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Ammonia and greenhouse gases emissions from dairy cattle buildings

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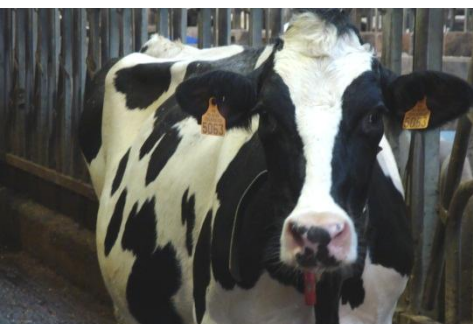
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Ammonia and greenhouse gases emissions from dairy cattle buildings: slurry vs. farm yard manure management systems

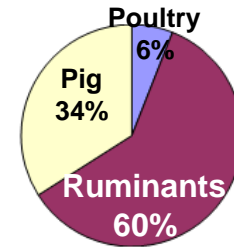
Edouard N., Charpiot A., Hassouna M., Faverdin P., Robin P., Dollé J.B.



Livestock emissions in France

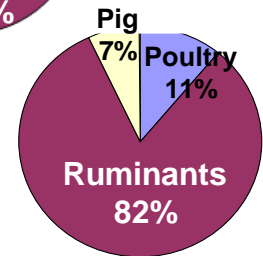
74% of CH₄ emissions come from agriculture

LIVESTOCK: enteric fermentation 48%
manure management 24%



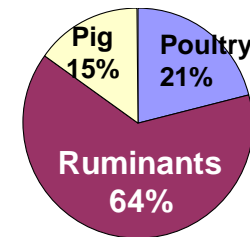
78% of N₂O emissions come from agriculture

LIVESTOCK: manure management 9%



97% of NH₃ emissions come from agriculture

LIVESTOCK: manure management 78%



Data CORPEN 2006, CITEPA 2010
www.citepa.org



Buildings and manure management systems

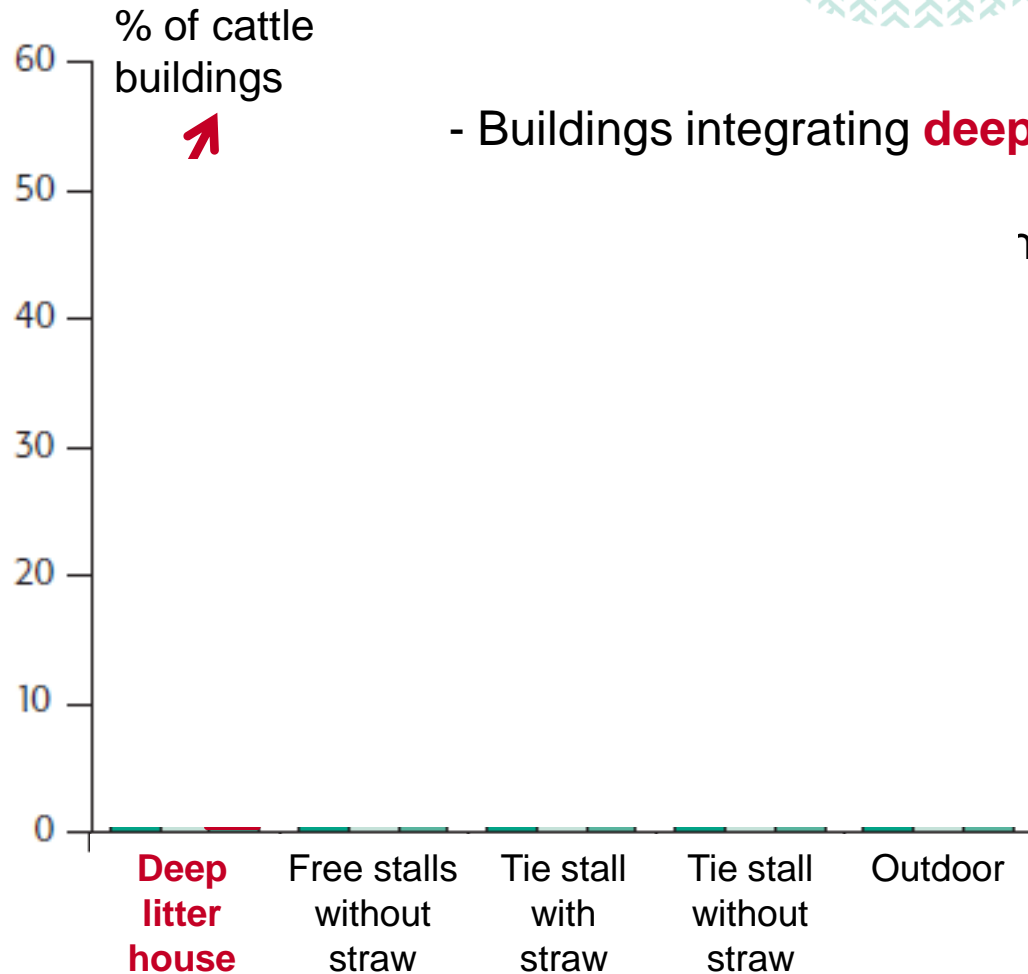
2012
EmiLi

June 10-13, 2012
St-Malo, France

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A large diversity of buildings and manure management systems in France



- Buildings integrating **deep litter** are increasing

their gas emissions

Aims:

- New **data representative** of diverse housing systems in dairy cattle
- Specify what is the **contribution of the litter**

Source : SSP - Agreste - Enquête bovine 2008

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Methods

- 2 groups of 3 **dairy cattle** in late lactation
- 2 contrasted **housing systems** compared in mechanically ventilated rooms:

Deep Litter => farm-yard manure

Tying Stall => slurry



DL – TS =
litter emissions

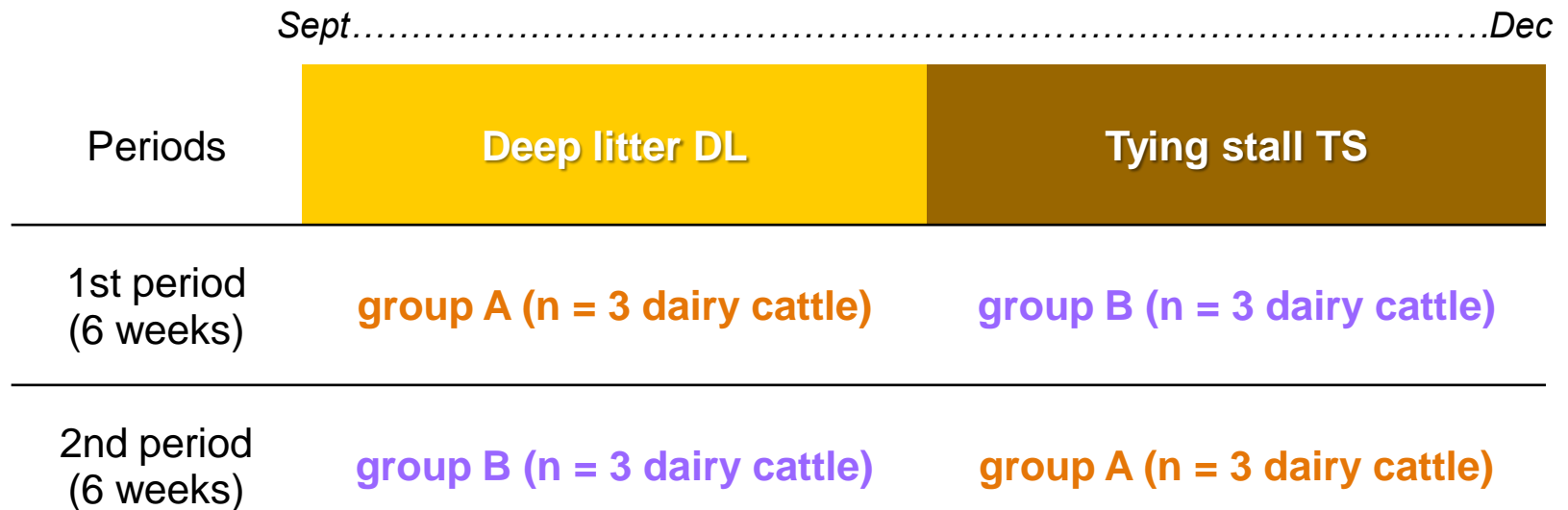


- Free cows,
- 10kg fresh straw/cow/day,
- 12m²/cow

- Tied cows,
- 2.5kg sawdust/cow/day,
- Slurry scraped twice a day

Methods

- 2 groups of 3 **dairy cattle** in late lactation
- 2 contrasted **housing systems** compared in mechanically ventilated rooms:

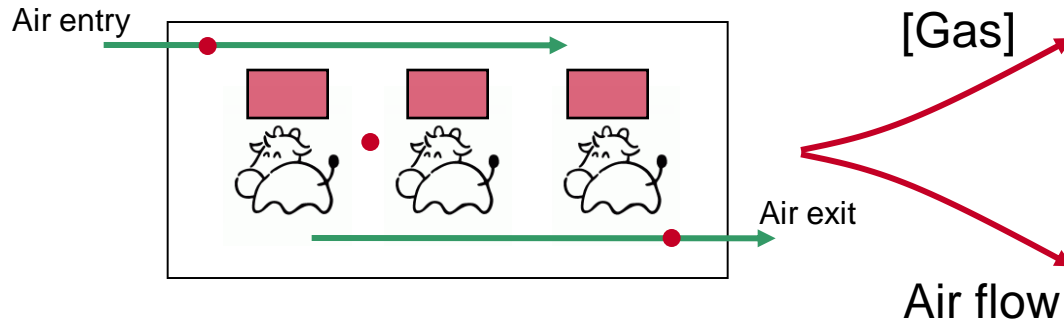


Methods

➤ NH_3 , CH_4 , N_2O , H_2O , CO_2 **emission** measurements

Continuously 24h/24 for the 2 systems

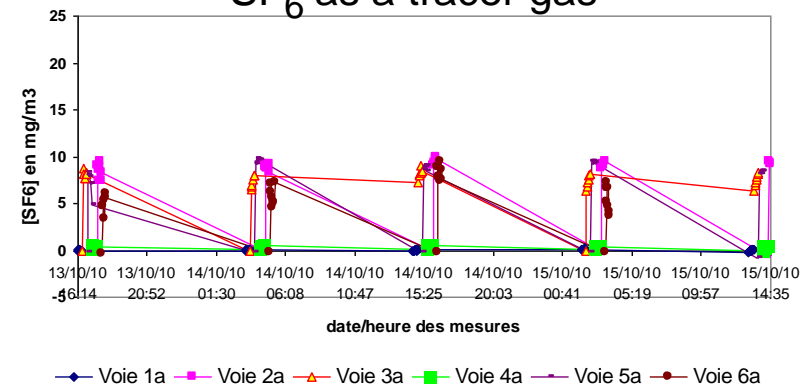
infra-red photoacoustic analyser INNOVA



➤ **Animals & diets** measurements

- Diet composition
- DM intake and digestibility
- Milk yields and composition
- Manure composition
- ...

SF_6 as a tracer gas



Emissions from contrasted housing systems

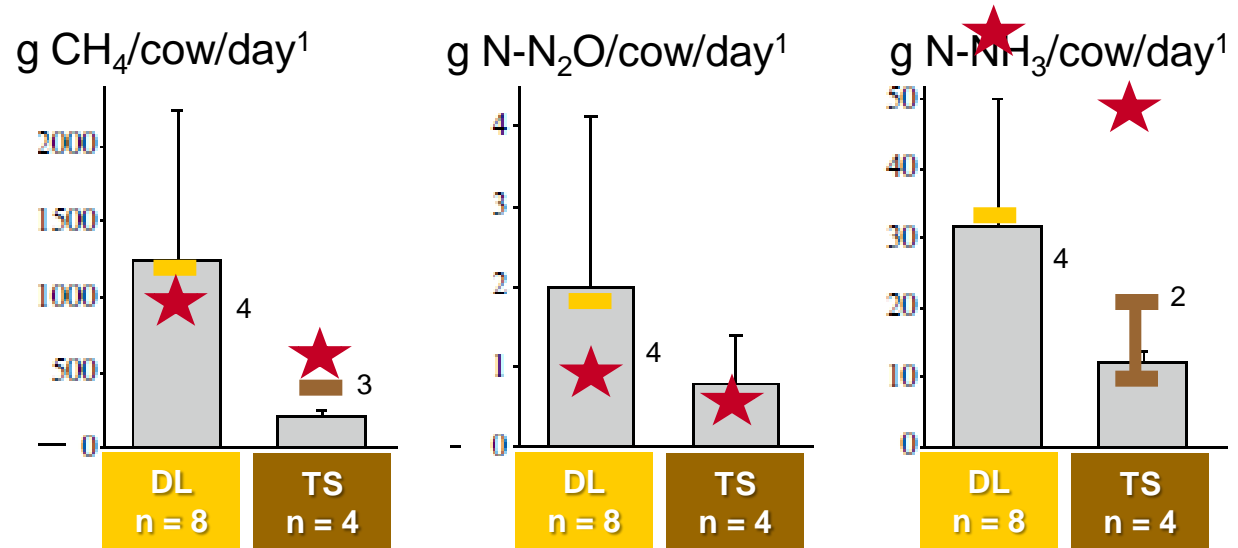
➤ System emissions (LU = 500kg)

g/day/LU	DL		TS
C-CH ₄	495 ±12	>	373 ±6
N-N ₂ O	0.67 ±0.07	>	0.36 ±0.02
N-NH ₃	46.2 ±1.7	>	37.4 ±1.2

In accordance with
Webb et al. (2012)¹

- ²Powell et al. (2008)
- ³Vermorel (1995)
enteric CH₄
- ⁴Mosquera et al. (2006)

★ Present study



Emissions from contrasted housing systems

➤ **System** emissions => quite high compared to the literature (C-CH₄ and N-NH₃)

- Over-estimation of ventilation rates?

	m ³ /h/cow	
Measured	950	10

1000 m³/h/cow in naturally ventilated buildings, France, Dollé and Robin (2006)

=> Anemometer?

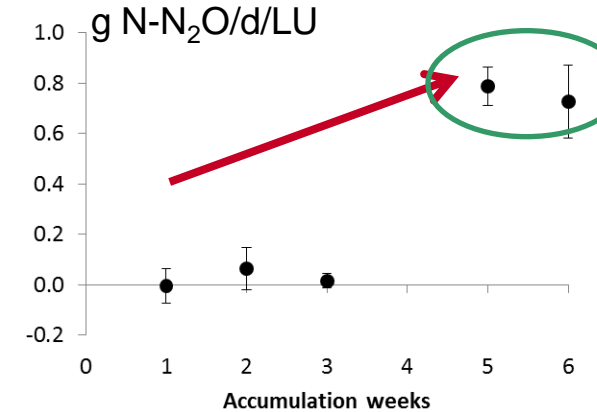
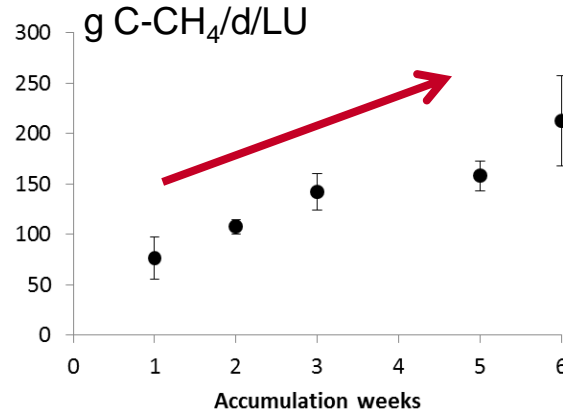
- Over-estimation of gas concentration inside the rooms due to polluted air coming from gutters (especially for tying stall)?

g/day/LU	Before experiment
C-CH ₄	34
N-NH ₃	9

Emissions from contrasted housing systems

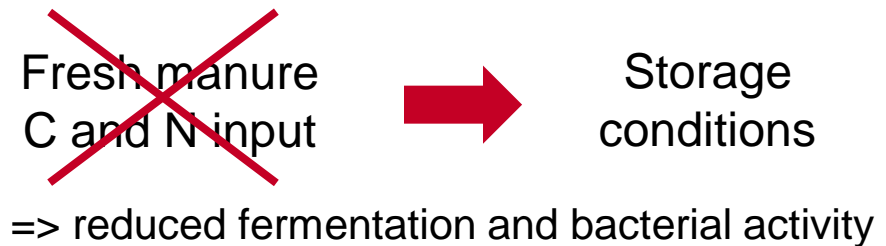
➤ Litter direct emissions (with animals)

g/day/LU	DL - TS	%DL
C-CH ₄	122	25%
N-N ₂ O	0.31	46%
N-NH ₃	8.8	19%



➤ Farm yard manure emissions after 6 weeks of accumulation (animals out)

g/day/LU	FYM
C-CH ₄	38
N-N ₂ O	0.93
N-NH ₃	10



Conclusions and perspectives

- New emission data representative of French livestock production systems

Deep Litter > Tying Stall

Good for welfare ← ↪ Bad for GHG building emissions
↪ Storage and land application?

Better understanding of emitting processes to propose mitigation options

- Perspectives: study crossed effects of nutrition and manure management

- Low N diet		- Free stall with cubicles => slurry
- High N diet	X	- Deep litter => farm yard manure

≠ N content/partition in manure X ≠ C/N ratio and manure management = **Gas emissions?**

Thank you for



your attention



your questions



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