Gaseous emissions during storage of pig slurry: what lessons for measurements in farms?

S. Espagnol\textsuperscript{1}, P. Levasseur\textsuperscript{1}, M. Hassouna\textsuperscript{2}

\textsuperscript{1} IFIP Institut du porc, France;
\textsuperscript{2} INRA, France
Context

- Necessité de spécifier les émissions des exploitations alimentaires en France

- Augmentation du rôle stratégique du stockage extérieur dans la gestion des engrais porcins
  - Réduction du temps de stockage dans la construction : Techniques les Plus Adéquates (BAT) : retrait de lésurée, lavage
  - Réduction des périodes d’application autorisées selon la réglementation française

- Difficulté à effectuer des mesures gazeuses pour le stockage : dépendance climatique
Goals of the study

- Identify possibility to measure gaseous emissions factors in commercial farms (NH$_3$, N$_2$O, CH$_4$, CO$_2$) from stored pig slurry
  - By the use of a dynamic floating tunnel
  - By the use of slurry mass balance deficit
Storage modalities

A pit fed progressively with fattening pig slurry stored during 5 months for 2 periods:

- Cold period: Sept 2010 – Feb 2011
- Warm period: March 2011 – Sept 2011
Generic measurements

Gaseous emissions

NH$_3$, N$_2$O, CH$_4$, CO$_2$, H$_2$O

Weather

T, H, v, P

Storage time
EMILI 2012

Slurry mass balance
Deficit of N, P, K, C (volume x composition)

Batches of pig slurry → Final emptying

Meth 0 - model of N, P, K production (reference)
Meth 1 - Taking in the passing pit

Meth 2 - Core drilling on the all height of non mixed slurry
Meth 3 - Core drilling on the all height of mixed slurry
Meth 4 - Taking of the supernatant layer of mixed slurry
Meth 5 - Taking in the slurry tank + bottom sludge

+ initial sludge

Building → Passing pit → Pit
Gaseous emissions measurement

Context

Goals

Experimental design

Gas analyser (INNOVA)

Photoacoustic infrared absorption spectrometry

Sampleur - dosimeter

\[ \Delta \text{Concentrations} \times \text{flow} = \text{emissions} \]
EMILI 2012

Corrections considering:
- 100% P and C sedimentable
- 45% N sedimentable
- 0% K2O

Context
Goals
Experimental design
Results & discussion

Slurries mass balances

losses

Cold period

Warm period
Total gaseous measurements

\[ V_{\text{tunnel}} = 0.41 \text{ m/s} \]
\[ V_{\text{slurry surface}} = 0.53 \text{ m/s} \]

\[ V_{\text{tunnel}} = 0.61 \text{ m/s} \]
\[ V_{\text{slurry surface}} = 0.42 \text{ m/s} \]
Conclusion (1)

Lessons for an application in commercial conditions
- Dynamic floating tunnel seems to be appropriated and could be used for intermittent measurements
- Slurry mass balance seems difficult to be used in commercial farm to identify the total losses

Simplified method using intermittent measurements has to be completed
- When doing the measurements?
- How many?
- How to use them to calculate the emission factors?
Conclusion (2)
Thank you for your attention