FARMING PRACTICE
LIVESTOCK FEEDING TECHNIQUES

IMPACT: GHG EMISSIONS

Reference 17

Dijkstra, J; Bannink, A; France, J; Kebreab, E; van Gastelen, S 2018 Short communication: Antimethanogenic effects of 3-nitrooxypropanol depend on supplementation dose, dietary fiber content, and cattle type JOURNAL OF DAIRY SCIENCE, 101(10), 9041-9047. 10.3168/jds.2018-14456

Background and objective

3-Nitrooxypropanol (NOP) is a promising methane (CH_4) inhibitor. Recent studies have shown major reductions in CH_4 emissions from beef and dairy cattle when using NOP but with large variation in response. The objective of this study was to quantitatively evaluate the factors that explain heterogeneity in response to NOP using meta-analytical approaches.

Search strategy and selection criteria

Literature searches of the Web of Science, CAB Direct, and Scopus online databases were conducted using keywords "NOP" (including all variants, such as "nitrooxypropanol") + "cattle" + "methane" (or "CH_4"). 1) To include a control treatment group that did not receive NOP, 2) to be conducted in vivo using cattle, and 3) to include measured CH_4 production.

Data and analysis

Effect size estimates and corresponding sampling variances were obtained using the "metaphor" (version 2.0–0) and "robumeta" (version 2.0) packages in R (version 3.1.1). The studies in this meta-analysis contain multiple treatment groups sharing a common control group; hence, the effect size estimates are not statistically independent. Therefore, a robust variance estimation (RVE) method was used to analyze statistically dependent effect sizes in this meta-analysis. Random-effects and mixed-effects models were fitted using the "robu" function in the "robumeta" package.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
9	Dairy and beef cattle	3-nitrooxypropanol (NOP) supplemetation	No additive	Metric: 1) Methane (CH_4) production; 2) CH_4 yield; Effect size: Standardized difference of the considered metrics between intervention and control	87.5

Results

- Using RVE random-effects models, an average dose of 123 mg of NOP/kg of dry matter in dairy and beef cattle reduced CH_4 production ($P < 0.001$) by 32.5 ± 5.74% and CH_4 yield ($P < 0.001$) by 29.3 ± 5.63%.
- NULL
- NULL
- NULL
- NULL

Factors influencing effect sizes

- Feed additive dose : A 10 mg/kg of dry matter increase in NOP dose from its mean (123 mg/kg of DM) enhanced ($P = 0.016$) the NOP effect on CH_4 production decline by 1.76 ± 0.441% and enhanced ($P = 0.043$) that on CH_4 yield decline by 1.58 ± 0.544%.
- Cattle type : Higher NOP doses (mg/kg of dry matter) are required for beef cattle than for dairy cattle to achieve a similar reduction in CH_4 emission.

Conclusion

The effectiveness of 3NOP at mitigating CH_4 emissions was positively associated with 3NOP dose, and negatively associated with dietary fiber content. Moreover, 3NOP had stronger antimethanogenic effects in dairy cattle than in beef cattle.