FARMING PRACTICE
MANURE LAND APPLICATION TECHNIQUES

IMPACT: GHG EMISSIONS

Reference 1

Emmerling, C; Krein, A; Junk, J 2020 Meta-Analysis of Strategies to Reduce NH_3 Emissions from Slurries in European Agriculture and Consequences for Greenhouse Gas Emissions Agronomy 10, 1633 10.3390/agronomy10111633

Background and objective

Research efforts are in place for the abatement of NH_3 emissions at the various stages of the manure management chain, namely; the feeding, housing, treatment, storage, and application stages to ensure a whole-farm management model. However, the impact of these mitigation strategies on the emission of other GHGs has not received equal attention. Investigate the consequences of the most effective measures to decrease NH_3 emissions from slurries, for the emission of other GHG (swapping effect)

Search strategy and selection criteria

A systematic literature search was conducted on the databases of Scopus, Google scholar, and gray literature, and from the websites of governmental/non-governmental agencies by combining the following keywords: ammonia emission, ammonia abatement, Europe, abatement strategies, integrated assessment, systematic review, meta-analysis, air quality, long-range transboundary air pollution (LRTAP), livestock, livestock management, animal housing, manure treatment, animal diet, Europe, France, Belgium, Germany, Netherlands, Spain, UK, Sweden, Finland. Not specified

Data and analysis

To analyze the combined effect of different measures, taking sample sizes into account, testing for moderators, and obtaining corresponding forest plots, the meta-analytical software OpenMEE was used (http://www.cebm.brown.edu/openmee). A random effect model was used to aggregate the collected data into a meta-analysis, to satisfy the assumption of variance heterogeneity.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
38	European agricultural systems with slurry fertilisation	Injection, Incorporation, or Band application	No slurry treatment, no storage cover, or band spread application	Metric: 1) CH_4 emissions; 2) N_2O emissions; Effect size: Relative difference between treatment and control	50

Results

- The results of the meta-analysis showed a (non-significantly) increased N_2O emission by +196% (CI −39, +1365) when injection was compared to surface application. CH_4 emissions decreased by −23% (CI −34, −13) no effect resulted for CO_2 emissions.
- Manure incorporation, with reference to surface application with no incorporation, showed a non-significant effect in N_2O, CH_4 and CO_2 emissions, with very high variability. N_2O emissions, however, tended to increase.
- Band application, relative to surface spreading resulted in significantly increased CH_4 (+153; CI +108, +197) and CO_2 (+18; CI +10, +25) emissions, while showing no significant effect on N_2O emissions (+25; −2, +57).
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Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

Different field application techniques (injection, incorporation, band application) were effective to varying degrees for the abatement of ammonia emission, but also resulted in the increased emission of at least one other greenhouse gas.