Influence of Manure Management on NH_3, N_2O and CH_4 emissions from fattening piggeries

Poster n°85

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In France, the pig sector has a low contribution to national emissions (NH_3: 8%, N_2O: 7%, CH_4: 9% - Citepa, 2022). However, due to national commitments at European level, its contribution has to be reduced. Housing is the first step in the emission process ; building design and manure management practices can effectively affect emission from building but also storage and land application. The goal of this study is to analyse NH_3, N_2O and CH_4 emission factors published in the literature in relation with manure management practices inside fattening housing.

Origin of data

- Data extraction from the database ELFE (Poster n°87 - ELevage et Facteurs d'Emissions i.E. Livestock and Emission Factors in english) described by Vigan et al., 2019
- Data relating exclusively fattening pigs kept on fully slatted floor
- Articles published between 1964 and 2022
- Including metadata concerning breeding conditions and measurement methods
- Conversion of raw data (in the publishing unit) into reference units if necessary
- Reference unit selected in relation with this used by IPCC, EMEP, IE Directive: kg N or C. place^{-1}.year^{-1}

Manure management systems

1 Slurry storage in pre-pit under animals (during the whole presence of pigs)

2 Slurry storage in pre-pit under animals with frequent emptying (>3 times per batch)

3 Manure collection in water

4 Flushing

5 V-Scraper

Main results on EF (Table 1)

- Systems 1 to 3 can be implemented in new and existing buildings. At the opposite, systems 4 and 5 can only be implemented in new buildings (golden columns).
- The reduction of the storage duration inside building leads to a reduction between 30% (system 2) and 50% (systems 4 and 5) of ammonia emission in comparison to system 1 (Table 1)
- Immediate separation between solid and liquid fractions inside the pit with the V-Scraper permits to obtain the highest reduction of NH_3, N_2O and CH_4 emissions.

Table 1: Emission factors (median) in kg N or C.place^{-1}.year^{-1}
(in golden, systems which can only be implemented in new buildings)

Manure management systems	1	2	3	4	5
NH_3	2.98	2.06	2.08	1.35	1.35
N_2O	0.10	na	0.07	0.18	0.05
CH_4	2.51	na	2.04	2.32	0.52

na : not available

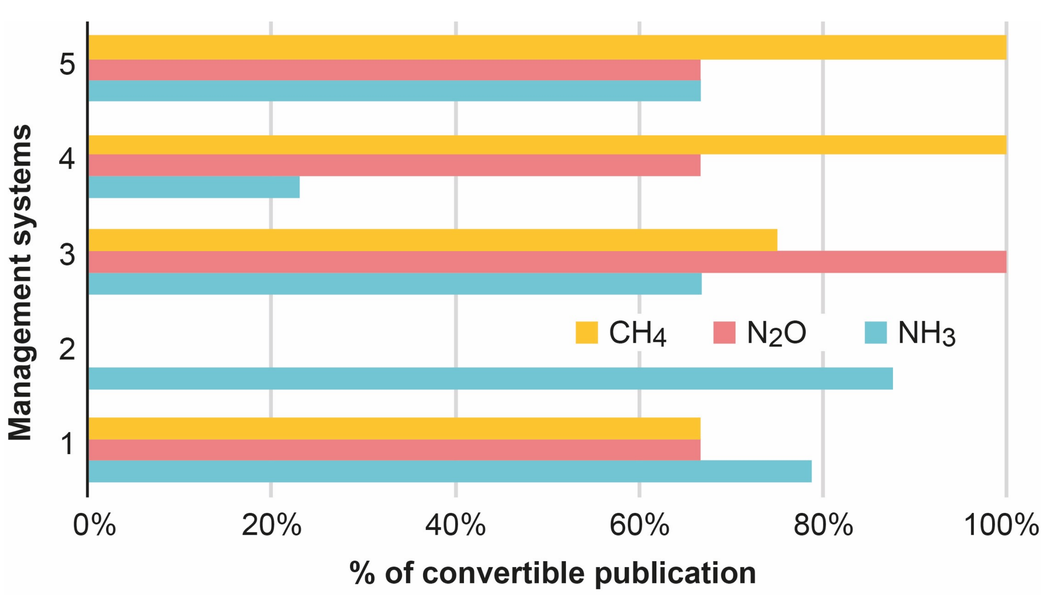

Figure 1: Percentage of convertible publications into reference units

Main results on the availability of data

- Lack of data does not permit to calculate emission factor for each manure management system for the three gases (Fig 1)
- System 1 (storage in pit) is the most wellknown system for the three gases (EF calculated with 89 values for NH_3, 13 for N_2O and CH_4).
- At the opposite, system2 is only studied on ammonia emission. No EF are available in the literature for the calculation of N_2O and CH_4 EF

Conclusions

Reduction of the duration of storage inside building is an efficient way to limit emission from the housing. There's a great difference of efficiency between systems which can be implemented in existing (system 1 to 3) or new buildings (system 4 and 5). Emission factors are more or less robust depending on systems and on gas. Investigations should be continued to improve the reliability of emission factors concerning manure management systems.