Carbon farming: feeding additives to dairy cows

Montrose Dairy, VIC

This case study is one in a series showcasing how Australian producers are successfully using best management practices to reduce the impact of climate variability, reduce their greenhouse gas emissions and improve productivity.

**Producers:** Graeme and Gillian Nicoll  
**Property:** Montrose Dairy  
**Location:** South Gippsland, Victoria  
**Property area:** 95 hectares used for dairy  
**Enterprises:** Dairy (280 cows)  
**Soil type:** Clay loam  
**Rainfall:** 1,000mm

**KEY POINTS**
- Feeding high fat/oil supplements to milking cows reduces methane emissions by speeding the passage of feed through the rumen, and therefore the enteric fermentation that releases methane.
- These high fat/oil supplements can also increase milk yield.
- Australian dairy farmers can now earn Australian carbon credit units under the Carbon Farming Initiative by implementing dairy feed additives projects.
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DEFINITIONS

**Climate variability** means natural alterations in the earth's climate\(^1\), or the shorter term (daily, seasonal, year-to-year) variations in weather. Australia has a highly variable climate, which includes cycles of wet and dry periods, and droughts. El Niño (dry) or La Niña (wet) events are part of climate variability.

**Climate change** means the long-term changes in average weather patterns, such as the rise in global average air temperatures. It involves a persistent series of unusual or anomalous weather events, rather than simply one or two unusual weather events. The World Meteorological Organisation describes it as when events that used to be rare occur more frequently (e.g. summertime maximum air temperatures increasingly break records each year), or vice-versa (e.g. duration and thickness of seasonal lake ice decreasing with time)\(^2\).

**CO2-equivalent** is a way of measuring the global warming potential of greenhouse gases such as methane and nitrous oxide compared to carbon dioxide (CO\(_2\)). For example, nitrous oxide has a global warming potential of 298, which means that one tonne of nitrous oxide in the air has the same effect as 298 tonnes of carbon dioxide over a 100-year time frame\(^3\).

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**Background**

Victorian dairy farmers Graeme and Gillian Nicoll first measured their dairy’s greenhouse emissions back in 2010, with the results confirming that 60 per cent of their emissions came from methane produced by their 280 dairy cows.

Recognising methane emissions as a loss of energy in their farming system, they ensured they were minimising their losses by following industry best practices – and also trying some new ideas.

More recent developments are opening up ways for dairy farmers like the Nicolls to reduce methane emissions from animals at the same time as improving productivity. For the first time, Australian dairy farmers can earn Australian carbon credit units under the Carbon Farming Initiative (CFI) by feeding high fat supplements to milking cows to reduce methane emissions.

Methane (CH\(_4\)) used to be called ‘marsh gas’. It is produced during a digestive process called enteric fermentation in ruminant animals including cattle and sheep, in which carbohydrates are broken down into simple molecules for absorption into the bloodstream. A grazing dairy cow typically burps up to 600 grams of methane every day.

In Australia, methane from ruminants accounts for approximately 10 per cent of Australia’s total greenhouse gas emissions\(^4\). Methane is 25 times more potent than carbon dioxide in terms of its impact as a greenhouse gas.

However, the problem with dairy farm methane emissions isn’t only their environmental impact. The loss of methane is a direct loss of energy from the farming system. The methane burped by dairy cattle is equivalent to those animals losing between 25 and 40 days of grazing per year, or up to 10 per cent of the total energy consumed by each animal\(^5\).

Dr Richard Eckard, Associate Professor and Director of the Primary Industries Climate Challenges Centre, has been researching strategies for reducing enteric methane and nitrous oxide from intensive grazing systems. One of his aims has been to develop practical feeding strategies that dairy farmers could implement to curb methane emissions.

According to Richard, the loss of methane from dairy systems is a significant inefficiency for farmers. Implementing strategies for reducing such losses are likely to have significant benefits on top of reducing greenhouse gas emissions.

“While some of the solutions we’re examining require much more research, some can be implemented by dairy farmers immediately and are likely to be cost-effective in their own right,” said Richard.

“The four most promising areas for reduction of methane emissions that can be put into place relatively easily are better feeding practices, genetic improvements, more efficient production methods and increased productivity.”

**Better feeding practices**

One of the immediate steps that dairy farmers can take to recover the lost energy of methane emissions is to improve forage quality. This helps enhance feed conversion efficiency and allows feed to pass through the rumen (the large first compartment of the stomach) more quickly, reducing the amount of enteric methane released.

In addition to improving digestibility, adding fat and/or oil products to cattle feed can also reduce greenhouse emissions. This methodology is the first CFI initiative to focus on reducing methane emissions through improving the digestive processes of cows.

The oil/fat supplements being fed to cows are generally by-products such as whole cottonseed meal, cold-pressed canola meal, brewer’s grains and hominy meal. The additives are most effective when correctly timed.
“During the spring period in most dairy areas, pastures are naturally high in oil and nutrition, so adding additional fat won’t have a great impact at that time,” said Richard.

“In summer the natural oil in pastures falls to around 1-1.5% and that opens up the opportunity add high fat feed supplements to the diets of dairy cattle, which will reduce methane emissions during that time.”

The results of high fat additives being fed under the correct conditions have been illustrated in farm trials, which found a reduction in methane emissions, particularly when pastures were low in nutritional value.

“For every one per cent of oil added to a ruminant’s diet it translates to a 3.5 per cent reduction in methane emissions,” said Dr Eckard.

“However the oil has other important benefits too, bringing energy into the diet and improving milk production. Whole cottonseed, for example, also increased milk production by 15 per cent, milk fat by 19 per cent and milk protein by 16 per cent.”

Montrose Dairy is situated close to the coast in the foothills of the Hoddle Range in Victoria.

Experiences of feeding oil to dairy cattle

Graeme Nicoll says he began supplementing his dairy herd’s pasture-based feed system with used vegetable oil back in 2005.

“We buy used vegetable oil locally and add to the feed rations, mainly as a way of reducing dust in the milking shed,” Graeme said. “It’s common around here – lots of dairy farmers do it for that reason.

“It’s a relatively cheap energy source and we account for it in the cow’s dietary budgets – though it is getting a bit more expensive as more people do it. But we are limited by how much we can feed and at what time of the year – so adding vegetable oils doesn’t have a big impact on our production.”

Graeme says that while he wouldn’t add fats to his cows’ diets solely to reduce methane emissions, he is serious about minimising the overall emissions of the enterprise and the greenhouse emission intensity (emissions per unit of production).

“Many of the existing best management practices in the dairy industry improve efficiency and reduce greenhouse gas emissions, so it makes sense to adopt them,” he said.

“We believe the biggest gains come from not keeping poor cows in the herd, ensuring our cows live long and productive lives, feeding high quality diets, and being good managers of our fertiliser applications,” he said.

“Where we see significant outcomes, in terms of greenhouse gas emissions, is in the management of our herd fertility – getting our cows in calf and not having waste cows on the farm.

“Having an efficient system is something we’re always focusing on in all facets of our business – not wasting nutrients in our cows’ diets through to not wasting nutrients through fertiliser.
“Research shows that these methods do work – following these practices on farm is a proven way to reduce greenhouse gas emissions.”

**The next steps for interested farmers**

Farmers who are interested in undertaking a CFI project should download the Dietary Fats Calculator tool to assess the feasibility. The tool allows for an easy estimate of what kind of abatement a project could deliver. Sample pages and built in guidance take users through a step-by-step process for using the tool and understanding the results. If the feasibility assessment is positive, the ‘Undertaking a dairy feed additives project guide’ sets out the next steps.

Richard said that research is continuing into ways for livestock producers to reduce methane emissions from their animals, with promising possibilities existing in breeding for improved feed conversion efficiency, reducing numbers of unproductive animals on farms and extended lactation (cows calving every 18 months rather than every year) as well as using dietary additives.

“Many of these strategies are best suited to intensive production systems like dairying, as cows are contained twice a day and it is relatively easy to alter their diets,” he said.

“We can see that through a range of breeding, feeding and animal management strategies, Australian livestock producers have done a good job in reducing their greenhouse gas emission intensities – meaning their emissions per unit of production – over recent years.

“The amount of milk produced per litre of methane produced by the dairy industry has improved. The challenge now is to reduce the net amount of methane being produced by the industry as well.”

*Montrose Dairy*
For more information

About the Carbon Farming Initiative:


The transition from the CFI to the ERF:

Department of Agriculture’s ERF and CFI page:

Guide to undertaking a dairy feed additives project:

Fact sheet on CFI methodology: Feeding dairy additives to milking cows:


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Young Carbon Farmers is a national project created by rural communication specialists Sefton & Associates, with the Future Farmers Network, and is supported by funding from the Australian Government.
How to claim carbon credits as part of a dairy feed additives project

The Carbon Farming Initiative (CFI) allows farmers and other land managers to earn carbon credits by storing carbon or reducing greenhouse gas emissions on the land. Participants can generate carbon credits by setting up a project under an approved CFI methodology determination, which sets out the rules for the activity.

Participation in the CFI involves five steps:
1. Planning a project
2. Applying to participate in the CFI
3. Applying to have your project declared as an eligible offsets project
4. Reporting and crediting
5. Participating in the market.

Many of Australia’s dairy farmers could use this methodology to generate carbon credits by feeding high fat supplements to milking cows. Eligible farms are those where milking cows are pasture grazed for at least nine months each year.

The methodology involves feeding dairy cows selected high fat feed supplements. These supplements enable better digestion of lower quality feed during drier seasons and result in lower methane emissions. The supplements are canola meal, cold-pressed canola meal, hominy meal, brewer’s grain and dried distiller’s grain, which are the by-products of other agricultural production processes.

The methodology is supported by the online CFI dietary fats calculator, which simplifies abatement calculations and makes it easier for dairy farmers to report and receive credits.

Projects need to meet the following requirements:
1. The milking herd must be in Australia.
2. Milking cows must be pasture grazed for at least nine months each year.
3. The concentration of fat in the diet of the milking herd must not exceed 70 grams of fat per kilogram of dry matter intake in any season.
4. Projects must calculate abatement using the CFI dietary fats calculator.

Farmers must collect data and use the calculator using the instructions in the methodology. The number of milking cows in the milking herd must be tracked and projects must have daily records of the milk production of their herd and seasonal records of the milking herd’s diet (including supplements). It’s important to keep records, because they will be used to assess the abatement that has been achieved by the project and demonstrate that it has been implemented and monitored properly. Projects must be audited by a registered CFI auditor.

The Government has committed to introducing the Emissions Reduction Fund (ERF), which will replace the CFI. Through the Emissions Reduction Fund auction arrangements, the Government will purchase Australian carbon credit units from existing Carbon Farming Initiative projects that are competitive at an auction. This will allow existing participants in the Carbon Farming Initiative to secure a return from eligible projects. Existing Carbon Farming Initiative projects will automatically be registered under the Emissions Reduction Fund.