

(1)



(2)



Literature review on NH_3 and GHG emitted by pig production

Part 2: storage, treatment and spreading

ESPAGNOL S. ⁽¹⁾, GUINGAND N.
⁽¹⁾, HASSOUNA M. ⁽²⁾

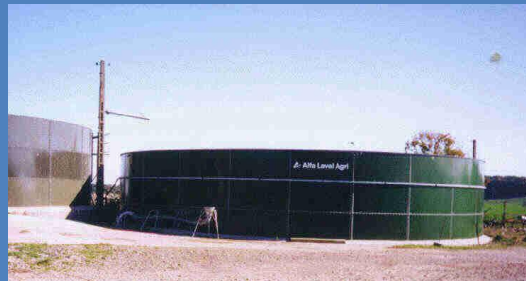


66th Annual Meeting of the EEAP
Warsaw (Poland) – August 31-September 4, 2015
Session 47: Livestock farming systems free
communications

Part 2 – storage, treatment and spreading



Building



Storage



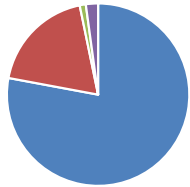
Spreading and treatment

Building of the database

Reminder :

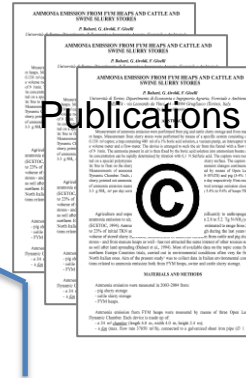
- The database includes data on gaseous emissions
- A data concerns gaseous emissions of NH₃ or GHG (CH₄, N₂O) and CO₂

Data from 22 countries



- Europe ■ America
- Australia ■ Asia

Sorting and selection of the data of the database



| Nb data | | NH ₃ | N ₂ O | CH ₄ | CO ₂ |
|---------|----|-----------------|------------------|-----------------|-----------------|
| 129 | 60 | | | | |
| | 21 | | | | |
| | 58 | | | | |

Causes of exclusions for treatment :

- Type of manure (slurry with straw)
- No information on manure composition
- Type of manure (mixed of pig and cattle)
- Time of experimental monitoring (< 1d)
- Type of manure (slurry with straw)
- No information on manure composition
- Type of storage (non representative of French conditions : lagune)



I : EF include

Informations collected in the database

Information on the gaseous emissions

- EF with the unit of the article
- EF with standard unit
- Emissions in % of the N or C input

Metadata :

- Nb for storage : 72
- Nb for treatment : 62
- Nb for spreading : 73

Building informations :

Type of manure
Physiological stage
Feeding strategies
Type of building

Slurry mass balance :

N default
C default
K2O default
P2O5 default

Geography :

Period of storage
Localisation
Time of storage
Outside temperature
Rain

Type of storage :

Quantity of manure stored
Amount of N stored
Surface of storage
Type of inputs
Frequency of inputs
Cover (Y/N)
Type of cover
Brewing
Temperature of the manure

Manure composition :

DM
SV
SS
COD
C/N
N tot
TAN
C tot
C org
P2O5
K2O
pH

Exemple of the storage

Gaseous measurements and analysis

Type of measurements
Time of measurements
Frequency of measurements
Methodology of sampling
Methodology of analysis
Type of concentration measured
Type of concentration calculation

Flow rate :

Type of flow
Methodology of measurement
Value of the flow
Air speed on the slurry surface
in the dynamic tunnel

Emissions :

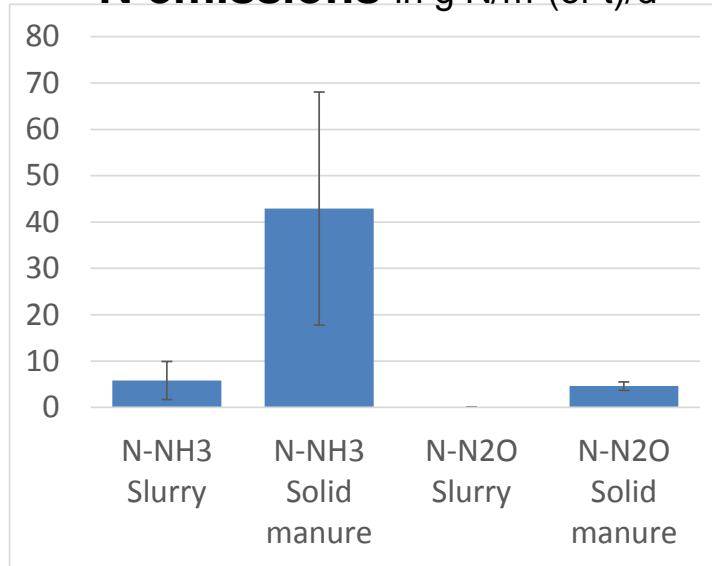
Type of emissions calculated
Methodology
Extrapolation



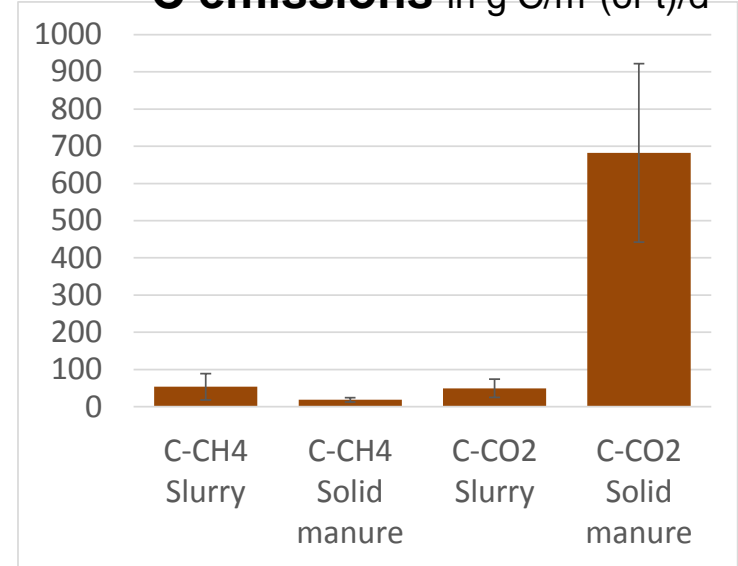
Emissions for storage (1)

SLURRY & SOLID MANURE

N emissions in g N/m³(or t)/d



C emissions in g C/m³(or t)/d



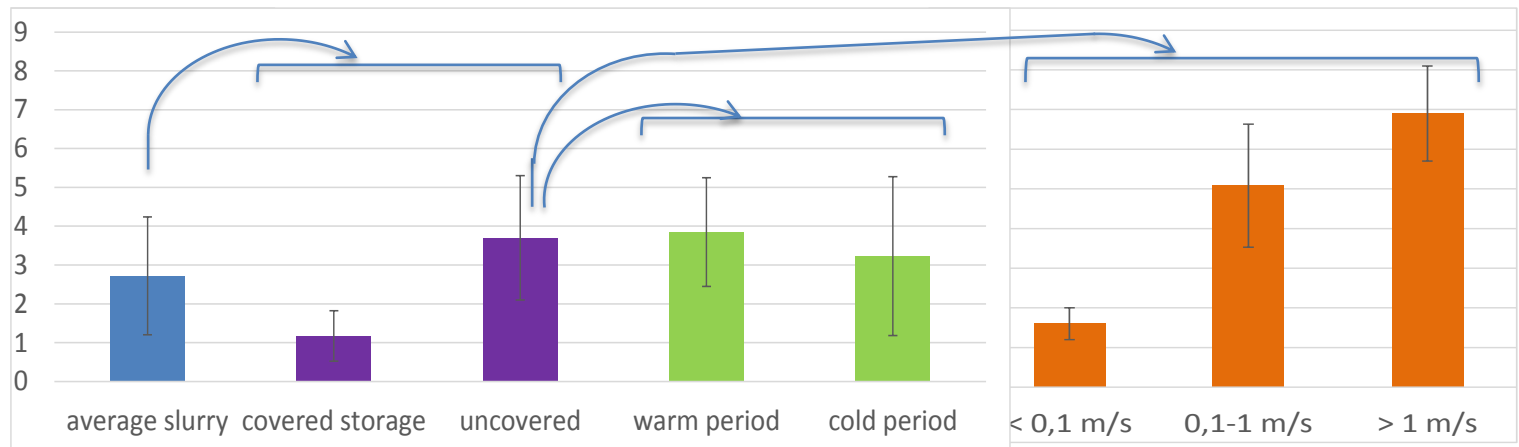
- Unit selected to express results : /m³/d or /t/d = the main unit of the publications except for the emissions of NH₃ for the slurry (in m²/d)
- N emissions of the solid manure higher than for the slurry.
 - Partly due to the duration of the emissions (less than one month for the solid manure and for several months for the slurry).
 - Still the emissions expressed in % of N input are higher for solid manure (17% of the N input) than for slurry (6%)
- CO₂ emissions of the solid manure also due to the degradation of straw.



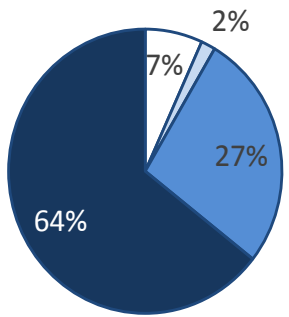
Emissions for storage (2)

SLURRY/NH3

g N-NH₃/m²/d



| | | | | | | | | |
|-------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Nb data | 59 | 26 | 32 | 20 | 10 | 5 | 5 | 5 |
| N slurry composition (g N/kg) | 4,5 | 5,4 | 3,6 | 3,4 | 3,9 | 3,9 | 3,4 | 4,2 |

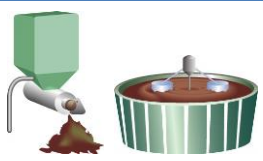


unknown sow mixt fattening

■ The results confirm the incidence of main factors on ammonia emissions

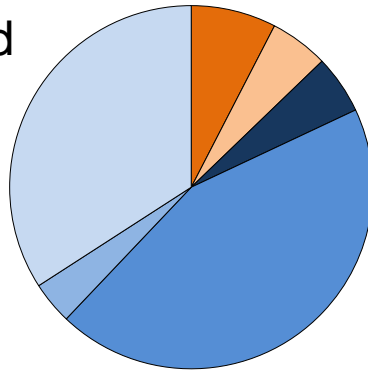
- presence of cover
- temperature
- air speed on the slurry surface
 - Main technique used to measure N emissions for slurry = a dynamic tunnel. Very few publications with the information on air speed and it is shown to be very important.

■ Importance of the metadata (average composition of the slurry higher for some modalities because of fattening pig slurry)



Emissions for Treatment (1)

Data selected



■ Solid manure composting

■ Solid manure additives

■ Slurry additives

■ Biological treatment

■ Anaerobic digestion

■ Slurry composting with straw

■ Three main treatments in publications

■ Slurry

■ Biological treatment

■ Composting with straw

■ Solid manure

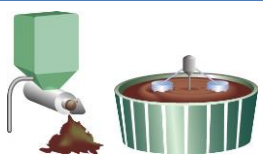
■ Composting

■ 93 data concerning biological treatment but :

■ A lot of phases (phase separation, reactor, decantation, storage of solid phase of separation, storage of sludge, storage of supernatant)

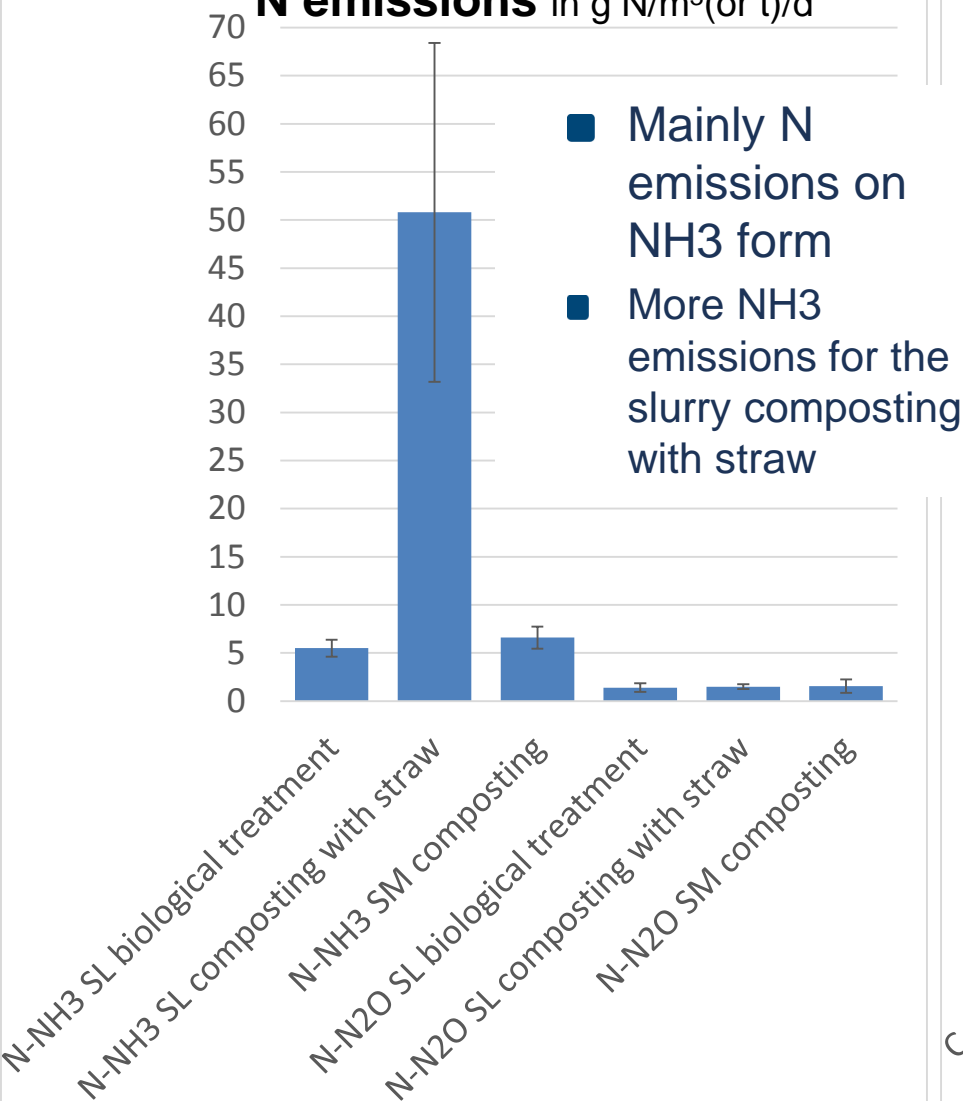
■ All data come from a unique scientific team

■ The data for treatment concern very different processes : few data per process

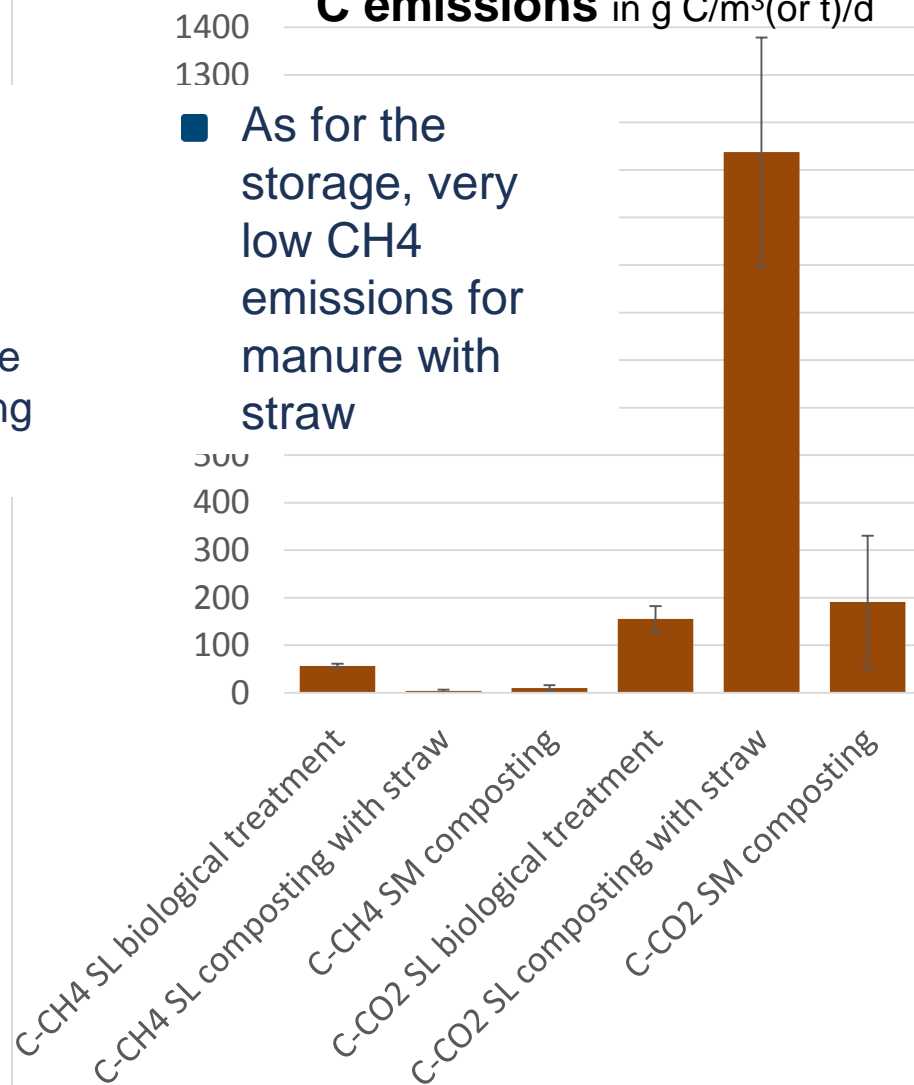


Emissions for Treatment (2)

N emissions in g N/m³(or t)/d



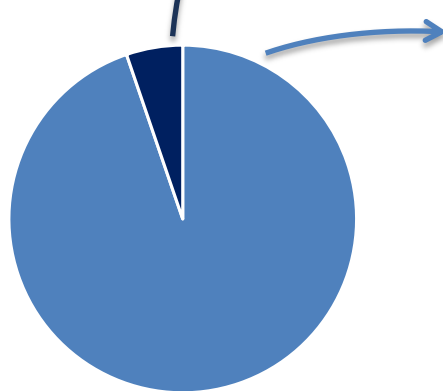
C emissions in g C/m³(or t)/d



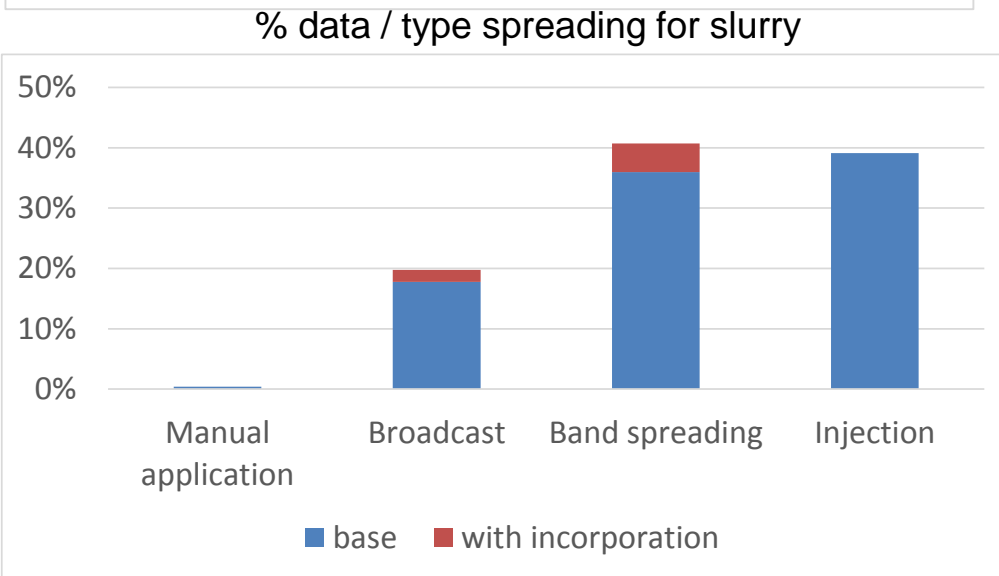
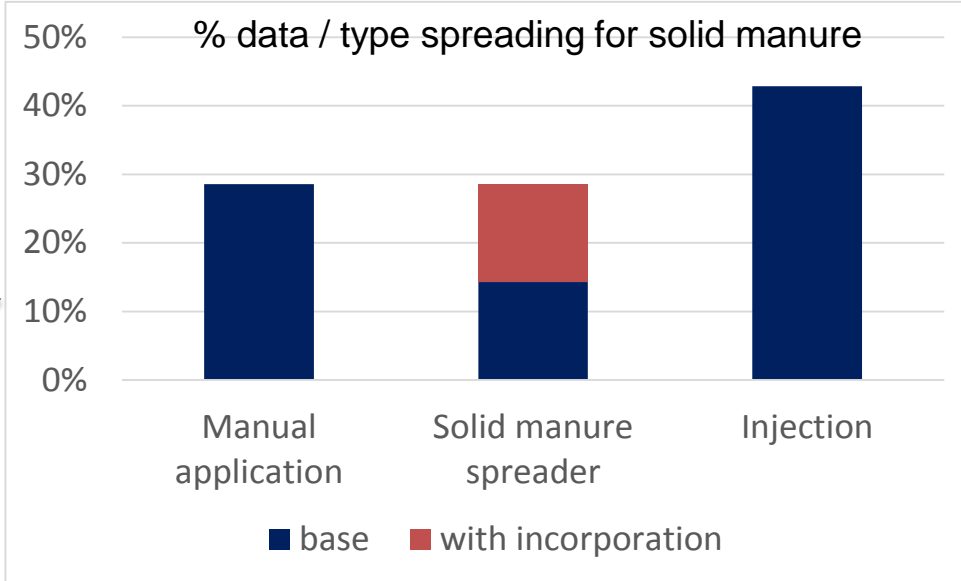


Emissions for spreading (1)

- Mainly data on slurry application (235 data selected vs 14 data for solid manure)
- For all the different types of spreading



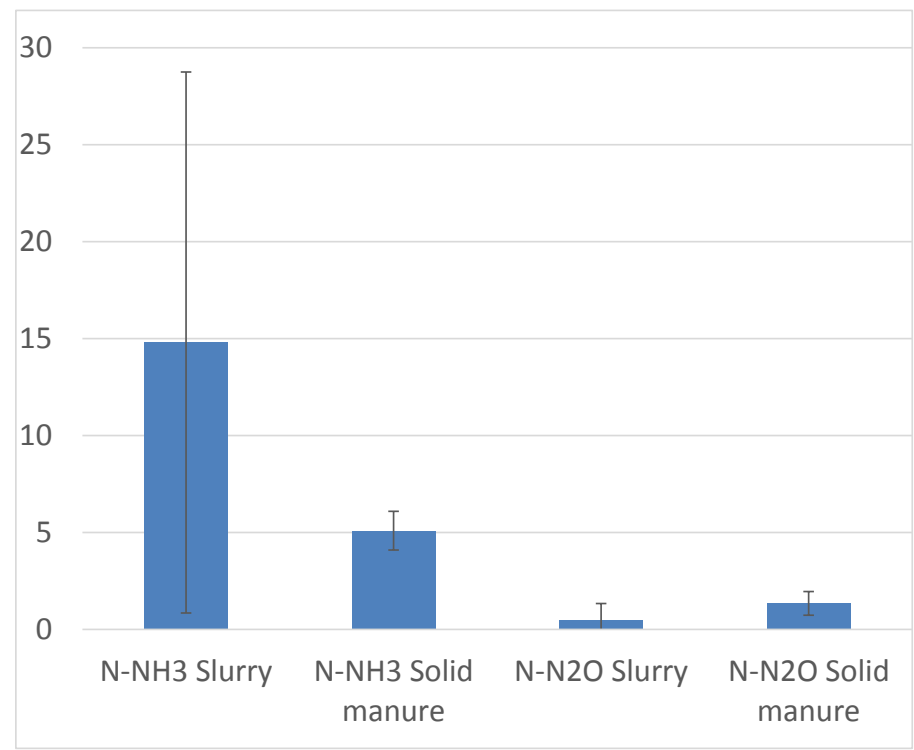
■ data slurry ■ data solid manure
Data selected





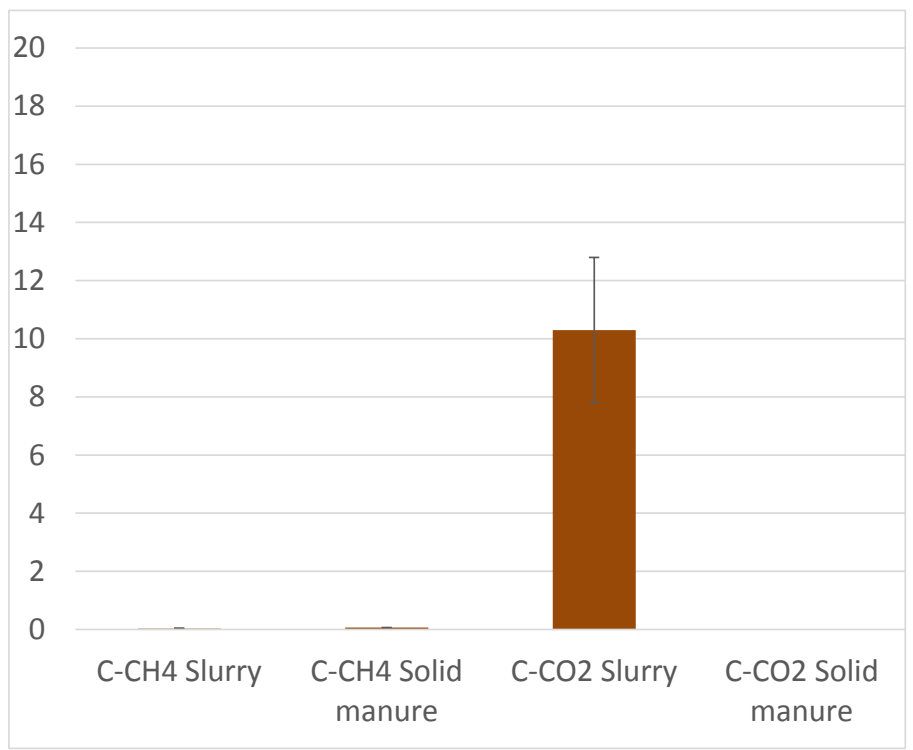
Emissions for spreading (2)

N emissions in g N/ha/d



- Mainly N emissions on NH3
- Emissions higher for slurry than for solid manure but with a very important variability

C emissions in g C/ha/d



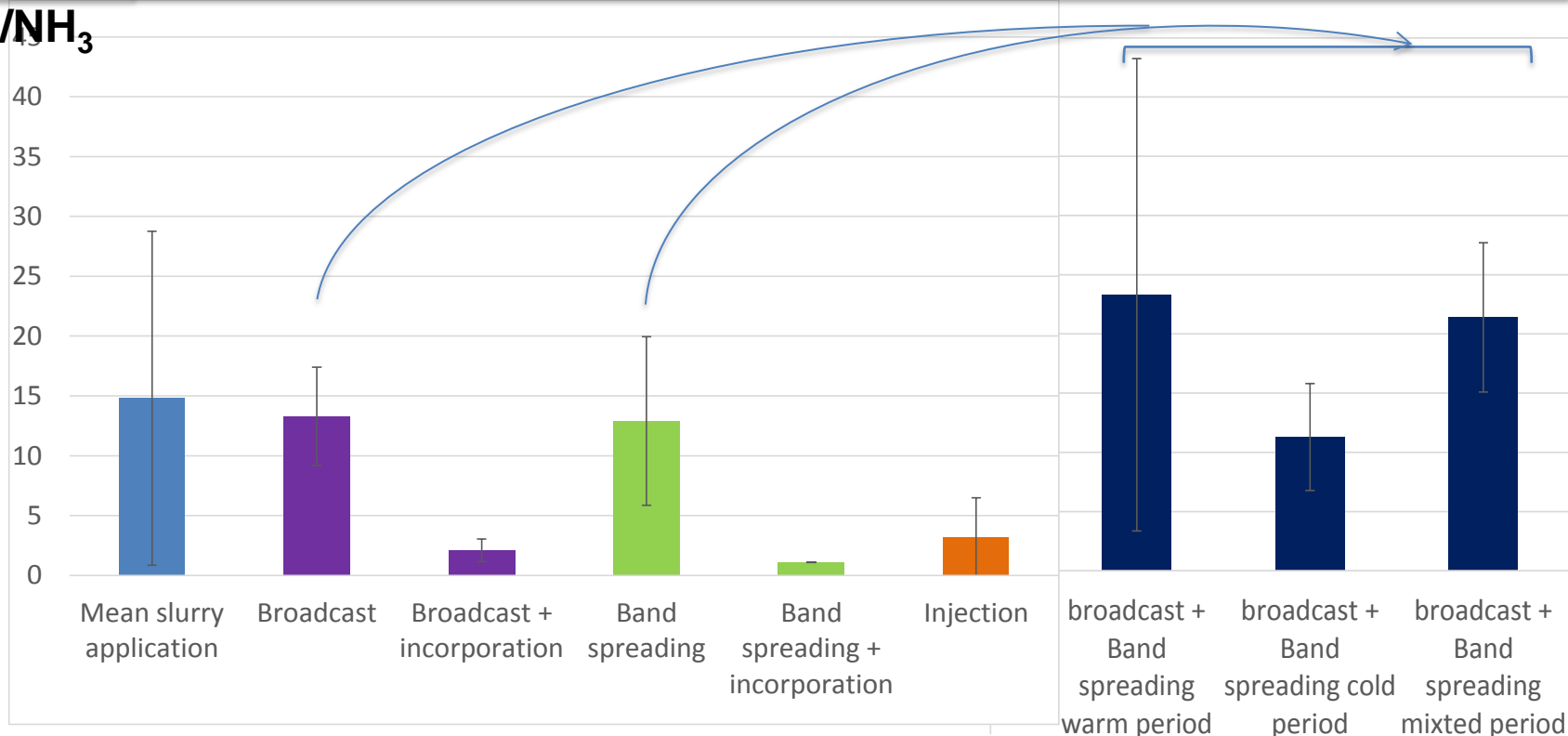
- No CH4 emissions during spreading.
- No data on CO2 emissions of solid manure during spreading



Emissions for spreading (3)

SLURRY/ NH_3

g N-
 $\text{NH}_3/\text{ha}/\text{d}$



| | | | | | | | | | |
|---------------------------------------------|-----|-----|----|-----|-----|-----|-----|-----|-----|
| Nb data | 135 | 21 | 5 | 63 | 2 | 32 | 51 | 24 | 19 |
| Application rate (m^3/ha) | 36 | 43 | 34 | 41 | 56 | 41 | 40 | 34 | 41 |
| Nitrogen input (kg N/ha) | 136 | 160 | 78 | 127 | 113 | 135 | 147 | 129 | 127 |

- Results confirm the incidence of the type of spreading on NH_3 emissions
- Again : importance of metadata on the application rate and the nitrogen input per ha

■ N : main losses on NH₃

- during storage of solid manure (18%)
- During spreading of slurry (16%) and solid manure (14%)
- During treatment by composting slurry with straw (30%)

■ Important lack of data

- Less than 10 data for
 - storage of solid manure
 - spreading of solid manure
 - For all process of treatments
- Composition of slurry, measurement duration, air speed for storage

- Several steps : building, storage, spreading and treatment
- A big lack of informations
- Most of the times on very influent parameters (nutritional strategy, manure management....)
- Great technical diversity in pig farms = increasing the number of EF to define pig farms in inventories
- Data base = useful tool to identify « black boxes » and to achieve new studies...

- Updating our tool
- Merging with others database developed by partners
- Pigs but also poultry and cattle production
- Not only NH₃ and GHG but also on particles and odors
- Future tool in english
- One name to remember : **ELFE**
- https://www6.inra.fr/animal_emissions/ELFE



The screenshot shows the homepage of the 'animal emissions' website. At the top, there are logos for INRA (Science & Impact), IFIP (Élevages & environnement), ANRS, and ANAEL. The main navigation bar includes 'Identifiez-vous' with options for 'Français' and 'English', and a user icon 'aa'. Below the navigation, there is a search bar and a sidebar with a menu: 'ADEME - Métrologie', 'Projets', 'Outils', 'ELFE', 'ANGAEL', 'MEGEVE', and 'Liens utiles'. The main content area is divided into 'Actualités' and 'Animal Emissions'. The 'Actualités' section features an article titled 'Mesurer les émissions gazeuses en élevage' with a sub-headline 'Mesurer les émissions gazeuses en élevage : gaz à effet de serre, ammoniac et oxydes d'azote' and a 'Lire la suite' link. Below this is another article snippet dated '10-13 juin : EMILI 2012 - Symposium international sur les émissions de gaz (ammoniac, gaz à effet de serre, odeurs) et de poussières par les élevages'. The 'Animal Emissions' section has a date '09 mars 2012' and a paragraph describing the website's purpose: 'Animal Emissions est le site web qui fait suite au projet ADEME métrologie destiné à la mise au point de procédures de référence pour la mesure des émissions en bâtiments d'élevage et au stockage des effluents. Son objectif est de mettre à disposition des outils et des liens permettant d'améliorer la gestion des émissions à partir de mesures en élevages.' A 'Liens' sidebar contains links: 'S'abonner aux actualités', 'RMT élevages et environnement', 'RMT bâtiments d'élevage du futur', and 'Calibration'. The page footer includes '66th EAAP, Warsa' on the left and '09/2015' and '14' on the right.

Thank you for your attention



www.ifip.asso.fr