and presently we only know how to produce 30% of this**
>
> Chris Russell – Australian Agricultural Scientist – Agriminders podcast trailer

The task farmers face in terms of feeding the world is a large one. But the challenge is wider than simply producing food; it is increasingly important that it is produced in an environmentally sustainable and ethical way. Consumers, and society in general, are influential drivers of this shift in focus for food production, while policy makers and regulators are becoming increasingly involved at a governmental level.

More changes in the way we farm are ahead, and farmers will continue to adapt and change their businesses to succeed in this new landscape – one that sees food production as only one part of the farming process.

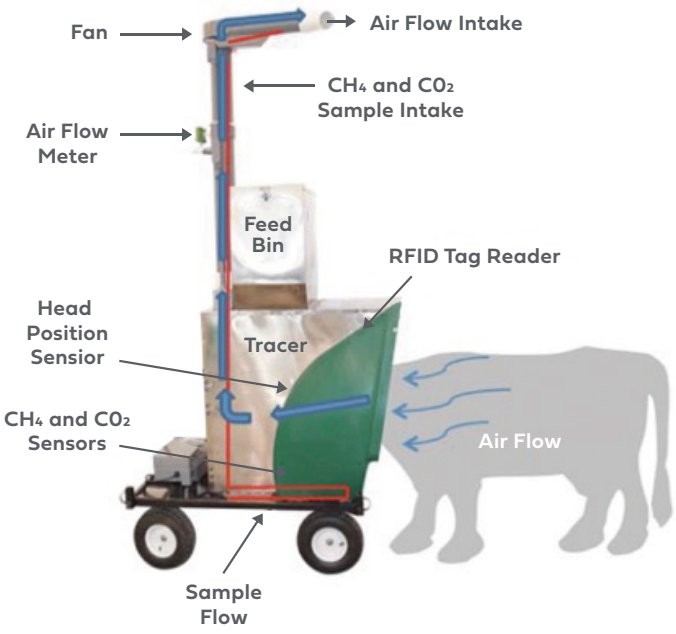
Emerging technologies will help farmers reduce their emissions footprint - a number of such exciting technologies summarised here.

1. Animal genetics

Establishing breeding values for methane could assist in breeding low methane cows. Collaborative research between LIC and CRV, funded by the New Zealand Agricultural Greenhouse Gas Research Centre, is in its early stages[1]. In 2021, 300 dairy breeding bulls are being measured for feed intake and methane emissions in a large trial with the aim of establishing a methane breeding value. Identification of genetic markers in relation to methane could also assist in breeding animals that are lower methane emitters. Further work will be required to measure intake and methane emissions from daughters from these bulls to understand the heritability of the trait.

The Resilient Dairy[2] project in New Zealand, which aims to increase cow longevity, will have potential benefits for emissions reduction per kg milksolids produced. Findings from this could have benefits for Tasmanian dairy farmers.

A photo of the feed intake and GreenFeed methane machine in the Young bull methane trial.



A schematic of the GreenFeed methane measuring machine being used in the New Zealand young bull methane trial.

2. Methane Inhibitors

a. **Feed Additives –** The goal of feed additives is to supress methanogens which live in the rumen producing methane which will then be belched or erupted through the cows mouth. Worldwide there are a number of feed additives being researched to reduce methane emissions from cattle. Some are being trialled in Tasmanian dairy farm systems. For feed additives to be used they need to be tested for their effectiveness, and their safety to be given to animals, both for the animal itself and for humans consuming products like milk and meat from the dosed animals.

i. **3-nitrooxypropanol (3 – NOP),** Dutch company Royal DSM are trialling a feed additive that cuts the methane output level by as much as 30%. Trial results in confinement system dairy and beef farms in Netherlands and Canada show promising results. Pastoral system research is also underway. "New Zealand's AgResearch Institute has been working with Royal DSM and Fonterra over the past three years looking into the development of a pasture-based model for Royal DSM's additive 3-NOP, investigating a number of formulations and feeding models," says AgResearch principal research scientist Dr Peter Janssen[3]

ii. **Seaweed -** Seaweed has been shown to have the potential to reduce emissions from cows, laboratory testing led by CSIRO, has shown seaweed to have the potential to reduce the emissions from cows by more than 80 per cent[4]. Fonterra is trailing the use *Asparagopsis*, a seaweed grown naturally in Australia and New Zealand, as a supplement feed for herds in Tasmania. Fonterra Australia Sustainability Manager Jack Holden says "Most dairy farming emissions come from the methane cows produce as they digest their feed. "Early testing shows the potential for these emissions to be reduced by incorporating natural seaweed into cows' diets, so we are keen to see if those test results can be replicated in dairy herds at scale," says Holden.
However, a concern is that the active ingredient in this seaweed is bromoform- a suspected carcinogen and ozone-depleting substance.

Research is currently underway to see if feeding cows this seaweed causes any health concerns to the cows, and whether if any harmful residues are found in milk or meat product could effectively and safely reduce methane emissions.

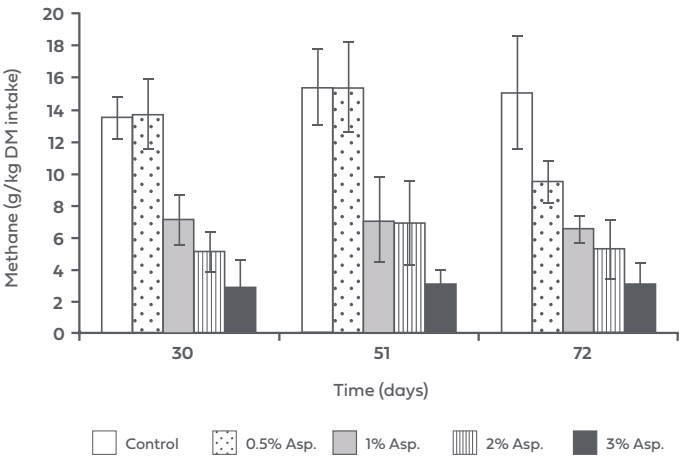


Figure 1
Mean (±s.e.m.) methane emissions (g/kg DM intake) measured at three intervals throughout the experimental period for sheep offered a pelleted diet with 200g of crushed lupins and increasing inclusion levels of *Aspatagopsis* (Asp.) (0% (control), 0.5%, 1.0%, 2.0% and 3.0% organic matter basis), with and without *Asparagopsis* (Asp.) on a daily basis.

(Xixi Li , Hayley C. Norman, Robert D. Kinley , Michael Laurence, Matt Wilmot, Hannah Bender, Rocky de Nys and Nigel Tomkins B,E, CSIRO PUBLISHING, 2016).

3. Vaccines

The goal of a methane vaccine is to trigger an animal's immune response to generate antibodies that supress the activity of methanogens in their rumen. It is complicated method to develop and difficult to evaluate the real effectiveness of this potential vaccine. This technology has been considered promising by many authors, and more research is needed to reach a rigorous conclusion on its feasibility, practical implementation, and sustainability[5].

4. Low Methane feeds

Work is underway to develop feeds and feeding strategies that result in reduced GHG emissions from ruminants in grazing based dairy systems such as in Tasmania. In Australia, feeding wheat reduced enteric methane from dairy cows by 49–78%, relative to feeding other grain supplements (Moate *et al.* 2017), and in New Zealand the feeding of forage rape and fodder beet reduced enteric methane emissions by 20–30% (Sun *et al.* 2015; Jonker *et al.* 2017). Research is ongoing in the area, as the practical impact of feeding low methane feeds can be challenging on pasture-based dairy farms.

5. Genetic Modification

While not permitted for commercial use in Australia currently, using genetically modified crops and potentially animals could deliver some significant benefit around reducing emissions. A genetically modified high-lipid ryegrass has been bred by AgResearch, New Zealand, with research currently evaluating the effect of the increased lipid on enteric methane emissions - Initial modelling is suggesting the grass may lead to a 15% reduction in methane emissions per kilogram of feed consumed, and a 10% reduction in nitrous oxide emissions. No published data available yet.

6. Alternative Proteins

Feeding the ever-growing world population with our current consumption levels is going to require more animal production worldwide. The pressure on resources and the environment may mean that, in time, consumer habits change to food which is perceived to be more environmentally sustainable or potentially cheaper. While alternative proteins may make up some of these options, traditional proteins such as dairy and red meat may sell to more wealthy consumers, especially in the case of dairy, with its high nutritional value. The movement toward plant based and alternative proteins has even seen large dairy companies such as Danone and Fonterra[6] invest in either their own or outside businesses which have research or products in these areas.

> Of the 100 largest economies 69 are companies and 31 are countries. Government policy may now be less influential than market forces. By 2050 (or sooner) our supply chain will only buy low emissions. Will it be milk or 'mylk'? GHG emissions are a very real threat to the future of dairy.
>
> **Professor Richard Eckard**

1. **https://www.lic.co.nz/news/pilot-trial-identify-possibility-breeding-lower-methane-emitting-cows-gets-underway/**
2. **https://www.lic.co.nz/about/research/resilient-dairy/, https://www.lic.co.nz/about/research/our-research/, https://www.dairynz.co.nz/animal/animal-evaluation/info-herds-resilient-dairy/**
3. **https://nzfarmlife.co.nz/diet-additive-promising-for-methane-reduction/?mc_cid=759457adba&mc_eid=7cfca08f61**
4. Kinley, R. D., de Nys, R., Vucko, M. J., Machado, L., & Tomkins, N. W. (2016). The red macroalgae Asparagopsis taxiformis is a potent natural antimethanogenic that reduces methane production during in vitro fermentation with rumen fluid. Animal Production Science, 282-289. Available from from: **https://www.publish.csiro.au/an/an15576**
5. Are Vaccines the Solution for Methane Emissions from Ruminants? A Systematic Review. By Victoria Baca-González, Patricia Asensio-Calavia, Sergio González-Acosta, Jose Manuel Pérez de la Lastra, and Antonio Morales de la Nuez. August 2020 **https://www.mdpi.com/2076-393X/8/3/460/htm**
6. **https://www.fonterra.com/nz/en/our-stories/media/fonterra-to-explore-opportunities-in-complementary-nutrition.html, https://www.danone.com/brands/dairy-plant-based-products.html**

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