10 Steps

Reducing the carbon footprint of **Tasmanian dairy**

7

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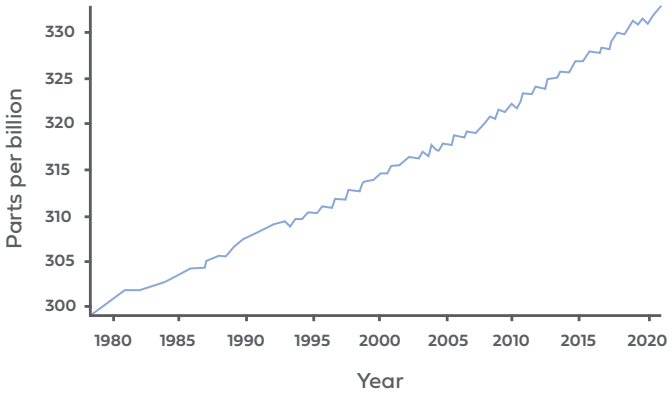
Nitrous oxide emissions on dairy farms can be up to 20-25% of total farm emissions.

Nitrous oxide (N_2O) is a potent greenhouse gas with 298 times the global warming potential of carbon dioxide. It accounts for about 10% of global greenhouse gas emissions, with 90% of these emissions derived from agricultural soils. Nitrous oxide emissions have been steadily increasing this century - see graph from Cape Grim Air Monitoring Station.

Nitrous oxide (N_2O): 332.7 ppb February 2021

Nitrous oxide at Cape Grim, Tasmania



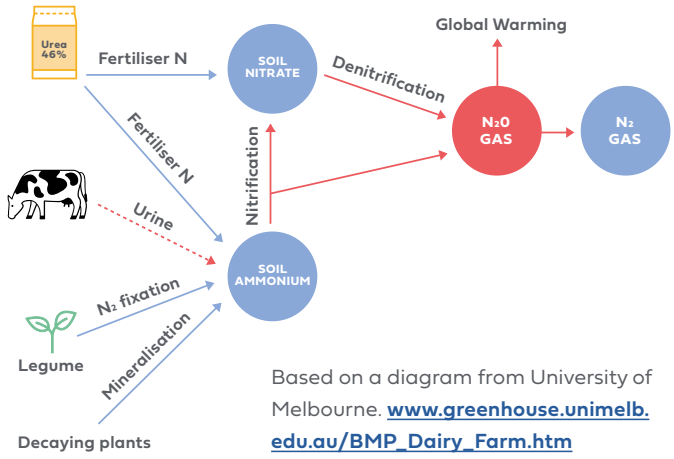
Nitrogen inputs on dairy farms

- Nitrogen is essential in building proteins and for pasture growth. Ryegrass pastures are typically 2.5-4.0% nitrogen. For pasture growth, N must be supplied in the form of either ammonium or nitrate
- It takes about 600kg N to grow 12t DM/ha regardless of where the N comes from
- Legumes (clovers) in a typical pasture can contribute up to 200 kg/ha N
- Mineralisation of organic carbon (OC) can contribute up to 25 kg N/ha for every % of OC
- Soil bacteria and thunderstorms fix small amounts of atmospheric nitrogen (N_2)

80-95% of the N in feed eaten by cows is returned to the pasture in dung and urine. Typically urine patches contain the equivalent of 1000 kg N/ha making them the major source of N_2O losses from grazed pastures. Some N_2O can be produced and lost during the nitrification process when ammonium-N is converted to nitrate-N in the soil.

However the majority of the N_2O emitted from dairy pastures occurs during the denitrification process in wet soils. Under wet conditions, the soils become anaerobic allowing the conversion of nitrate to N_2O and then under waterlogged conditions ultimately to nitrogen gas (N_2).

Nitrous oxide emissions on dairy farms



Based on a diagram from University of Melbourne. www.greenhouse.unimelb.edu.au/BMP_Dairy_Farm.htm

Nitrous oxide on dairy farms

The majority of N_2O emissions come from urine patches in the paddock. There is a lot of research underway on reducing emissions from urine patches, but limited practical advice can be given to farmers at this stage.

Effluent emissions can be reduced with "ready to go, keep it low" effluent management. Avoid full storages and get the nutrients out on the paddock growing grass. Using effluent can replace imported fertiliser use.

Similarly for manure and compost piles. Getting the nutrients out growing grass for milk production can lower overall emissions intensity. Apply at agronomically sensible rates and time applications to avoid high soil moisture.

Dairy exits, boggy areas around water troughs and gateways are other hotspots for denitrification to N_2O. Managing these areas better is a win-win for emissions, cow health, milk quality and farm staff.

Around 5% of farm emissions come from N fertiliser use.

Apply N fertiliser strategically using the 4Rs:

- Right product
- Right rate
- Right time
- Right place

Poor drainage can create anaerobic areas where denitrification occurs. Improved drainage is a win-win for emission, pasture growth and for moving cows and machinery around the farm. Over irrigation can leach excessive nitrates which can then be an indirect source of N_2O emissions.

And don't forget the amazing work that dung beetles do in cycling nutrients on your farm!

Sources

Fert$mart
Making fertiliser profitable

Fert$mart Nitrogen Strategy - right fertiliser, at the right rate, at the right time, in the right place

Fert$mart Nitrogen Strategy

- Urea is currently the cheapest pure SOURCE of N. If P fertiliser is also needed at the same time, di-ammonium phosphate (DAP) is a cost-effective source of N.

- Apply N at RATES of 20 to 50kg N/ha per application, no closer than 21 to 28 days apart. It can also be useful to combine the daily equivalent rate by the interval between N applications (e.g. 1.5kg N/ha per day by 21 days = 32kg N/ha applied).

- TIME N applications for when pastures are actively growing and can utilise the N. Ensure that soil moisture is adequate, rainfall is likely or irrigation is available in the regrowth period, temperatures are conducive to good pasture growth, there is a good species composition and other major soil nutrients are non-limiting.

- PLACE N application where there is a high density of actively growing and desirable (i.e. sown) species. Avoid areas where N responses are unlikely (near gateways, water troughs, shelter belts).

- Ensure that the extra pasture grown is utilised either through grazing or as harvested forage. If you feed the grass, your cows need to eat the grass! Nitrogen applications over 250 kg/ha (544 kg/ha urea) annually need to be considered carefully in terms of pasture consumption. Is consumption more than 10 t DM/ha? Many dairy regions globally now have nitrogen caps below 200 kg/ha.

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