On-Farm Understanding for Farmers

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Mitigating methane emissions from ruminants - the current science.

Climate Change and GHG emissions

Compared to many other developed countries New Zealand has a unique greenhouse gas (GHG) emissions profile, with a high proportion of our GHG emissions coming from agriculture. The challenge of reducing agricultural emissions is being addressed, in part, by investigating strategies that might reduce the amount of methane emitted from ruminant livestock. Methane is emitted by microbes called methanogens as they assist in digestion of fibrous food in the rumen. The current lead approaches to finding a way to reduce methane emissions from ruminants include selecting livestock with low methane emissions per unit of feed intake and manipulating rumen function by better understanding of the function of microbes in the rumen. This research has lead to developing inhibitory compounds and conceptually a vaccine against methanogens. Research on forage quality is also being conducted. On a different scale, research with a focus on efficient farm systems, as way of reducing methane emissions, is underway. It is important to understand that some of the research strategies mentioned in this fact sheet may not lead directly or immediately to on-farm reductions in methane emissions and it could be many years before the strategies are ready for uptake on-farm.

Mitigation science

Reducing the GHG, including methane emissions, from ruminant livestock, is an important research focus for agricultural based economies.

Can we change the animals?

Scientists have found that some animals emit less methane for a given feed intake compared to others, and research is underway to discover what makes the animals that emit less methane different from animals that emit more methane. There appears to be an unconfirmed link between feed conversion efficiency and methane emissions of ruminant livestock. Research is underway to investigate how much breeding can be done to select animals that emit reduced levels of methane for a given unit of feed eaten. The challenge is to avoid a selection process that depresses other productivity traits and breeding goals.

Some of the other strategies under consideration are to reduce the number of unproductive animals on farm, for example, by extending dairy cow lactation or finishing beef cattle as early as possible.

Can we change what happens in the rumen?

Although much of the research is in the early stages, attempts are being made to change the microbial populations in the rumen. Some options under investigation have been to look at bio-control by introducing competitive or predatory microbes that displace the methanogens or to administer chemicals that simply kill the methanogens. Another angle of research has been to use the principles of vaccination to stimulate a response in the rumen to the presence of methanogens that would make conditions unfavourable for methanogens. There are concerns about the public acceptability of *some* of these options, and whether they would be commercially viable either because they are expensive options or the effects of the treatment do not last for a very long time.

Can we change the animals diet?

In theory, if the quality of the livestock diet is improved this may lead to more efficient digestion, better animal productivity and a reduction in methane emissions. Investigations are underway to look at establishing new plant species or breeding low fibre and high sugar varieties of existing species. The impact of plant compounds such as tannins, oils, pro-biotics, and enzymes are also being investigated. The challenges around introducing novel feed to animal's diets include the possibilities of unintended consequences to other parts of the farm system, as well as costs, availability and practicalities of feeding animals these novel substances and plants.

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Farm system strategies to reduce methane

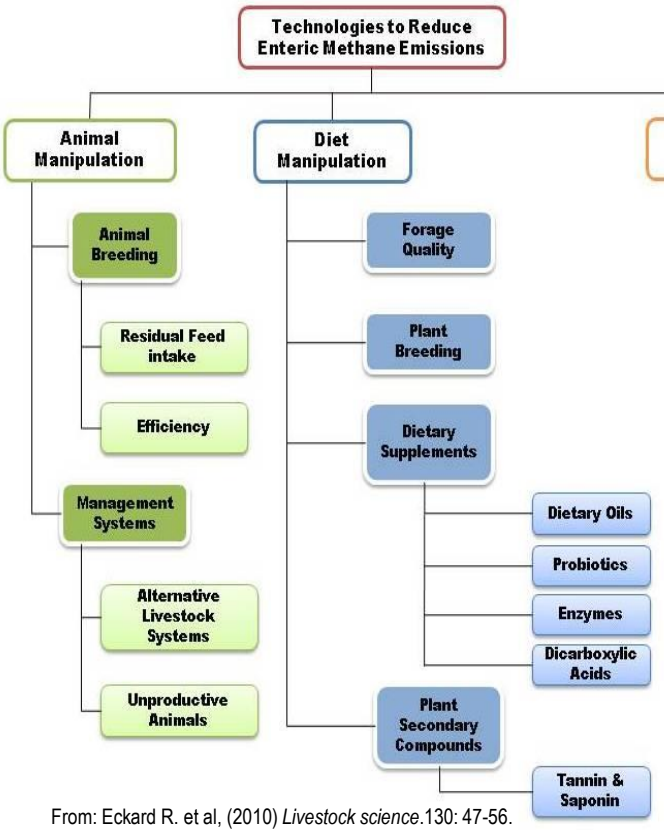
An important part of research into methane mitigation options is testing the different options for whole farm systems using model simulations to picture a range of possible outcomes. It is important to look at the impacts of any particular strategy to reduce methane emissions from farms and farm products to ensure that it does not increase GHG emissions somewhere else in the life cycle of the product. For example, adding grain to a ruminant's diet will decrease the fibre intake, increase animal growth rates and decrease the amount of methane produced during rumination but the total carbon costs of growing, transporting and feeding out the grain might be more than the carbon costs of feeding the animals permanent pasture.

Combining Strategies to reduce methane

It is thought that where the strategies to mitigate methane emissions act at different points in the farm system, their impacts might be additive and might significantly reduce methane (and other greenhouse gases) emissions. For example, if each methane mitigation strategy alone is likely to reduce emissions by a small amount, then combining several strategies (such as,breeding dairy cows for improved feed conversion efficieny, adding oil to their diet, and extending their lactation) might result in a substantial reduction in methane emissions. At present most of these strategies appear to be more suited to intensive farming systems than extensive systems because the costs of the interventions are more easily off-set and managed by intensive systems.

Key Points

- Many of the strategies to reduce emissions under investigation at present are a long way from being available to farmers. Pathways to discovery are not easy to navigate.
- Many of the strategies have not yet been assessed across the whole farm system they would impact on.
- One dilemma is that improved on-farm efficiencies may be seen as an opportunity to increase the stocking rates and could lead to ***no*** overall reduction in methane emissions at the farm or national scale.
- The strategies for reducing methane emission from pastoral agriculture being investigated are;
  - animal breeding,
  - diet quality,
  - targeting methnogens in the rumen.



From: Eckard R. et al, (2010) *Livestock science*.130: 47-56.

Further reading

Eckard,R. et al. (2010) Options for the abatement of methane and nitrous oxide from ruminant production: A Review. *Livestock Science*. 130: 47-56.

Buddle, et al. (2011) Strategies to reduce methane emissions from farmed ruminatns grazing on pasture. *The Veterinary Journal*. 188: 11-17

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