Agricultural Greenhouse Emissions Project

Emissions: Methane

Methane is a potent greenhouse gas; one kilogram of methane is equal to 21 kilograms of carbon dioxide. Methane is a gas generated by a group of microbes called *methanogens*. These microbes live in anaerobic conditions (little or no oxygen) such as the rumen and as a result methane is mainly belched out by the cow (enteric methane).

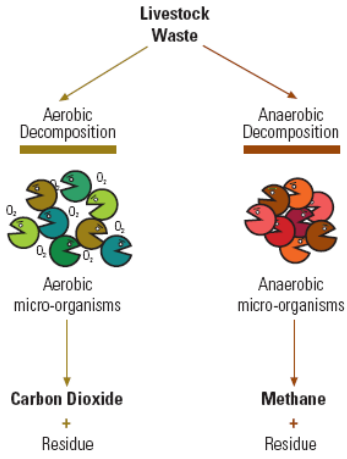
One tonne of Methane has the same global warming potential as 21 tonnes of Carbon dioxide

Aerobic Vs Anaerobic

The amount of greenhouse gas produced is determined by whether the decomposition of waste occurs under aerobic or anaerobic conditions.

Aerobic conditions (presence of oxygen) are more common in actively composted manure stockpiles, dry aerated deep litter, treatment ponds with low volatile solids content and ponds with active aeration.

Anaerobic conditions (little or no oxygen) occur in the rumen, wet manure, compacted stockpiled manure, saturated deep litter, treatment ponds with high volatile solids content and in airtight digesters.



Anaerobic decomposition can be expected to result in larger greenhouse impacts than aerobic systems, due to the greater global warming potential of methane.

(Farming for the Next Generation – Guidance for Managing Greenhouse Gas Emissions, 2008)

Best Practice Measures:

Reducing Animal Numbers / maintaining production

An obvious management practice would be to run fewer animals, but to manage each animal to be more productive. **By improving genetic and nutritional management, production can be maintained from a smaller herd.** A range of techniques can be used to achieve this.

One example involves managing extended lactations in dairy cows. With the shift towards North American genetics in the Australian dairy herd, farmers are finding it increasingly difficult to get their cows in calf within a 12 month cycle. This research has shown that these cows could be milked on an 18-month to 2-year inter-calving interval with only a 1 to 10% loss in annualised milksolids, respectively (Auldist *et al.*2006).

In this management system there are less replacement heifers required and a reduced period with dry cows. This means that the farm needs fewer cows in total, has less unproductive cows at any one time and thus less methane in total and less methane per litre of milk produced.

Improving Diet Quality

Methane producing rumen microbes thrive on highly fibrous feeds (eg. mature pasture, tropical grass and hays). These low digestibility diets ferment producing large amounts of hydrogen gas, on which the methane-microbes thrive. In contrast, cereal grain concentrates ferment to produce little hydrogen gas and a highly acidic rumen, both of which are restrictive to methane producing rumen microbes. **Ensuring a high quality pasture** (i.e. high quality ryegrass rather than Setaria or Paspalum) **will cause cows to eat more, produce more, and produce less methane per unit of output.**

Generally, the lower the quality of the diet the more methane is produced.

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Feed Additives: Oils

The addition of dietary oils has some potentially exciting production and environmental benefits. Scientific trials suggest significant benefits from up to 5-7% of dietary intake being made up of oil. For example;

- **For every 1% of Oils in the feed (up to 6% of the diet), methane is reduced by 6% Beauchemin et al 2008 Eckart**
- Research completed at the Ellinbank Dairy Research Centre by Chris Grainger and the Greenhouse in Agriculture Project has demonstrated that feeding whole cotton seed to dairy cows being fed on summer pastures **reduced methane emissions by 12% whilst increasing milk solids by 16% (Grainger *et al* 2008a cited in Eckard *et al* 2008).**
- Likewise feeding **tannin extracts from the black wattle to dairy cows on lush spring pasture was shown to reduce methane emissions by up to 29%,** while also reducing urinary **nitrogen excretion by up to 59%** (Grainger et al. 2008b)
- Grapemark is a wine industry by-product used as a feed additive, that is high in energy and in tannins which can reduce methane and nitrous oxide excreted through dung and urine
- **Pasture species with improved digestibility (less fibre) means cows eat more and then make more milk (or meat)** – low digestible feeds such as mature pasture and hay produce lots of hydrogen in the gut, which the methane microbes love.
- For dairy cows, high energy, low protein feed concentrates are both hostile to the methane microbes and decrease the amount of pasture required – both lead to less emissions.

Specific medium chain fatty acids, such as those found in coconut oil, **effectively poison ruminal methane producers reducing methane production.**

It should not be expected that protected or insoluble fats (eg. Megalac™) will reduce methane production since they are especially formulated to be rumen inert.

While free polyunsaturated fatty acids such as linseed oil also suppress methane production, they also cause a general suppression of rumen fermentation and reduce energy absorption at levels above 5% in the diet.

Important:

As a precaution to ensure Australia remains free of **BSE, (Bovine Spongiform Encephalopathy),** used cooking oils, which are frequently made from tallow (animal fats), must comply with the relevant Australia Standards and go through a certification process. Essentially, these standards require;

- All used cooking fats and oils must be heated to 90₀C and **must be at least 90₀C when they are clarified by settling or centrifugation.**
- All recycled fats and oils must be clarified both **by filtration or screening to remove solids** including floatable solids; and by centrifugation or settling and **draining off to remove water and solids.**
- **After processing, used cooking fats and oils must have a moisture and insoluble impurities (M&I) content of no more than 2%**

A copy of the *Australian Standard for Recycling of Used Cooking Fats and Oils (2007)* is available from: www.ausrenderers.com.au
Registered suppliers of recycled oils produced to this standard are listed on this web site.

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3.2. Antibiotics

To maintain consumer confidence in milk as a pure and safe product, **the non-therapeutic use of antibiotics in animal agriculture should be eliminated as a matter of principle.** One antibiotic that is generally accepted in dairy production is Monensin, **(commercially known as Rumensin)** provided as either a feed additive or a rumen capsule.

Two government agencies verified that Rumensin reduces methane emissions from beef and dairy cattle by 20 percent the addition of Rumensin can improve average daily gain by up to 4.6% (1) and feed conversion efficiency by up to 10.6%

Unfortunately, the methane suppressing effect of Rumensin are typically not maintained for long periods. While its action has been shown to continue for over a month in sheep, cattle studies have shown **Monensin often loses its methane suppressing activity with prolonged or repeated application.** Recent evidence of sustained methane suppression by Monensin in cattle during a 72 day field study shows further study is needed on the long-term efficacy of monensin as an anti-methanogen.
Other antibiotics which have had application as feed additives such as Virginiamycin, have smaller effects on methane production and would not be used for this purpose alone.

References:

Eckard, R. & Hegarty, R. (2007) Best Management Practices for reducing greenhouse gas emissions from Dairy Farms. Sourced from Greenhouse in Agriculture

Eckard, R., Grainger, C. Graham, J and Griffin, T. (2008) Greenhouse emissions from livestock and fertiliser and implications for a National Emissions Trading Scheme.

Further Information:

www.greenhouse.unimelb.edu.au

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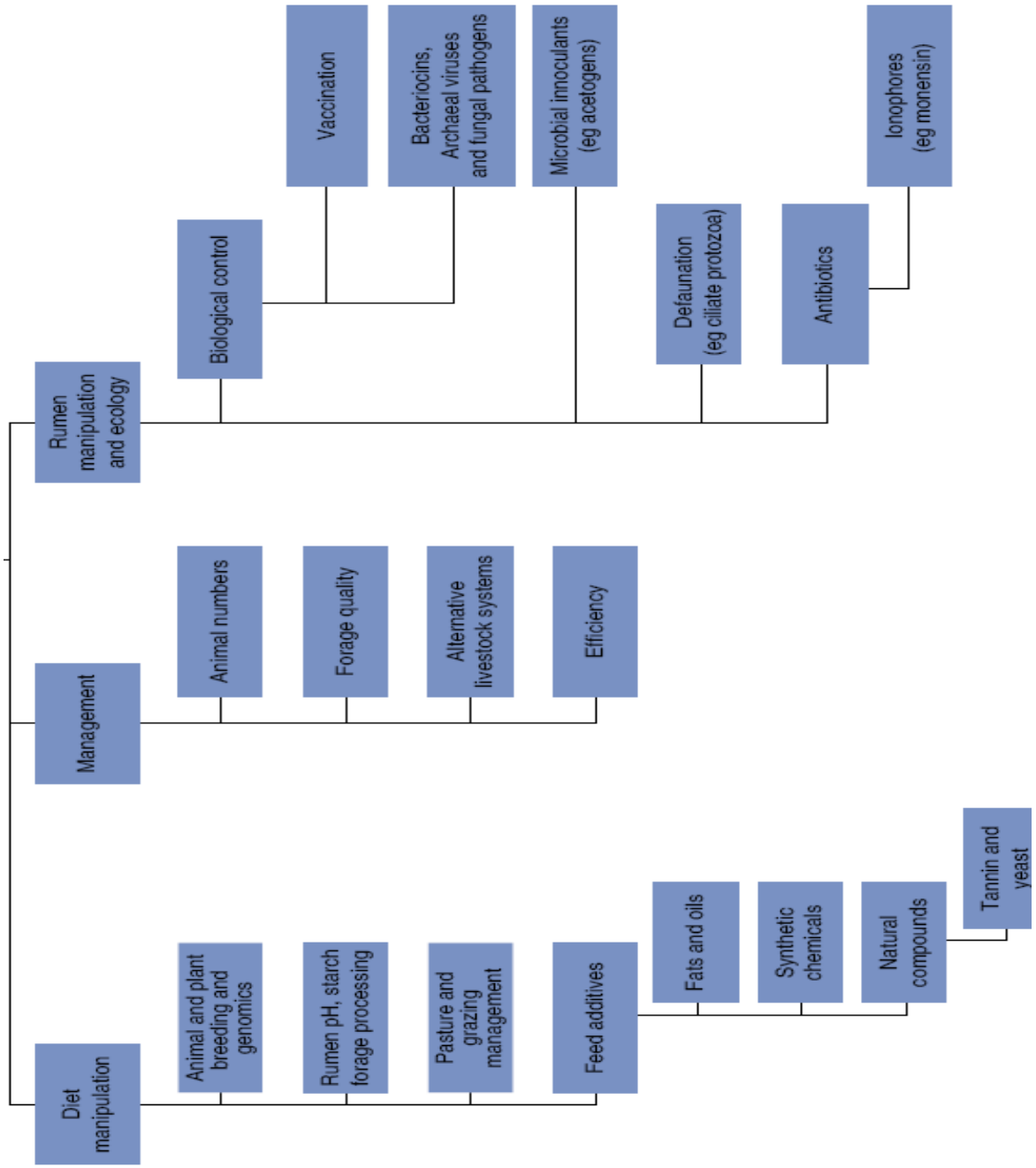
The table below identifies potential options for reducing enteric methane



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