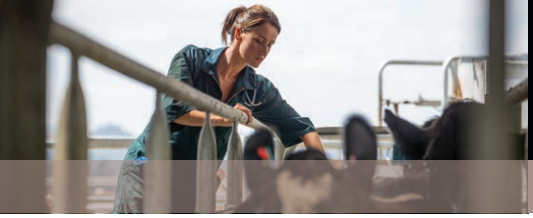

HOW ANIMAL EFFICIENCY IMPACTS ON-FARM EMISSIONS

Introduction

The earth is warming at an unprecedented rate. Global warming is largely driven by human activity causing increased levels of greenhouse gas (GHG) emissions into the atmosphere. The key emissions come from transport, energy production, factories, households, and agriculture.

The main agricultural greenhouse gases are:

Methane (CH_4)
When generated by ruminants it is termed biogenic methane and is mostly emitted when cows burp. It is a short-lived gas, whereas Carbon dioxide (CO_2) and Nitrous oxide (N_2O) are long-lived gases. Methane comprises about 70% of NZ's on-farm dairy emissions.

Nitrous oxide (N_2O)
Released into the atmosphere from dung and urine patches, and nitrogen fertilisers. Emissions increase with the use of nitrogen fertilisers.

Carbon dioxide (CO_2)
Produced by vehicles and machinery, including during manufacture and transportation of feed and fertiliser.

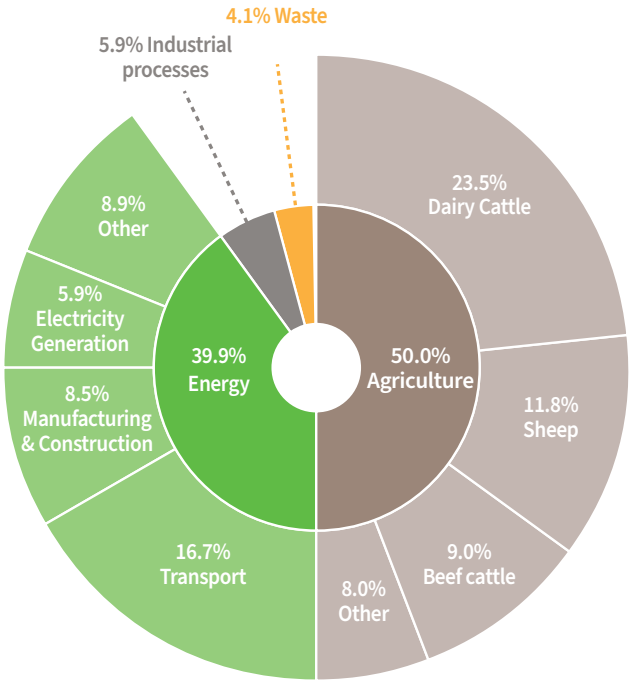

Figure 1. New Zealand's dairy carbon footprint[1]

Half of New Zealand's emissions are from agriculture, including 23% from dairy farming[1] (Figure 1). This is in contrast to most other developed countries where agriculture emissions make up approximately 12%.

New Zealand only contributes 0.17% of total global emissions and has the lowest carbon footprint for producing milk.[2]

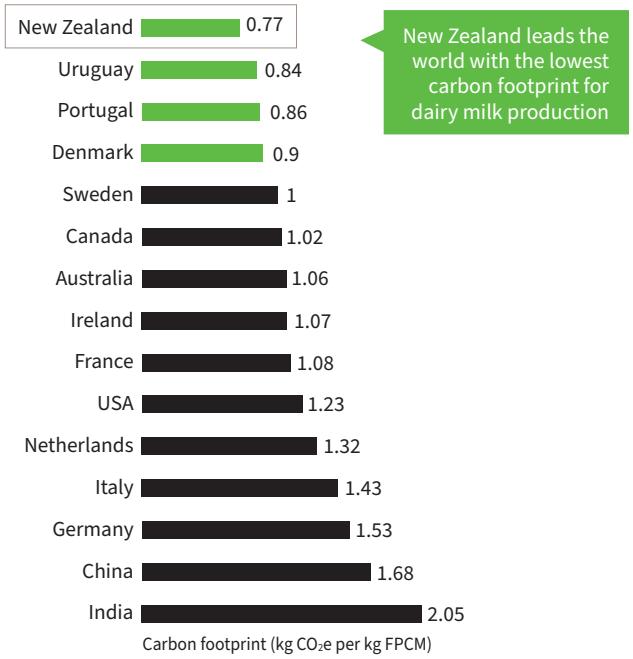

Figure 2. Carbon footprint of milk production from cattle[2]

Why reduce emissions?

Climate change is impossible to ignore, and increasingly countries and businesses world-wide are seeking to reduce their carbon footprint. Global dairy customers have advised Fonterra and other milk processors they require lower emissions per kg of milksolids, and are setting ambitious reduction targets over the next 25 years (Figure 3).

Customer	Target	Baseline
Mars	27% reduction by 2025 Net Zero by 2050	2015
Nestlé	20% reduction by 2025 50% reduction by 2030 Net Zero by 2050	2018
Starbucks	50% reduction by 2030	2018
Unilever	100% reduction of Scope 1 & 2 by 2030 Net Zero by 2039	2015
Yum!	46% reduction by 2030 Net Zero by 2050	2019

Figure 3. Current customer emissions reduction targets[3]

Note: This is not exhaustive & only identifies a small number from a growing list of customers setting ambitious climate related targets

Fonterra initiative to reduce on-farm emissions

90% of the carbon footprint from Fonterra's exported dairy product comes from on-farm emissions (Figure 4). To meet global customer expectations, and for NZ dairy exports to be internationally competitive, on-farm emissions need to reduce.

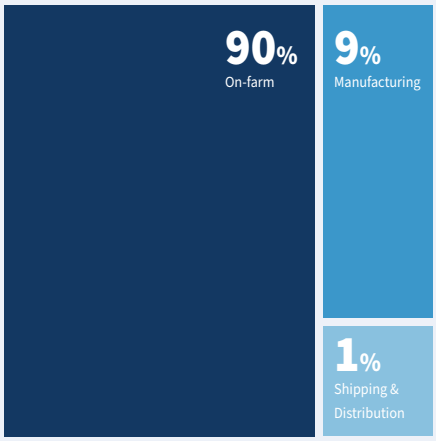

Figure 4. Fonterra's carbon footprint[3]

To support farmers in emissions reduction, Fonterra recently released 'Our Approach to on-farm emissions'[3]. An important goal is to reduce emissions intensity - emissions per kilogram of milk solids (kgMS).

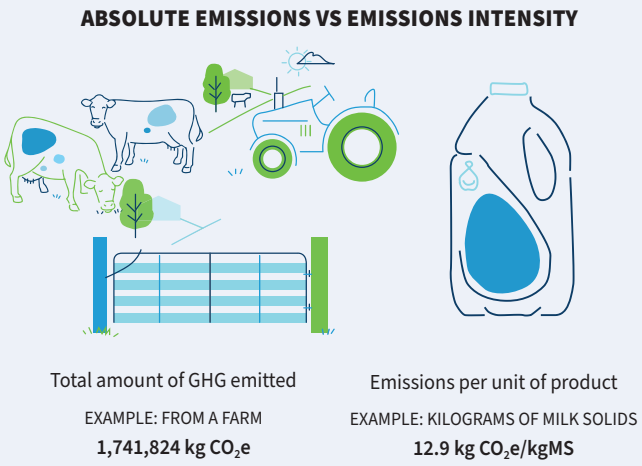

Figure 5. Absolute emissions vs emissions intensity[3]

Fonterra's Farm Insights Report[4] tracks annual farm emissions, which are displayed on both an absolute and an intensity basis[3] (Figure 5).

Improving animal efficiency is a key pathway to reducing emissions intensity, along with nutrient optimisation.

Emissions reduction can be an emotive topic

Along with all New Zealanders, farmers want to ensure the sustainability of our environment, however, how to achieve this is sometimes vigorously debated. Emissions reduction is an emotive topic for farmers for a number of reasons, including concern that the warming impact of biogenic methane is overestimated, and the measurement methodologies are not sufficiently accurate. There is also concern around Government regulations and pricing of emissions.

Regardless of these concerns, the main driver of emissions reduction for NZ dairy farming is customer expectations. Major global food companies are seeking a significant and prompt reduction in emissions intensity from our dairy products, so the time to take action is now. The good news is that there are other benefits of reduced emissions intensity, including improved animal wellbeing and efficiency along with farm profitability.

Animal Efficiency

Efficiency is the relationship between inputs and outputs i.e., the dry matter (DM) eaten for milk solids (MS) produced. The more efficient a cow is, the lower the emissions intensity (emissions/kgMS). The primary goal is for a cow to produce more milk in her lifetime, through more milk per lactation, and more lactations per lifetime.

The key drivers of animal efficiency are health status, reproductive performance and longevity. Consequently, veterinarians have a key role in supporting farmers to reduce disease and wastage, improve nutrition, reproductive performance and milk production. This in turn will reduce waste and emissions intensity, improve animal wellbeing and farm profitability.

What can vets do to help farmers improve animal efficiency?

1. Nutrition

Optimising feed quality and quantity to generate efficient per cow production will reduce a farm's emissions intensity.

Actions:

- Encourage farmers to do a feed budget, and actively monitor pasture cover to maximise pasture quality.
- Monitor Body Condition Score (BCS) of the herd, and use BCS data to adjust feed intakes for individual cows and manage drying off dates to meet targets.
- Refer farmers to a nutritionist for more information on feeding and nutrition.

2. Health

The better the health in the herd, the more likely that cows can maximise their milk production and be more efficient. Mastitis, lameness, metabolic disease, trace element deficiencies, and infectious diseases such as BVD and Johnes, all create wastage and can reduce productive and reproductive performance in a herd. The end result is less kgMS produced, lower early in-calf rates, and higher involuntary culling.

Actions:

- Prevention is better than cure. Partner with farmers to collaboratively develop Animal Health/Wellbeing Plans, and identify areas for prompt action. Include tools to monitor and measure key diseases. Review plans annually with each farmer. The Fonterra Farm Insights Report[4] contains useful health information to assist in this process (Figure 6).
- Cow monitoring technologies can help identify cow health issues earlier.
- Reduce clinical mastitis and help farmers produce more milk of higher quality. Start with teat scoring the herd and develop an action plan using the Ready to Milk resources.[5]
- Reduce lameness prevalence using the Monitor, Manage, Minimise resources.[5]
- When disease outbreaks occur, ensure appropriate action is taken swiftly, and then follow up to monitor progress.

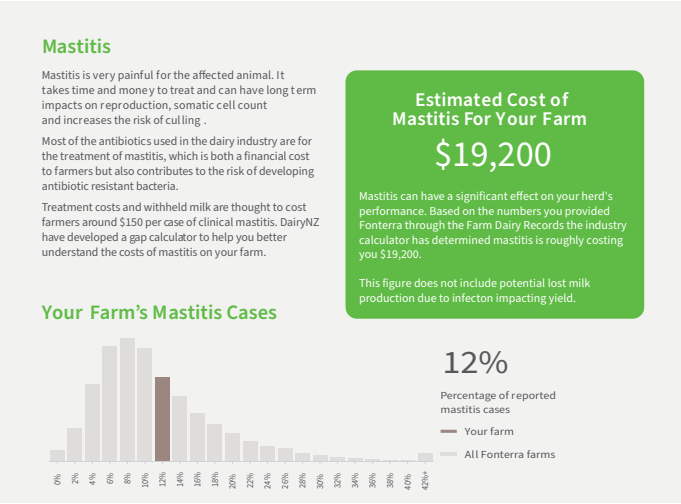

Figure 6. Example of mastitis information from the Fonterra Farm Insights Report[4]

3. Environmental stress

Both heat and cold stress can impact animal wellbeing and milk production. For instance, feed intake can drop in hot sunny conditions, whereas more energy is diverted to keep cows warm during colder conditions. This often results in decreased milk production and quality, which will increase the emissions intensity of milk produced.

Actions:

- Develop an adverse weather plan as part of the farm's animal health /wellbeing plan, including strategies to mitigate heat and cold stress.
  - Options for heat stress include increasing water availability, water cooling options, changes to milking and feeding routines, and access to more shade in the short and long-term. The Fonterra Farm Insights Report[4] contains an estimate of the impact of heat stress on individual farms (Figure 7).
  - Options for cold stress include access to shelter, increased feed intake and provision of a comfortable lying surface.

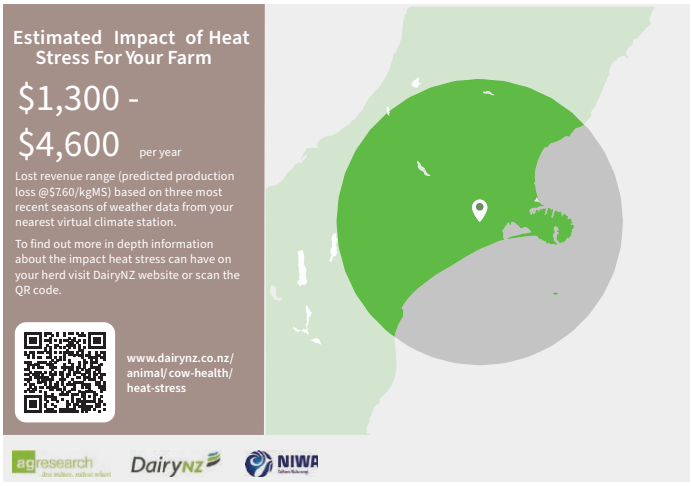

Figure 7. Example of heat stress impact from Fonterra Farm Insights Report[4]

4. Genetics

Animals with a high Breeding Worth (BW) are more efficient as they partition more feed into milk production, with less waste. This also results in reduced nitrogen in urine and faeces and hence reduced N_2O emissions and nitrate leaching , as more nitrogen is used for milk protein production. Additionally, by converting more of the feed into milk, the amount of methane (CH_4) produced per kgMS is decreased.

Actions:

- Ensure farmers have a breeding plan, and track the BW of their cows and herd over time.
- Regular herd testing is useful for monitoring individual cow productivity (and SCC).

5. Reproduction

Good reproductive performance means having more cows in-calf early and fewer cows empty at the end of mating, resulting in more days in milk and reduced emissions intensity.

Replacement rates also contribute to a farm's carbon footprint, as NZ dairy heifers produce emissions for approximately two

years prior to their first calving. A lower replacement rate improves average per cow production, and lowers emissions intensity of the milk produced.

Measuring cow performance helps farmers decide which cows should supply replacement heifers, and which cows should be culled. There is no simple recipe for achieving good reproductive performance. Every farm is different and will require a bespoke reproduction management plan.

Actions:

- Review fertility focus reports with each farmer, and identify areas for improvement.
- Engage with farmers in a collaborative and proactive manner to help improve early in-calf rates, by using Ready to Mate resources (Figure 8).[5]
- Develop a plan with a few key actions that the farmer can follow and reassess throughout the year.

Figure 8. Ready to Mate resources outline the influence of these key factors on mating success, along with targets and tips to lift early in-calf rates.[5]

Summary and Take Home messages

- Climate change is impossible to ignore, and increasingly countries and businesses world-wide are seeking to reduce their carbon footprint.
- Global dairy customers have set ambitious emissions reduction targets and if the NZ dairy sector wants to remain internationally competitive it is crucial that these expectations are met.
- NZ dairy farmers are well positioned, with the lowest global carbon footprint for milk production. However, with approximately 90% of the carbon footprint from exported dairy products coming from on-farm emissions, farmers need to take action now to further reduce these.
- Improving animal efficiency is one of the key ways to reduce waste and emissions intensity (emissions/kgMS), with the added benefits of improving animal wellbeing and farm profitability.
- Vets have a critical role in supporting their farmers to improve animal efficiency and reduce waste in the following areas:
  - Nutrition
  - Health - including reducing mastitis and lameness
  - Environmental stress
  - Genetics
  - Reproduction - including earlier in-calf rates
- Don't forget to ask farmers to share their Fonterra Farm Insights Report[4], there is a wealth of information in these reports to support improvements in animal efficiency.
- Visit the AgriHealth Animal Efficiency page for further resources: www.agrihealth.co.nz/products/animal-efficiency
- For more information on greenhouse gas emissions visit the DairyNZ website: www.dairynz.co.nz/environment/agricultural-greenhouse-gases/

References

[1]https://environment.govt.nz/publications/new-zealands-greenhouse-gas-inventory-1990-2020-snapshot/

[2]Mazetto AM, et al. Mapping the carbon footprint of milk production from cattle: A systematic review. J Dairy Sci. 105:12, 9713-9725, 2022

[3]Our approach to on-farm emissions, Fonterra, 2023

[4]Farm Insights Report, Fonterra

[5]https://agrihealth.co.nz/products/animal-efficiency