

SINGLE-IMPACT FICHE

MANURE PROCESSING TECHNIQUES



IMPACT: NUTRIENTS LOSS

Data extracted in July 2021

Note to the reader: This fiche summarises the impact of manure processing techniques on NUTRIENTS LOSS. It is based on 2 peer-reviewed synthesis research papers¹, including from 76 to 114 individual studies.

1. WEIGHT OF THE EVIDENCE

- CONSISTENCY OF THE IMPACT:

Manure processing techniques, namely improved techniques for manure composting, have different effects on nutrients loss, depending on the considered composting techniques (see **Table 1**). The number of synthesis papers reporting positive, negative or no effect is based on the statistical comparison of the intervention and the control. The number of synthesis papers reporting relevant results, but without statistical test of the effects is labelled as “uncertain”.

According to 1 synthesis paper, periodical turning of manure composting piles and the addition of bulking agents were found to have no significant effect on nutrients loss, compared to conventional solid manure storage, while forced aeration resulted in a negative effect (i.e. increased nutrients loss).

In the other synthesis paper, optimized aeration rate, compost turning frequency, and C/N ratio regulation showed a positive effect on nutrients loss, compared to absence of mitigation technique.

The 2 reviewed synthesis papers include data collected in Europe (see **Table 2**).

Table 1. Summary of effects. The effect with the higher score is marked in bold and the cell coloured. The numbers between parenthesis indicate the number of synthesis papers with a quality score of at least 50%. Details on quality criteria can be found in the next section.

| Impact | Metric | Intervention (Technique) | Positive | Negative | No effect | Uncertain* |
|-------------------------|---------------------|--------------------------|----------|----------|-----------|------------|
| Decrease nutrients loss | Total nitrogen loss | Composting | 1 (1) | 1 (1) | 1 (1) | 0 |

* Number of synthesis papers that report relevant results but without statistical test comparison of the intervention and the control.

- QUALITY OF THE SYNTHESIS PAPERS: *The quality score summarises 16 criteria assessing the quality of three main aspects of the synthesis papers: 1) the literature search strategy and studies selection; 2) the statistical analysis; 3) the potential bias. Details on quality criteria can be found in this document [→](#).*

As shown in the “Quality score” in **Table 2**, both papers have a quality level of 69%. The least frequently satisfied quality criteria were “Number of studies at each step”, “Individual effect sizes”, “Dataset available” and “Publication bias analysed”.

2. IMPACTS

¹ Research synthesis papers include a formal meta-analysis or systematic reviews with some quantitative results


The main characteristics and results of the synthesis papers are summarized in **Table 2**. Detailed results of each synthesis study are reported in the summary reports .

Table 2. Main characteristics of the synthesis papers reporting impacts of manure processing techniques on nutrients loss. The references are ordered chronologically with the most recent publication date first.

| Reference | Population | Scale | Num. papers | Intervention (technique) | Comparator | Metric | Conclusion | Quality score |
|---|--|--------|-------------|---|---|-----------------------|---|---------------|
| Zhao, SX; Schmidt, S; Qin, W; Li, J; Li, GX; Zhang, WF 2020 | Soild manure and organic waste | Global | 114 | Mitigation strategies in solid manure composting, i.e. C/N ratio regulation (C/N RR), optimized aeration rate or turning frequency (OAT). | No mitigation technique | Total nitrogen loss | The reduction of total nitrogen losses across all technologies for composting optimization was statistically significant, and averaged C/N regulation 27.9%, optimized aeration 26.9%. | 69% |
| Pardo, G; Moral, R; Aguilera, E; del Prado, A 2015 | Solid manure (dairy cows, swine, poultry, green waste) | Global | 76 | Solid manure storage/treatment techniques (turning, forced aeration, compaction, covering, bulking agents, additives) | Solid manure conventional storage (heaps) | Total nitrogen losses | The incorporation of a bulking agent do not increase substantially nitrogen losses. Forced aeration showed significant losses in total nitrogen, while no significant effect was associated with turning. | 69% |

3. KNOWLEDGE GAPS

No knowledge gap was reported.

4. SYSTEMATIC REVIEW SEARCH STRATEGY

| | |
|-----------------|---|
| Keywords | <p>TOPIC: (manure OR slurry OR digestate OR (digested near/3 manure)) AND TOPIC: (management OR storage OR lagoon* OR "anaerobic digest*" OR tank* OR treatment OR process* OR technolog* OR techni* OR (soil near/3 application) OR (soil near/3 distribution) OR (soil near/3 amend*) OR biogas OR precision) AND TOPIC: ("meta-analy*" OR "systematic* review*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis")</p> <p>or</p> <p>TITLE-ABS-KEY: (manure OR slurry OR digestate OR (digested W/3 manure)) AND TITLE-ABS-KEY: (management OR storage OR lagoon* OR "anaerobic digest*" OR tank* OR treatment OR process* OR technolog* OR techni* OR (soil W/3 application) OR (soil W/3 distribution) OR (soil W/3 amend*) OR biogas OR precision) AND TITLE-ABS-KEY: ("meta-analy*" OR "systematic* review*" OR "evidence map" OR "global synthesis" OR "evidence synthesis" OR "research synthesis")</p> |
|-----------------|---|

| | |
|--------------------|--|
| Search dates | No time restrictions |
| Databases | Web of Science and Scopus, run in July 2021 |
| Selection criteria | <p>The main criteria that led to the exclusion of a synthesis paper were if the paper: (1) was out of the scope; (2) did not deal with manure processing techniques or dealt with other stages of manure management (e.g. storage, land application, animal housing techniques); (3) reported studies with absolute values of emission factors, without comparing processing techniques with a reference management scenario; (4) did not clearly state the intervention and comparator; (5) was not either a systematic review or a meta-analysis; (6) was not written in English. Synthesis papers that passed the relevance criteria were subject to critical appraisal carried out on paper-by-paper basis.</p> <p>The search returned 269 synthesis papers potentially relevant for the practice object of our fiche. Searches for other farming practices added another 8 potentially relevant synthesis papers. From the 277 potentially relevant synthesis papers, 207 were excluded after reading the title and abstract, and 53 after reading the full text according to the above-mentioned criteria. Finally, 17 synthesis papers were selected for manure processing techniques, from which 2 was relevant for this impact.</p> |