FARMING PRACTICE
LIVESTOCK FEEDING TECHNIQUES

IMPACT: GHG EMISSIONS

Reference 26

Nayak, D; Saetnan, E; Cheng, K; Wang, W; Koslowski, F; Cheng, YF; Zhu, WY; Wang, JK; Liu, JX; Moran, D; Yan, X; Cardenas, L; Newbold, J; Pan, G; Lu, Y; Smith, P 2015 Management opportunities to mitigate greenhouse gas emissions from Chinese agriculture AGRICULTURE ECOSYSTEMS AND ENVIRONMENT, 209, 108-124. 10.1016/j.agee.2015.04.035

Background and objective

Globally, there is a large body of research on methods for mitigating enteric methane (CH_4) emissions from livestock production; however data specifically from Chinese production systems are scarce. This paper presents the outcome of a bottom–up assessment to quantify technical potential of mitigation measures for Chinese agriculture using meta-analysis of data from 240 publications for cropland, 67 publications for grassland and 139 publications for livestock, and provides the reference scenario for the cost analysis of identified mitigation measures. Here, results on strategies for the reduction of enteric methane emissions from livestock are reported, specifically, for diet manipulations and rumen manipulations.

Search strategy and selection criteria

The livestock database used for this meta-analysis has been described in detail by Veneman et al. (2015). In brief, a global search was made of relevant databases (including databases of Chinese literature) to identify published research on mitigation of CH_4 from ruminant livestock. To date, the global database contains 294 papers covering in vivo mitigation data for a wide range of animals, production systems, and mitigation strategies. Not described

Data and analysis

Mean effect size and 95% confidence intervals were estimated using bootstrapping (1000). Sample variances were not available for many of the studies included; hence estimates were weighted by sample size.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
139	Livestock production systems	1) Ensiling or treatment of hay with urea or enzymes; 2) Ruminal protozoa inhibition; 3) Lipids; 4) Tannins or saponins; 5) Nitrates; 6) Probiotics; 7) Chemical inhibitors; 8) Ionophores supplementation	1) No ensiling or treatment of hay with urea or enzymes; 2) No additive supplementation	Metric: Methane (CH_4) emissions; Effect size: Ratio of the considered metrics in the intervention to the considered metrics in the control	50

Results

- Lipid supplements significantly reduce CH_4 emissions with a predicted mean reduction of 15% ± 4%.
- Tannins in general and saponins specifically, have proven very effective with a mean reduction of by-product of tea production for cattle.
- Dicarboxylic acids include the addition of nitrates or fumarate to the diet as alternative metabolic sinks for hydrogen. This has proven to be very effective as a method of reducing CH_4 in all ruminants (23% ± 10% mean reduction). Of all methods compared in this analysis, the use of nitrates has been shown to be the most effective method.
- Altering the microbial community through probiotic supplementation of yeast or bacteria, or through defaunation (i.e., removal of ciliate protozoa from the rumen ecosystem), has not proven successful in reducing CH_4 emissions (1% ± 4% and 0% ± 9% mean reduction respectively).
- Halogenated analogues, such as bromochloro-CH_4 or ionophores such as monensin, is an effective method in the short term (22% ± 6% and 6% ± 3% mean reduction, respectively), with bromochloro-CH_4 being the most effective.

Factors influencing effect sizes

- No factors influencing effect sizes to report

Conclusion

Dietary supplements can reduce CH_4 emissions, with lipids (15% reduction) and tannins or saponins (11% reduction) showing the greatest potential.