10 Steps

Reducing the carbon footprint of **Tasmanian dairy**

5

Homegrown Goodness

how can farmers practically reduce emissions on farm?

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> It is estimated that biological emissions can be reduced by up to 10 percent for the dairy sector with currently available farm management practices.

DairyNZ, 2020

That's good news for farmers, but what exactly can be done? Feed planning and management is one area where improvements can be made.

Feed itself is not a source of emissions, emissions occur in the production and processing of the feed and the digestion of the feed by ruminants, such as cows. Primarily these emissions are enteric methane, (mostly belched from the rumen, with some in manure), and nitrous oxide which is produced from nitrogen excreted in the cows urine.

Emission levels in dairy cattle are affected by the feed eaten, including type, quantity and quality, and the nitrogenous fertilisers used on pasture and crops. Farmers can utilise these factors to help reduce emissions intensity.

Current mitigation strategies include more efficient growth and utilisation of homegrown feed, use of different feed types and considered application of effluent and fertiliser on your farm. Other solutions may emerge from research work currently underway.

Total enteric methane emissions link directly to the total amount of feed eaten on farm. For every 1 kg of dry matter eaten 21.5 g of methane is emitted. Therefore every management strategy that results in more feed being eaten will increase emissions. Importing feed to your farm system will increase emissions, so if you can grow and eat more homegrown feed you can:

- reduce the requirement for imported supplement,
- reduce costs, and
- reduce total emissions due to the embedded emissions of supplement feed (e.g. from transport, cultivation, processing etc.).

Maximise homegrown and harvested feed

Maximise homegrown and harvested feed. Pasture is still the largest and most economical source of feed on Tasmanian dairy farms. Cows are herbivores and are ideally placed to utilise this feed, while the soil beneath sequesters carbon and acts as a carbon sink. But not all pastures are equal in terms of feed value – metabolisable energy, digestibility and crude protein are the key measures that will affect the emissions associated to the feed when eaten.

Optimising pasture composition, yield and harvest on farm results in maximum pasture quality, feed conversion efficiency and profit on pastoral dairy farms. It represents one of the biggest opportunities to improve emissions intensity and farm profitability to many and is critically important to all. The logical first place to look for reduction in overall emissions is to increase the proportion of the diet that is homegrown feed, i.e. the pasture grown and eaten on farm and therefore reducing supplementary feed requirements.

Matching feed supply and demand is a fundamental principle for profitable dairy farming and central to this on seasonal pasture based farms. Ensure your stocking rate and calving date are matched specifically to your farm in relation to balance date (magic day) and your feed supply curve.

Pasture growth and harvest

Growing and utilising more pasture depends on many farm specific factors. Knowing your current pasture yields per paddock will help to identify poorer performing pastures which may need to be replaced. Investigate these poor performing paddocks to identify if they are 'run-out', weedy, deficient in clover, have poor soil fertility, are pugged or poorly drained, or have other identified issues. It may also be the species or cultivar is not suited to the specific locality or paddock attributes.

When managing your pasture ensure you are hitting targets for pre and post-graze pasture covers. Strategically make and use supplementary feed in periods of pasture surplus and deficit to maintain pasture cover targets. Avoid over-grazing, particularly in very wet and very dry conditions. Ensure the timing and application of irrigation, effluent and nutrients is matched to climate conditions and plant growth. Avoid applying nutrients if soil conditions are too cold, too wet or too dry. To ensure irrigation water is not wasted actively monitor soil moisture levels.

Crops and cultivation

Crops can help increase homegrown feed eaten as long as they yield more than the pasture they have replaced. They can also fill an expected feed deficit and should be used and grazed efficiently. If harvesting and ensiling crops for later use, ensure wastage is minimal and feed quality is maintained.

Some crops have a better environmental footprint than others. Research is underway to better quantify the total emissions associated with different crop types. Fallow ground after crops should be re-planted as soon as practical.

Carbon is lost to the atmosphere when soil is cultivated, so cultivation should be restricted to paddocks where soil structure issues such as compaction are being addressed. Pasture replacement through spraying out and direct drilling has lower emissions. It also retains valuable organic matter in your soil.

Each supplementary feed has a different feed value, cost and emissions footprint. Using the life cycle assessment approach the embedded emissions associated with each supplementary feed can be calculated. These are the emissions associated with growing, producing, processing, harvesting, and transportation of the feed. Figure 1 is an example of the average carbon footprint of supplementary feeds in the Waikato region of New Zealand (Ledgard, 2016). The values are averages and will vary from farm to farm depending on crop yields, fertiliser rates, transport distances, cultivation practices, and harvesting methods.

Fig. 1 Supplementary feeds carbon footprint on farms

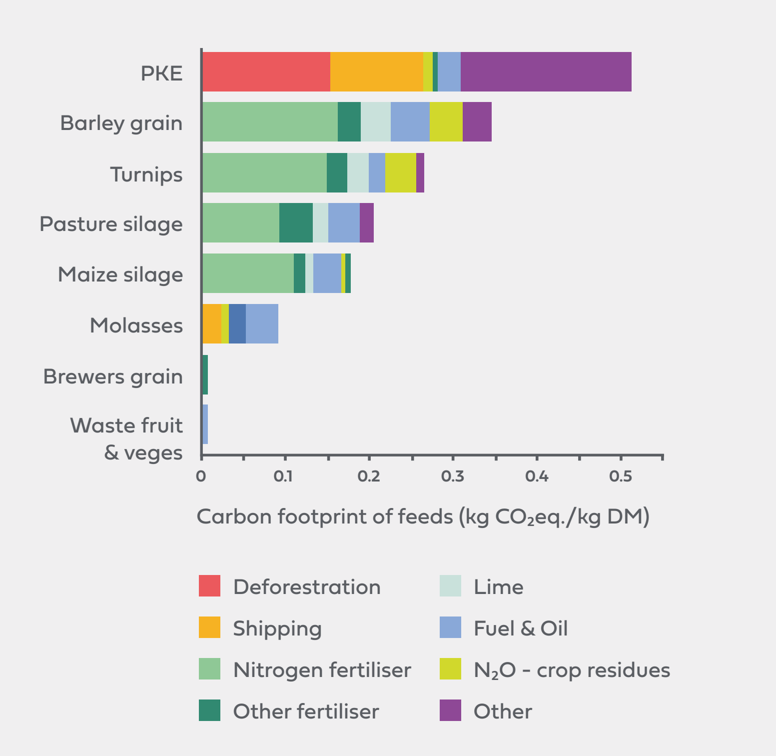

Figure 1
Carbon footprint for the production of various supplementary feeds used on farm (excluding transport to the farm and feeding out on the farm). (Ledgard, 2016)

It is important to consider the footprint associated with the embedded emissions from supplementary feeds and the enteric methane that will result from every kilogram of dry matter brought onto the farm.

Improving diet quality

Any strategy that improves diet quality (metabolisable energy content, digestibility and crude protein) will tend to reduce emissions intensity, such as:

- Improving pasture quality through grazing management
- Increasing the portion of C3 (temperate) species such as ryegrass or fescue in the diet compared to C4 (subtropical) grasses such as paspalum or kikuyu
- Adding grain to a forage diet

Increased metabolisable energy and digestibility will results in more production from the same level of feed and emissions. This efficiency gain will lower the emissions intensity. However, while improvements in pasture management can reduce methane emissions intensity, they often act to increase total farm methane emissions. This is because total feed consumed by cows increases, albeit with higher production levels to dilute the emissions intensity. So farm system changes must be accounted for in any mitigation strategy if total emissions reduction is required.

Higher production levels do not always translate into lower emissions intensity. Using FPCM (fat and protein corrected milk) as a standard measure emissions intensity this work by AgResearch NZ (Ledgard, 2016) showed that with high input systems in the Waikato region the effect of embedded emissions from brought in feed and additional enteric methane emissions were not able to offset by higher production levels.

Fig. 2 **Supplementary feeds Carbon footprint on farms**

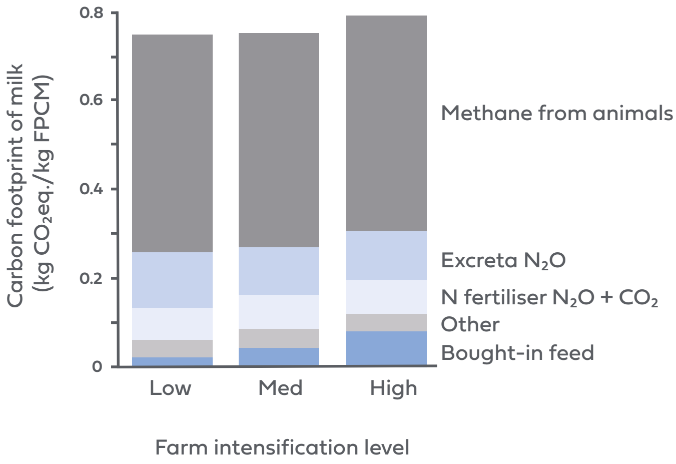

Figure 2
Carbon footprint of milk (fat and protein corrected milk; FPCM) and contributing factors from Waikato farms (2010/2011; from DairyNZ DairyBase) that had low, medium or high levels of intensification based on level of brought-in feed (Ledgard, 2016)

The crude protein content of the diet and animal production levels determines the surplus nitrogen the animal excretes. Excretion is in the form of urine and dung, with nitrous oxide emissions coming from these deposits. Managing dietary protein levels can reduce surplus nitrogen excretion and therefore reduce nitrous oxide emissions. It is important to understand any trade-offs or emissions swapping that may occur when trying to dilute protein in the diet. For example, purchasing low protein supplement feed may come with higher embedded and enteric methane emissions while helping reduce nitrous oxide emissions.

Ledgard, S.F., Chobtang, J., Falconer, S.J. and McLaren, S., 2016. Life cycle assessment of dairy production systems in New Zealand In: Integrated nutrient and water management for sustainable farming. (Eds L.D. Currie and R.Singh). flrc.massey.ac.nz/publications.html Occasional Report No. 29. Fertilizer and Lime Research Centre, Massey University, Palmerston North, New Zealand. 8 pages.

Putting this into practice

New Zealand's Lincoln University Dairy Farm (LUDF) performance provides a good example of reducing total emissions with current management options. The three things LUDF implemented were:

1. Fewer, higher producing, superior genetics cows (not increasing individual liveweight)
2. Reducing supplement feed and nitrogen fertiliser inputs
3. Improving pasture management

The Figure below shows the total carbon footprint of each of the two systems the farm has operated. This already high-performing farm was able to show a 12% reduction in total carbon emissions.

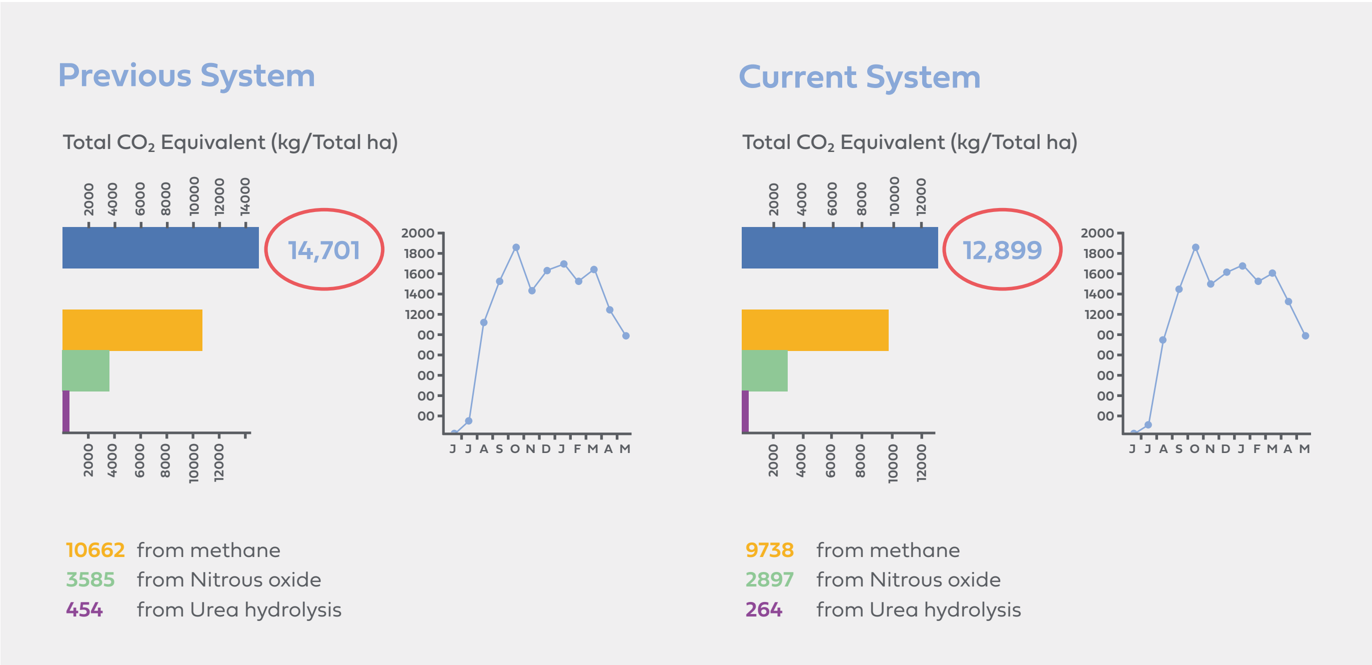

Figure 03
Modelled carbon emissions from previous and current farm management systems on LUDF (LUDF, 2021)

Data from the first completed season resulted in an 8% reduction in total production while operating profit remained similar. You can track the progress of this farm through: http://www.siddc.org.nz/lu-dairy-farm

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