FARMING PRACTICE
ANURE LAND APPLICATION TECHNIQUES

IMPACT: AIR POLLUTANTS EMISSIONS

Reference 3

Wang, Y; Xue, W; Zhu, Z; Yang, J; Li, X; Tian, Z;Dong, H; Zou, G; 2019 Mitigating ammonia emissions from typical broiler and layer manure management - A system analysis Waste Management 10.1016/j.wasman.2019.05.019

Background and objective

Much work in literature has been done to evaluate gas emissions or mitigations targeted at one specific gas or one emission stage from poultry production, while little research has considered them in a comprehensive way, especially for the mitigation from a system level perspective. The overall objective of this study is to make a quantitative assessment of ammonia (NH_3) emissions from the broiler and layer manure management systems and the effects of 14 mitigation options on the NH_3 emissions from the whole manure management chain using meta-analysis. Here the results concerning manure storage and treatment are reported.

Search strategy and selection criteria

The ISI Web of Knowledge database (www.isiwebofknowledge.com) and the Chinese journal database (www.cnki.net) were used to search all published datasets as of April 2018. Specific search terms were combined and used, depending on animal categories (broiler, layer, poultry, chicken), manure, in-house manure management (litter, cage, manure belt, high-rise, deep pit), outdoor manure management (compost, stockpile), land application (surface spread, incorporation), gaseous emission (NH_3, gas emission), and mitigation measures (diet, crude protein, additive, amendment, urease inhibitor, biofilter, biotrickling, cover, nitrification inhibitor, incorporation, reduce, mitigation). The literature sources used in this study were selected based on the following criteria: (1) The research object was broiler or layer; (2) the study included NH_3 emissions; (3) a gas emission flux or gas emission factor was available; and (4) for literature related to mitigation, only studies that reported at least one control group were selected so that the emission mitigation efficiency could be calculated.

Data and analysis

The Wilcoxon Signed-Rank test was used to determine if the median values of mitigation efficiency were significantly different from zero when there were sufficient results for specific measures.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
96	Broiler and layer production (chicken)	Land application mitigation strategies for chicken manure (incorporation, additives).	A reference litter based or layer manure belt based system (diet: conventional, in house: no treatment, outdoor: composting, land application: spreading)	Metric: NH_3 emission factor; Effect size: Ratio of the considered metrics in the intervention to the considered metrics in the control	62.5

Results

- For chicken manure land application, changing manure surface application to rapid incorporation to the depth of 5–9 cm could reduce ammonia emissions by 83.3% (n =1). As only one observation was reported, the Wilcoxon test was not applied in this case. The result was considered as uncertain.
- Using some kinds of manure additives could also reduce ammonia emissions from surface manure application. It's reported that the addition of superphosphate to chicken manure reduced ammonia emissions by 31.1% during the manure land application process. Sawdust additive couldn't reduce ammonia emissions in chicken manure surface application. Besides the limited publications related with the additives specifically for poultry manure, some other additives were also proven to be effective in ammonia mitigation during manure land application.
- NULL
- NULL
- NULL

Factors influencing effect sizes

- Manure characteristics : The higher TN content or lower C/N ratio of the initial manure both indicated higher ammonia mitigation efficiency (1% increase in initial chicken manure TN increased the ammonia mitigation efficiency by 7.07%; 1% decrease of C/N ratio of the initial chicken manure increased the ammonia mitigation efficiency by 4.37%)

Conclusion

Due to lack of data (only one or 2 observations), the effect of manure incorporation and the addition of additives before land application (superphosphates and sawdust) was considered as uncertain on ammonia emission.