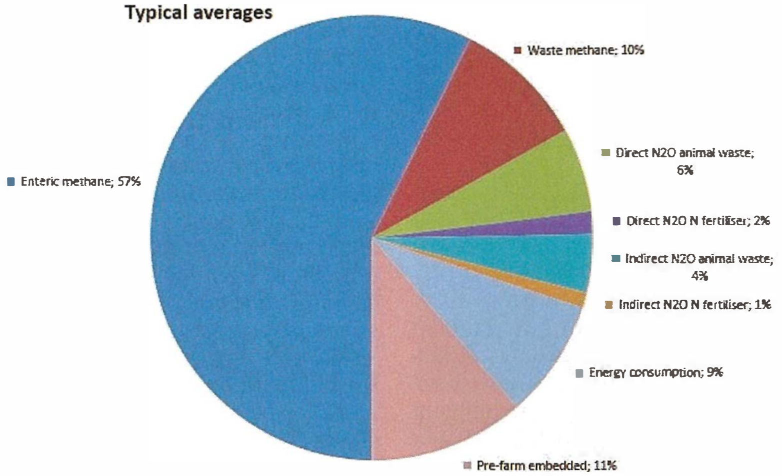
Dairy effluent and the greenhouse effect

Key points

- ✔ Greenhouse gases produced during storage, management and application of dairy effluent
- ✔ Effluent can be managed to reduce these
- ✔ Practices that aim to maximise the benefit of the nutrients in effluent also help reduce greenhouse gases



An example of 'typical average' break down of contributions of greenhouse gases as a CO2 equivalent on a dairy farm (Dairying for Tomorrow, 2017)

THE main objective and focus of dairy effluent management to date has been on ensuring nutrients and pathogens remain on farm in the interests of nutrient utilisation, protecting water quality and biosecurity.

With an increasing focus on climate change, which is driven by the greenhouse effect, greenhouse gases from effluent may also need to be managed to reduce their losses into the future. Greenhouse gases such as carbon dioxide (CO_2), methane (CH_4), water vapour and nitrous oxide (N_2O) hold heat that enters the atmosphere from the sun and prevents this heat from escaping back into the atmosphere. During the storage, management and application of dairy effluent, both methane and nitrous oxide are emitted. The overall greenhouse gas contribution will vary between farms, however, a 'typical average' is provided in Figure 1, illustrating the breakdown of gases. ▶

A Flexitank Round or an Ecobag totally closed effluent storage system stops N disapearing from your system. More N for grass! Less N in the air.

This picture was not part of the orginal article

Methane can trap 28 times more heat than carbon dioxide, and nitrous oxide can trap 265 times more heat than carbon dioxide. This makes reducing their emissions an important component to help address climate change.

Methane losses are overall the largest contribution of greenhouse gases from dairy farms. Methane is produced from cows (burping), as well as from dairy effluent.

Methane emissions from ponds are the largest greenhouse gas contribution from dairy effluent systems (Laubach et al 2015). Methane is produced when manure or organic material breaks down in an environment without oxygen (anaerobic conditions). Situations that favour anaerobic conditions include deep effluent ponds and stockpiles of manure that may become waterlogged. Higher temperatures and the volume of organic material (and its biodegradability) entering ponds, including milk waste, are also factors that can affect the production of methane.

Strategies that can be used to reduce methane production include:

- Regular application of dairy effluent to pasture from ponds during periods when application is appropriate.
- Storage of solids stockpiles to ensure the solids are composted in a way that promotes aeration and 'aerobic conditions' and/or storage of solids undercover so that wet anaerobic conditions don't prevail. Aerobic conditions can be maintained through turning windrows rather than static piles (Dairy Australia 2008).
- Covering effluent ponds for anaerobic digestion of methane is an effective method for removing methane, however, its initial capital cost may limit its feasibility for many situations. Alternatively covering effluent ponds and 'flaming off' excess methane is also effective and may be less cost-prohibitive.
- Treatment of dairy effluent ponds with floating biofilters of volcanic pumice soil has initially shown to be effective at removing methane through the establishment of methanotrophic communities with further research needed (Pratt et al, 2012).
- Removal of solids and organic waste prior to storage in ponds may help to reduce the methane production in the ponds (Dairy Australia 2008). Activities such as dry scraping of manure from feedpads or utilising a trafficable solids trap to remove solids prior to storage could help.
- Allowing a natural crust to form on the effluent pond to allow an environment for bacteria to oxidise methane (Dairy Australia 2008).
- Reducing the volume of manure produced by dairy cattle by ensuring that the energy requirements for the animal are met from the feed with the highest digestibility (Dairy Australia 2008).

Mitigation of nitrous oxide from dairy effluent

Nitrous oxide emissions from dairy effluent are created through land application and before storage, either directly from urine and manure deposits onto concrete surfaces, or from stockpiles. Laubach et al (2015) explains that nitrous oxide emissions from land applications of effluent are the second biggest source of greenhouse gas emissions from dairy effluent management.

Nitrous oxide is a greenhouse gas that can be produced when conditions are wet on-farm through a process called denitrification or when conditions are hot and windy through a process called volatilisation.

Strategies that can be used to reduce nitrous oxide include:

- Application methods such as injection and incorporation of effluent to minimise the contact of the manure with air to reduce nitrous oxide emissions and odour. This is providing the soil is not waterlogged (Dairy Australia 2008).
- Avoiding application of manure to wet soils.

Practices that aim to maximise the benefit of the nutrients in the manure and effluent, such as regularly applying to paddocks, can also help to reduce greenhouse gas emissions.

References

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