

## IMPACT: AIR POLLUTANTS EMISSIONS

### Reference 25

Lewis, KA; Tzilivakis, J; Green, A; Warner, DJ 2015 Potential of feed additives to improve the environmental impact of European livestock farming: a multi-issue analysis INTERNATIONAL JOURNAL OF AGRICULTURAL SUSTAINABILITY, 13(1), 55-68. 10.1080/14735903.2014.936189

### Background and objective

While the use of feed additives is widespread, it is currently driven wholly by desires for increased productivity and improved animal health and not by their potential to deliver environmental benefit. To conduct a comprehensive systematic review to identify feed additives, listed on Annex 1 of the European Union Register of Feed Additives, that have potential to reduce polluting emissions from livestock and to conduct a very simple meta-analysis of the collated data in order to identify the potential efficacy of these substances and agents. Here, results on ammonia emissions are reported.

### Search strategy and selection criteria

Scientific papers, research and industry reports, and other literature were sourced mainly from online databases supplemented by manual searching of key journals and provision of information directly from industry. In addition, reference 'snowballing' was used, whereby the cited references in each publication are utilized as a rich source of other related works. 1) Farm-animal trial data published post-1990 and restricted to only those studies where direct environmental effects were measured. Consequently, this excluded studies with companion, zoo and wild animals, and also those that were dietary manipulation rather than supplementation. Studies with fish were also excluded; 2) Studies using lifecycle analysis, mechanistic and metabolic modelling approaches were omitted as well as those where environmental benefits were related to performance improvements alone.

### Data and analysis

The main objective of this study was simply a screening exercise in order to provide a general picture of the range of substances and agents which when used as feed additives may have potential to reduce polluting emissions. A means of demonstrating the range and scope of effects identified was required even if a more precise picture of the potential environmental effect was less easy to quantify. This was achieved by using a metric-free approach such that data were converted to a % change value (%Δ), i.e. the change in environmental parameter compared to a negative control. Due to the potentially significant differences between the studies with respect to methods and metrics only substances and agents where a %Δ < -10 (i.e. decreases in emissions of more than 10%) were considered to have effectively demonstrated potential for beneficial effects and, likewise only those where a %Δ >= 10 (i.e. an increase in emissions of equal to or more than 10%) were considered to have effectively demonstrated potential for a deleterious effect.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
270	Cattle, buffalo, sheep, goat, swine, poultry	Additives	No additive supplementation	Metric: NH <sub>3</sub> emissions; Effect size: not applicable	56.25

### Results

- For cattle, most additives decreased ammonia emissions except four substances (malic acid, guava (*Psidium guajava*), linseed oil and sunflower oil) that are shown to increase ammonia while decreasing methane.
- For sheep and goat reductions of ammonia are quite significant with, for example, both thymol and clove oil demonstrated mean reductions of 46%Δ. Again, many substances are shown to deliver simultaneous benefits for both methane and ammonia. Unlike the studies with cattle, none of the substances considered appeared to increase ammonia emissions.
- The studies conducted with pigs, the carboxylic acids all appear to reduce ammonia emissions, with the greatest potential shown by benzoic and adipic acids at 23%Δ and 25%Δ, respectively. The studies considered in this review showed that reductions of around 21%Δ may be feasible with phytase.
- For poultry, only bentonite was identified with potential to reduce ammonia (41%Δ).
- NULL

### Factors influencing effect sizes

- No factors influencing effect sizes to report

### Conclusion

Authors report that ammonia emissions could potentially be reduced by up to 30% using feed additives, but the uncertainty is high due to the limitations of the methodology implemented.