Livestock emissions – is all the excitement for the wrong reason?

Adrian James, November 2013

Ruminant livestock (cattle, sheep and goats) have been our best way of turning inedible grass and shrubs into food for human consumption for thousands of years, and for thousands of years no one complained.

Like most things, that's changed.

Livestock industries are "under attack" over greenhouse gas emissions, namely methane coming 'out the front' and nitrous oxide coming from what goes 'out the back'

But don't get defensive, this is one issue you'd want to improve whether there were activists behind it or not. You see, both of those gas emissions lead to potentially costly productivity losses.

Livestock scientists have proven over and over again that when livestock methane emissions are reduced, liveweight gain, milk or wool production is increased (FAO, 2013). This is because methane is rich in energy - energy, which comes from pasture and feed that could otherwise be used by the animal for its growth and vigour.

The good news is that ruminant livestock producers have plenty of options to look into. Let's start with methane.

Methane (CH_4) is a gas, which you could use to run your car, so long as the engine has been converted. The pundits say the average dairy cow emits enough methane each year to power a car for over a thousand kilometres. Multiply that by numbers in the herd and that's a fair bit of lost

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"Reducing land sector emissions and effecting the Carbon Farming Initiative in Tasmania" is supported by funding from the Australian Government Department of Agriculture

energy. It's worth a moment's thought as to how much extra milk the herd could produce if that energy was able to be harnessed in the system.

The reason ruminants emit all that methane is because their foreguts are colonised by really specialised bacteria that very efficiently remove excess hydrogen (H) out of feed through the animal's gut. There is a lot of hydrogen in carbohydrates, and in the rumen the hydrogen could end up going in different directions. It could be used by the animal for energy, it could combine with nitrogen in protein and end up as ammonia (NH_3) in manure (fertilising the pasture) or it could combine with carbon and get emitted 'out the front' as methane (CH_4). The thing that makes energy efficiency in the animal difficult is that the bacteria that create the methane are so efficient; in fact, they tend to dominate other processes and produce methane as a by-product.

Rumen ecology is incredibly complex and while several bunches of particularly clever scientists are working on vaccines and other ways to strongly suppress methane production, their future solutions are not something you'll be able to include in your 2014 production cycle. The odds for 2015 aren't great either.

Hold on, didn't I mention there were lots of options available now?

With methane from livestock, those options generally involve feed and animal management. Energy density of pasture and other feeds are important. Low energy feeds such as straw end up producing more methane and achieve less growth than a vigorous ryegrass and clover pasture. Matching protein intake also has an impact, as high levels of feed protein tend to dilute energy levels in the rumen. Balancing the energy to protein ratio is well suited to intensive livestock production where large quantities of feed supplements are provided, but is more difficult to achieve in the paddock.

One helpful option is growing legumes that contain condensed tannins in their leaves. Tannins suppress methane-producing bacteria and bind onto proteins, improving protein conversion and reducing methane emissions. Pasture legumes containing tannins include trefoil, lotus, serradella and sulla. Ask your local agronomist if any of these legumes are suited to your soil, climate and production system.

Fats and oils in feed have similar methane-reducing effects, up to a point. Too much fat in a ruminant's diet suppresses feed intake. Some intensive production systems provide oils (such as in canola meal) as supplementary feed but it's important to balance that against fats already contained in the pasture. Feed testing and specialist nutrition advice would be useful if using fats and oils to reduce emissions.

Regarding livestock health, reproduction and management, reducing emissions comes down to each animal's lifecycle. As livestock are eating and emitting methane every day just to stay alive, the faster they grow and the more young they produce, the lower their life-long emissions will be relative to the product sold. For example, a ewe which reliably produces healthy twin lambs each year has vastly lower emissions per kg of lamb sold compared to a ewe with suspect fertility. Likewise, when growing steers out it pays to have them on the best, balanced feed as they'll lose less energy per kg of dry matter consumed, and be losing that methane energy for fewer days before they're ready for market. In other words, improving feed conversion efficiency will not only reduce emissions intensity but also improve productivity.

Like Matthew Pitt, a farmer in the Derwent Valley said "I'd encourage livestock producers to improve their stock and grazing management to minimise release of greenhouse gases and improve the farm's bottom line".

Reducing methane emissions per animal will reduce the whole flock and farm's net emissions. This would be a small help in Australia meeting its greenhouse reduction commitments. Reducing emissions usually leads to higher productivity and therefore livestock producers may have the opportunity to increase their stocking rates. While reducing emissions per animal and increasing stocking rates would lower the emissions per kg of product sold, it could also increase the farm's total emissions. This situation could be avoided in some circumstances by setting land aside for revegetation offsets, while taking advantage of the productivity increase on a smaller amount of land.

Now, for nitrous oxide. This is another powerful greenhouse gas, which leaves the farm and enters the atmosphere when soil nitrogen (e.g. nitrogen from urine, manure, legumes, bacteria or fertiliser) combines with oxygen and loses the oxygen combination. This is nitrification and denitrification. Most nitrous oxide emissions come from denitrification, which occurs rapidly when the soil is warm and waterlogged. Luckily in Tasmania, pastures are usually waterlogged in winter. Irrigated pastures are another matter, where it's best to follow industry guidelines on efficient irrigation management, including variable-rate irrigation and soil moisture monitoring.

There's a lot of nitrogen in protein, so high protein feeds mean more nitrogen coming 'out the back', which leads to more nitrogen lost. It's unfortunate that a lot of lush spring pastures have very high protein levels, far exceeding what the animal requires, especially when it takes nitrogen fertiliser to get those protein levels. Matching feed protein and energy to the animals' requirements will help to optimise feed usage as well as minimise nutrient losses.

Tannin-containing pasture legumes are again a potential winner in this scenario, as they provide some free nitrogen to begin with, and inside the livestock's guts the tannins also partition excess nitrogen into the faeces instead of urine. Nitrogen in solids recycles more slowly and are less likely to be lost as nitrous oxide, compared to the nitrogen in urine.

That's just the beginning, but as this article is rapidly running out of space it's going to have to finish on three points:

1. Greenhouse gas emissions from livestock are clearly constraints on productivity
2. There are lots of ways livestock producers can improve their productivity and reduce emissions at the same time
3. Contact the author or their Carbon Farming Initiative Extension and Outreach colleagues to find out more and get individual advice on how it can best work on your property

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This article has been produced for a project supported by funding from the Australian Government.

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