FARMING PRACTICE
LIVESTOCK FEEDING TECHNIQUES

IMPACT: AIR POLLUTANTS EMISSIONS

Reference 16

Wang, Y; Xue, WT; Zhu, ZP; Yang, JF; Li, XR; Tian, Z; Dong, HM; Zoua, GY 2019 Mitigating ammonia emissions from typical broiler and layer manure management - A system analysis WASTE MANAGEMENT, 9(3), 730-743. 10.1016/j.wasman.2019.05.019

Background and objective

Agriculture represents the largest ammonia (NH_3) emissions and contributes 60% of all NH_3 emissions, with livestock farming being the leading sector that accounts for 39% of global emissions. Broiler and layer productions are important NH_3 emission sources in the livestock industry. Ammonia emissions arise from the decomposition of nitrogen from manure. Thus, for the evaluation of the NH_3 emissions from poultry production, a manure management chain perspective should be considered, including the NH_3 emissions from the in-house stage, the manure outdoor storage or treatment stage, and the land application stage. The overall objective of this study is to make a quantitative assessment of NH_3 emissions from the broiler and layer manure management systems and the effects of (sets of) mitigation options on the NH_3 emissions from the whole manure management chain using meta-analysis. Here, results for in-house mitigation measures are reported.

Search strategy and selection criteria

The ISI Web of Knowledge database and the Chinese journal database 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). 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 median mitigation efficiency (Em) values for each measure were calculated using an analytical approach adapted from Benayas et al. (2009) and Tuomisto et al. (2012). The normality of the data was tested using the Kolmogorov-Smirnov test. Not all of the Em values for each mitigation measure were normally distributed. Therefore, the Wilcoxon Signed-Rank test was used to determine if the median Em values were significantly different from zero when there were sufficient results for specific measures. SPSS 20.0 software was used for the statistical analyses.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
96	Poultry (broiler and layer)	1) Low crude protein (CP) diet; 2) Diet additives supplementation	1) Normal diet; 2) No additives	Metric: Ammonia (NH_3) emissions; Effect size: Ratio of the considered metrics in the intervention to the considered metrics in the control	56.25

Results

- Low CP in the broiler feed decreased N excreta by 17.4% ($p < 0.001$) and reduced NH_3 emissions by 20% ($p < 0.05$).
- When applied in layer production, low CP diet reduced N excreta by 21.3% ($p = 0.068$). Additionally, the NH_3 emissions were reduced by 10.0%; as only one observation was available for the specific use of low CP on layer production, the significance test could not be performed.
- Feed additives can optimize the feed composition and improve the N absorbency, thus leading to the reduction of NH_3 emissions. The additives in feed reduced the in-house NH_3 emissions by 36.3% ($p < 0.001$). Additionally, the N excreta was reduced by 17.4% ($p = 0.109$). The only three observations collected for N excreta change value caused the result to be not significant.
- NULL
- NULL

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

A low crude protein diet is highly beneficial as it limits N intake at source, resulting in the lower N content of excreta, thus the N-related gaseous emissions during the subsequent manure management phases would be decreased. Also the use of diet additive showed beneficial results.