Manure Management Practices

to Mitigate Greenhouse Gases

DAIRY FARMERS OF CANADA

Ontario

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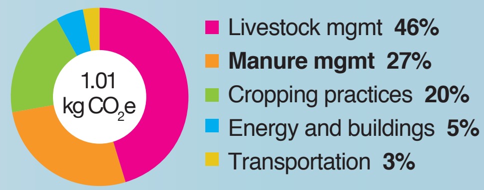
Manure management – handling and storage of manure – is an important source of agricultural greenhouse gas (GHG) emissions. Methane is the most important GHG associated with liquid manure management.

Manure methane emissions occur as a net result of microbial production and consumption of methane. 'Wetter' (less oxygen) conditions favour the production of methane, while drier conditions (such as in a crust on manure) result in methane consumption. Management practices to avoid optimal conditions for methane production and/or to provide favourable conditions for methane consumption are helpful in reducing GHG emissions from dairy manure.

CONTRIBUTION OF EACH LIFE CYCLE STAGE



Minimum **0.94** — **1.01** Weighted average kg CO_2e — Maximum **1.10**

*Source: The Environmental and Socioeconomic Life Cycle Assessment of Canadian Milk (2012)

The Dairy Livestock and Crop Systems Project

identified the following promising management practices to help reduce methane emissions from dairy manure.

1 Straw Cover on Liquid Manure

Applying a straw cover on the liquid manure surface has the potential to reduce methane emissions during storage by up to 15%.

The thickness of the cover should be at least 15 cm to achieve this suggested reduction as thin straw covers have been found to increase methane emissions.

Reduction by up to 15%

Example of straw covering on liquid manure.

Benefits

- They are simple to put into practice and inexpensive;
- Adaptable and immediately usable;
- Decrease ammonia emissions, and reduce odour and hydrogen sulfide production.

Drawbacks

- They are susceptible to wind and rain damage;
- Straw has limited buoyancy time.
  (it can be made more durable by providing floating supports)

? **A straw cover reduces methane emissions by creating an environment where there is enough oxygen for microbes to break down the methane that is produced at the bottom of the tank before it rises to the surface and into the atmosphere.**

2 Complete Emptying of Stored Manure

Completely emptying a liquid manure storage tank in the spring eliminates the inoculum (or aged manure) in the tank and reduces the methane emissions from the newly loaded manure in the following months by up to 40%.

The more manure removed, the better. Even emptying to 5% of the total tank volume will reduce emissions, as compared to 15 percent left in the tank.

Reduction by up to 40%

3 Anaerobic Digestion

In this process,"methane-producing" bacteria use volatile manure solids as "food" to produce methane under enhanced environmental conditions in a digester. This leads to lower methane production during storage of the digestate, the liquid portion of the digested manure, due to lack of "food" for "methane-producing" microbes. The methane produced during anaerobic digestion is captured and used as an energy source in a generator.

Benefits

- Reduces methane emissions from the tank storage component by up to 60%;
- Odour control;
- Conversion of organic nitrogen to inorganic nitrogen;
- Production of homogeneous effluent.

Reduction by up to 60%

Drawbacks

- Capital costs for installation of anaerobic digestion systems
  are high but the associated GHG benefits are substantial.

4 Solid-Liquid Separation

Separating solids from the liquid manure and composting the solid fraction has the potential to reduce overall methane emissions by about 30 %.

Reduction by up to 30%

Caution has to be exercised because storage of the solid fraction could increase nitrous oxide emissions; however, by supplying sufficient oxygen in manure heaps and implementing good composting practices, emissions can be reduced.

Applying a straw cover, complete emptying of tanks to eliminate inoculum, producing biogas using anaerobic digestion and separating solids can significantly reduce greenhouse gas emissions from dairy farms.

? Farm size and the amount of manure produced by the herd will impact the cost-benefit bottom line.

Anaerobic digestor with methane trapped under the dome cover.

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