FARMING PRACTICE
MANURE PROCESSING TECHNIQUES

IMPACT: GHG EMISSIONS

Reference 14

Jayasundara, S; Appuhamy, JADRN; Kebreab, E; Wagner-Riddle, C 2016 Methane and nitrous oxide emissions from Canadian dairy farms and mitigation options: An updated review CANADIAN JOURNAL OF ANIMAL SCIENCE 10.1139/cjas-2015-0111

Background and objective

There is a need for a comprehensive review of recent Canadian relevant research evaluating options for mitigating GHG emissions from enteric fermentation and manure management. The objectives of this paper were to (1) review recent Canadian research on enteric methane (CH_4) emissions, and CH_4 and nitrous oxide (N_2O) emissions from stored manure related to dairy cattle, and (2) identify strategies for GHG mitigation that can currently be used in Canadian dairy farms and promising technologies that have potential to be used as mitigation strategies in the future.

Search strategy and selection criteria

Not reported Although the primary focus is on Canadian research, applicable research from other cold climatic regions with similar dairy production systems was considered. The majority of studies evaluating GHG emissions from composting in Canada do not include reference manure storage for comparing change of emissions due to composting; therefore, only studies on dairy manure composting were considered.

Data and analysis

Not reported

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
7	Dairy cattle	Composting of solid manure, Solid-liquid separation, Anaerobic digestion of slurry	No mitigation strategy	Metric: CH_4 and N_2O emissions; Effect size: not reported	18.75

Results

- Studies on dairy manure composting show that GHG emissions from stockpiled dairy manure were mitigated substantially by composting (72%–83% reduction of total GHG) relative to emissions from the stockpiled dairy manure during the warm season. Management practices such as timing and frequency of turning appeared to be very critical for composting during the winter season, because mixed results for GHG mitigation have been observed for winter season composting.
- One study found that total N_2O emissions during the storage of separated solid and liquid fractions increased by over 1100% compared with N_2O emissions from the stored untreated dairy slurry, while the total CH_4 emissions from the two fractions (separated solids and liquids) were reduced by about 34% relative to the emissions of CH_4 from the untreated slurry. Only a modest mitigation (<10%) of CH_4 emissions under warm ambient temperature (25 °C) and slightly higher (~4%) emissions from the separated fractions at colder temperature (5 °C) were observed in another study. Separation efficiency seems to be an important factor influencing the effectiveness of solid–liquid separation on overall GHG mitigation.
- Several recent experiments evaluating the effect of various cover types on CH_4 and N_2O emissions from dairy manure have indicated appreciable reductions of these two gases combined (up to 26% reduction) compared with emissions from uncovered slurry.
- In theory, implementing an AD system could reduce CH_4 emissions from dairy manure very effectively, as CH_4 emitted from manure is captured and destroyed in the process of generating energy.

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

This review identify several promising strategies for mitigating GHG emissions from dairy manure, including AD, solid–liquid separation, composting, manure storage covers, and complete emptying of liquid manure storage at spring application. These results are uncertain due to the methodology used in this study (systematic review, no quantitative analysis).