FARMING PRACTICE
MANURE PROCESSING TECHNIQUES

IMPACT: GHG EMISSIONS

Reference 12

Sajeev, EPM; Winiwarter, W; Amon, B 2018 Greenhouse Gas and Ammonia Emissions from Different Stages of Liquid Manure Management Chains: Abatement Options and Emission Interactions Journal of environmental quality 10.2134/jeq2017.05.0199

Background and objective

Farm livestock manure is an important source of ammonia and greenhouse gases. Concerns over the environmental impact of emissions from manure management have resulted in research efforts focusing on emission abatement. However, questions regarding the successful abatement of manure-related emissions remain. The deficiencies in single-pollutant, single-stage approaches when devising abatement strategies are also highlighted, along with potential solutions and the way forward in tackling these deficiencies. The present study identifies potential abatement options to reduce greenhouse gases (GHGs) and ammonia (NH_3) emissions collectively. It also sheds light on the potential cobenefits and the issue of pollution swapping by determining the trends in interactions of methane (CH_4), nitrous oxide (N_2O), and NH_3 among the various abatement options identified. Here the results regarding the impact of different abatement options at different stages of pig and cattle manure management (feeding strategies, animal housing, manure treatment and manure storage) on GHGs (CH_4 and N_2O) emissions are presented.

Search strategy and selection criteria

Emission reduction potentials for the identified abatement options were estimated using effective observations from published literature according to the methods described in recent studies that focus on emission abatement in manure management systems. The selection criteria were as follows: (i) the animal category was either cattle or pigs; (ii) the study was subject to at least one of the eight chosen abatement options; (iii) the study measured and reported either NH_3 and/or GHG emissions for at least one of the manure management stages of housing, treatment, storage, or application; (iv) the study included data on reference treatments and base emissions; and (v) the article was peer reviewed and available in English. This resulted in a selection of 89 peer-reviewed papers and reports measuring NH_3 and/or GHG emissions from on-farm and experimental farm settings.

Data and analysis

Descriptive statistics were used to quantify and describe the emission reductions. Means and SDs were calculated and reported for all existing datasets. High variability occurred in several instances, with SDs exceeding the mean value such that reported trends may be merely indicative. The use of complex statistical models was not possible due to a small sample size.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
89	Pig and cattle manure	Anaerobic digestion	No abatement options	Metric: CH_4, NO_2 emissions; Effect size: Logarithm of ratio of the considered metrics in the intervention to the considered metrics in the control	43.75

Results

- In the case of CH_4 emissions, estimates from the present study show a reduction in emissions by 29 ± 116%, primarily during the storage of digestate. N_2O emissions increased by 20 ± 41% during the storage of anaerobic digestate. N_2O emissions decreased by 29 ± 43% during the application of anaerobic digestate.
- This study indicates that acidification of manure can reduce CH_4 emissions by 74 ± 22% during the storage of manure. Overall estimates indicate a N_2O reduction of 56 ± 51% during storage of acidified manure. Overall estimates indicate a N_2O reduction of 52% when acidified manure was applied to the soils.

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

This study shows that anaerobic digestion can reduce CH_4 emissions from from pig and cattle manure management. However, several options are associated with tradeoffs on N_2O emissions from storage of digestate. These results are uncertain, because based only on descriptive statistics, and not on a model taking into account between-studies variability.