Enteric methane emission of dairy cows on practical farms

EAAP 2019, Ghent, Belgium

August 29th, Lisanne Koning

Wageningen Livestock Research

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100years
1918 — 2018

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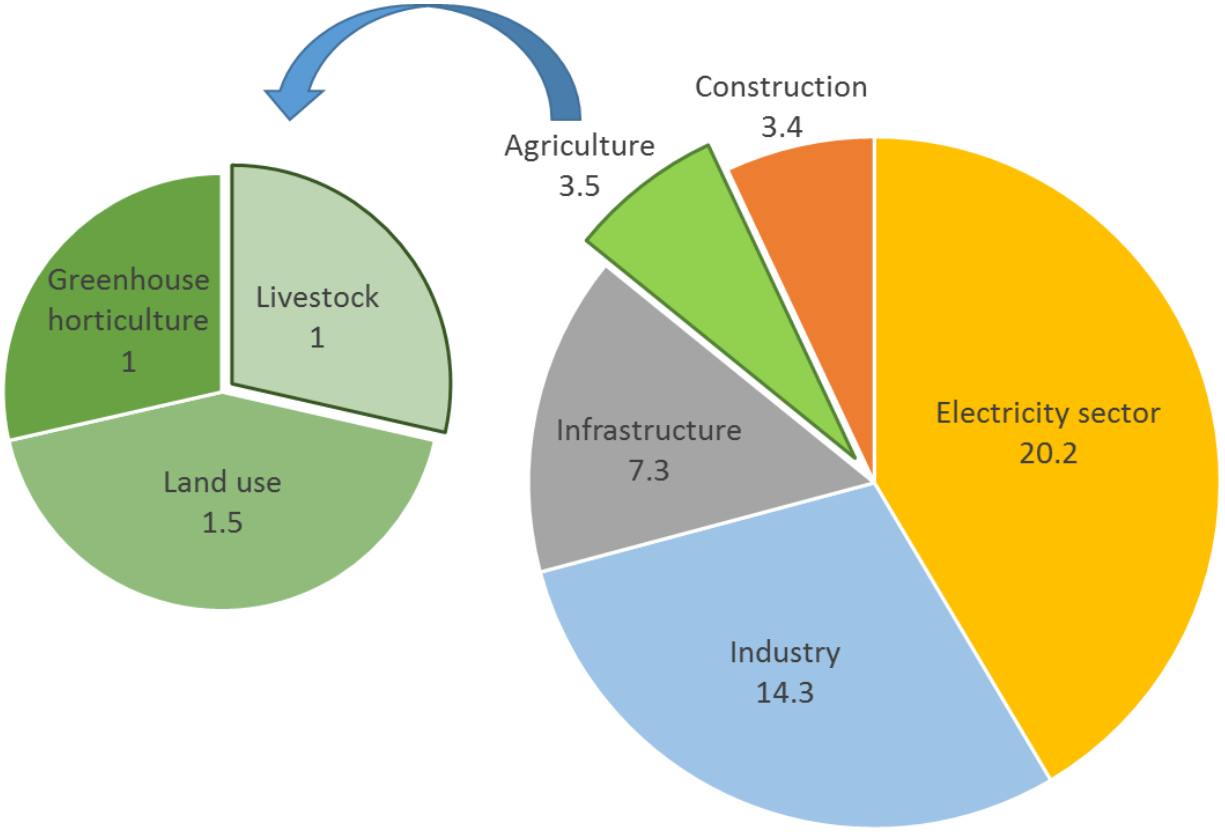

- Paris Clir
- Current k
  - Ave and
    - 15.4 g CH_4 /kg FPCM (Bannink *et al.*, 2011)
      - 13.8 g CH_4 /kg FPCM
  - Reduction potentials up to 30% based on experiments (Tamminga *et al.*, 2007, Lopes *et al.*, 2016)

Aims of this study

- An inventory to gain insight into the average CH_4 emission and variation of the Dutch dairy herd
- Finding indications that factors as animal and farm have an effect on the variation in CH_4 emission
- Addressing possibilities for follow up research

Measuring at commercial dairy farms

- September ‘18 – February ‘19
- 633 cows of 18 farms
  - Individual CH_4
  - Individual milk production
  - Group feed intake
  - Diet composition
- No experimental set up
- Greenfeed (C-lock Inc., USA)

Greenfeed (C-lock Inc., USA)

- Measures CH_4, CO_2, airflow and head positioning
    - Uses all this to calculate ar emission in g CH_4/cow/day
- Voluntary visits lured by compound feed
- Preferably 20 measurements or more per animal (Manafiazar, 2016)
- Measuring period 2 weeks per farm (+1 week adaptation)

https://www.c-lockinc.com/shop/automated-emissions-measurement/greenfeed-large-animals/

Results

- 491 cows with ≥20 measurements
- 1 farm discarded
- 2 farms no milk data available

Test group

31.8 kg FPCM

21.7 kg DMI

Bannink *et al.* (2011)

Dutch dairy herd average

Results

- Average CH_4 emission:
  - 431±62 g CH_4/cow/day
  - 14.3±3.1 g CH_4/kg FPCM
- Adapted Bannink *et al.* (2011):
  - 13.8 g CH_4/kg FPCM
- Respiration chamber data:
  - 406±60 g CH4/cow/day
    (VanLierde *et al.*, 2018)
  - 414±71 g CH4/cow/day
    (Van Gastelen *et al.*, 2015)

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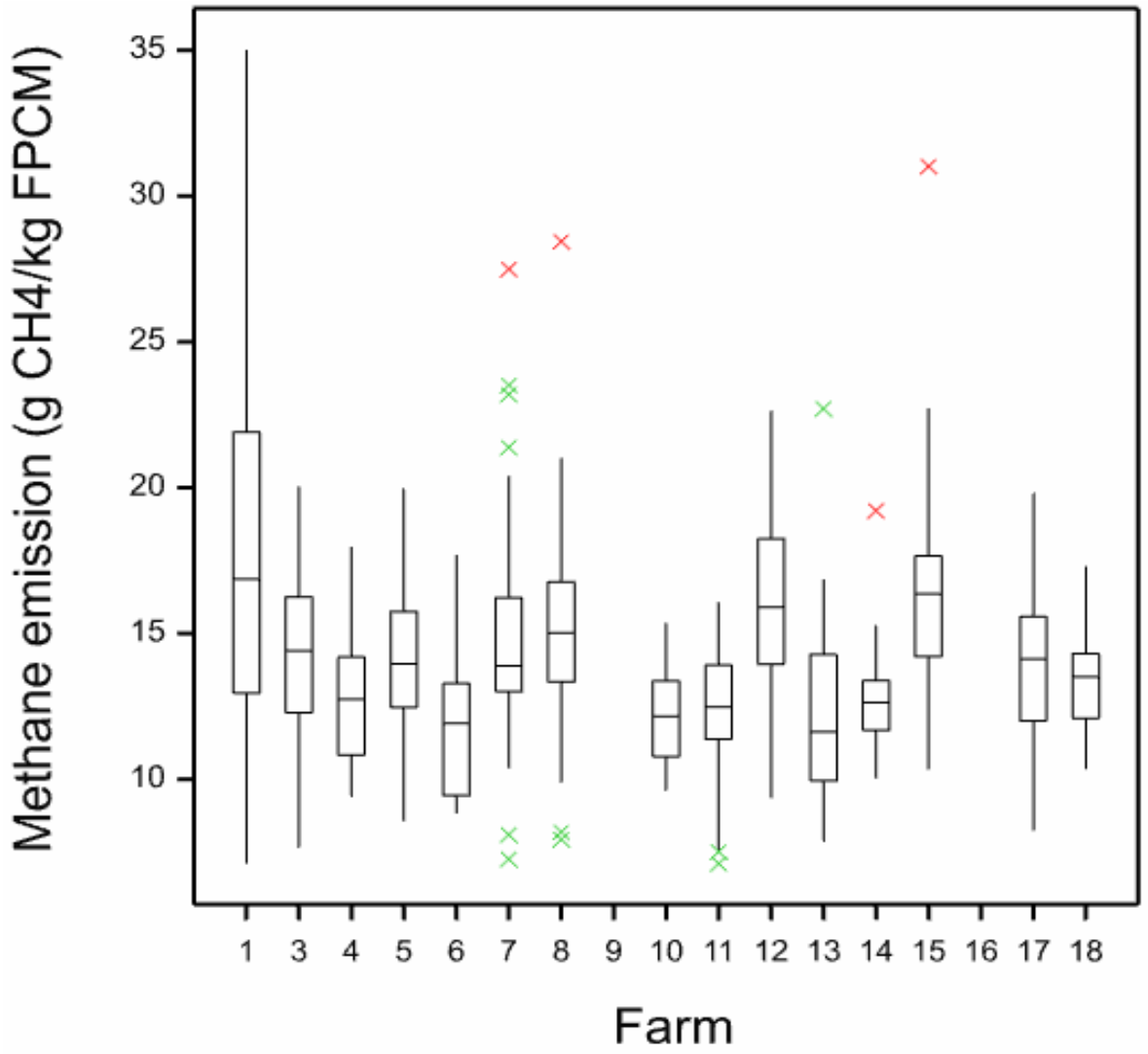
Results

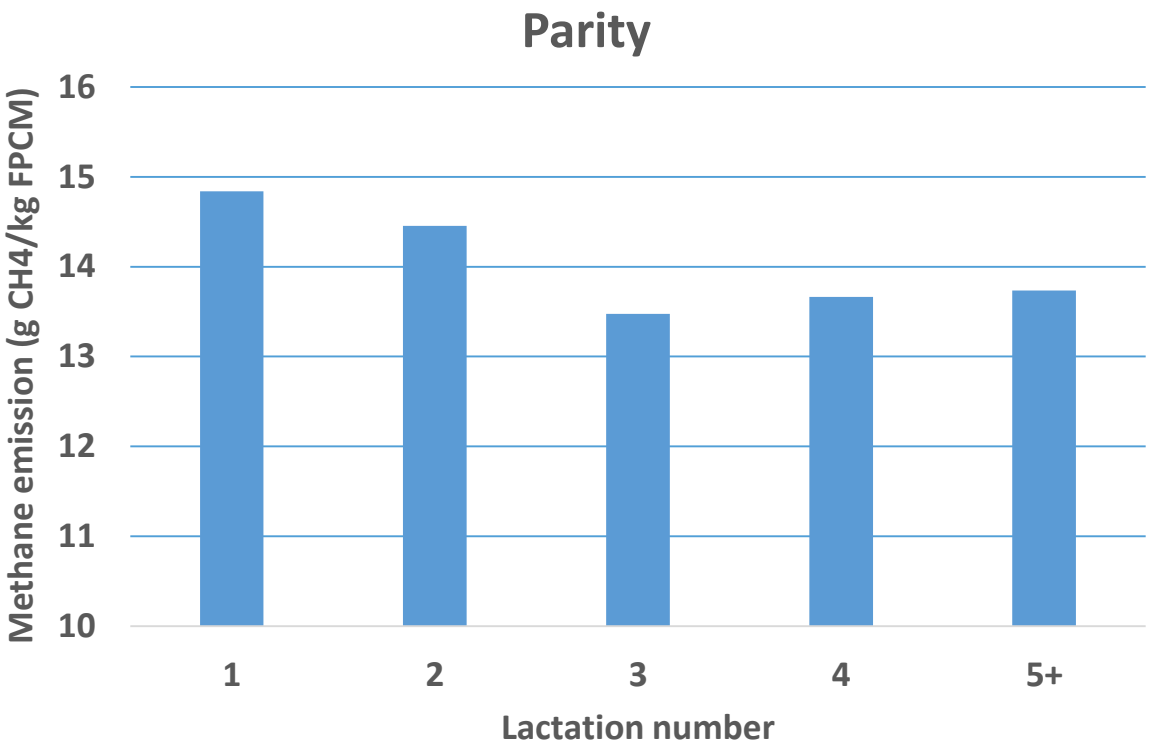

Methane emission (g CH4/kg FPCM)
35
30
25
20
15
10
1 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Farm

Effect of cow characteristics

Mixed model

Effect of parity:

R_{unadj}^2=3.1%
F=6.18, p<0.001

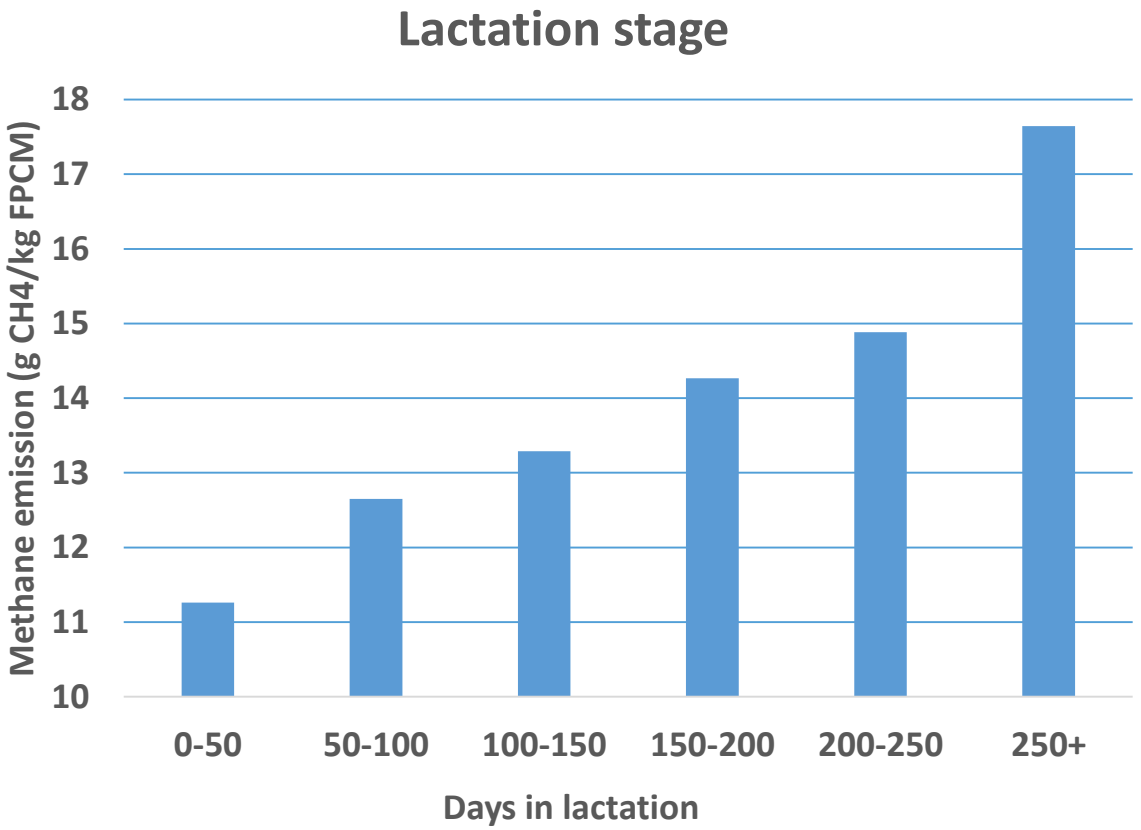


Effect of cow characteristics

Effect of lactation stage:

R_{unadj}^2=42.9%
F=74.54, P<0.001

(Bittante *et al.*, 2017)

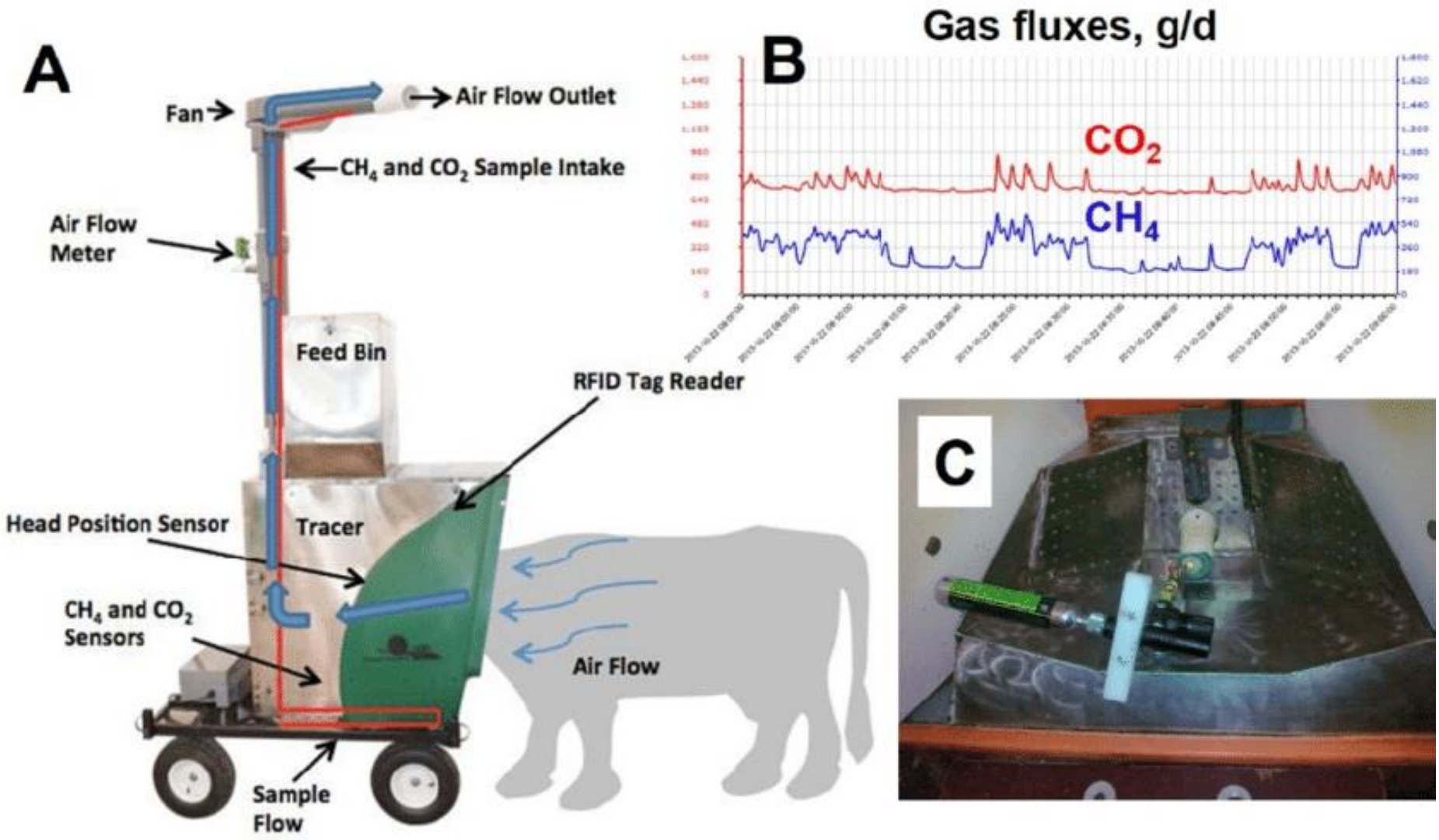


Conclusions

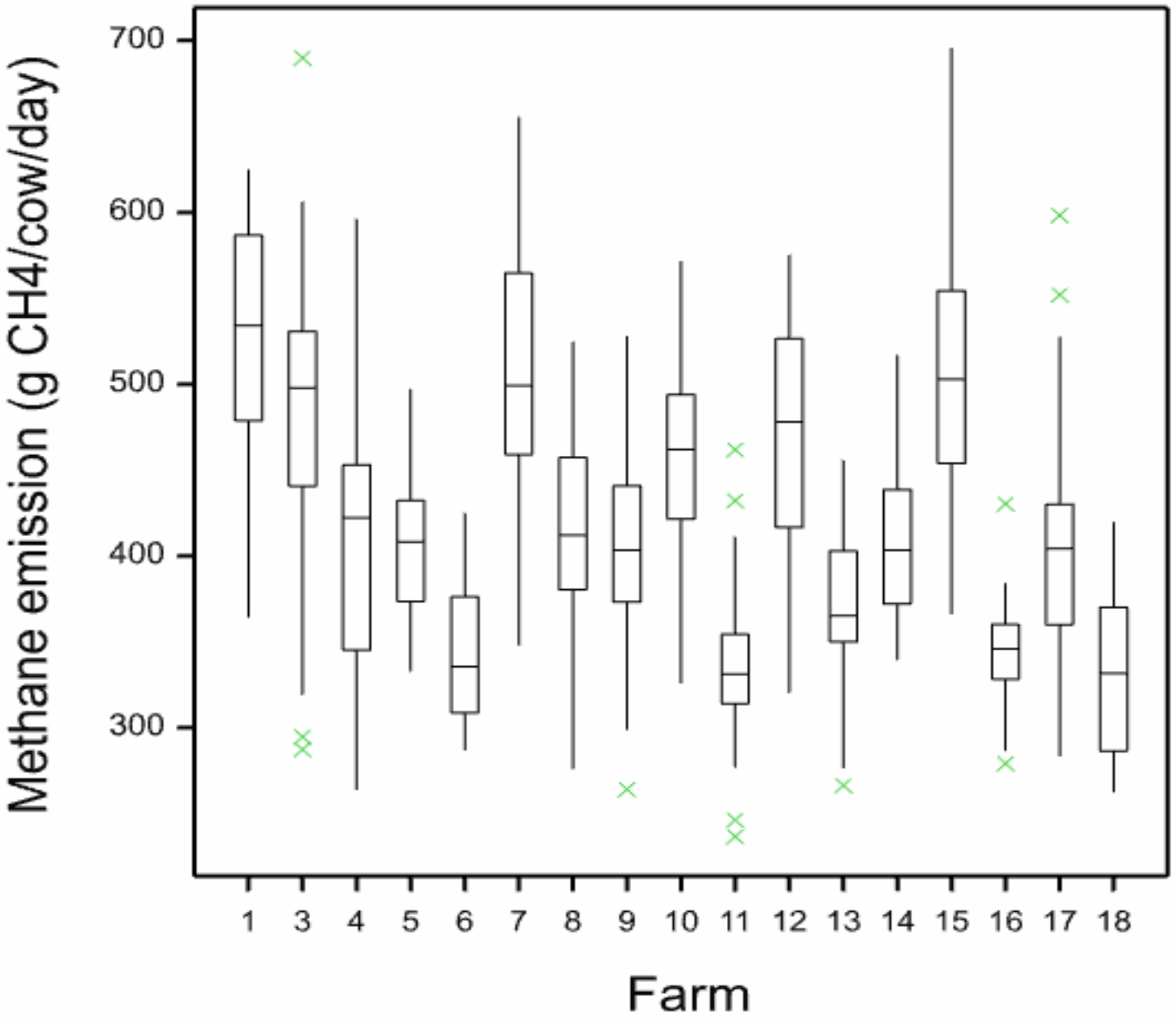
- Results are preliminary, making it difficult to draw conclusions.
- Average CH_4 emission: 14.3±3.1 g/kg FPCM
- Measured versus calculated emission is in agreement
- Both within farm and between farm variation is large
- Average CH_4 emission changed over parity and lactation stage, with a with a greater effect of lactation stage (42.9%) compared to parity (3.1%)

End

Thank you for your attention!



(Cabezas-Garcia, 2017)


Methane emission (g CH4/cow/day)
700
600
500
400
300
1
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Farm

Tables

Feed component	Reference diet %	Avg test diet %
Grass silage	39	38
Maize silage	26	25
Grass herbage	10	5
Concentrates	22	26
Wet by-products	3	6

	Dutch average	Test group
DM intake (kg DMI/cow/day)	20.3	21.7
FPCM	29.7	31.8
% heifers	32.6	35.0
% 2nd lactation	27.4	28.8
% 3rd lactation	18.4	16.6
% older cows	21.6	19.5

Comparisons

Test group	• 31.8 kg FPCM • 21.7 kg DMI • Diet (g:m:c): 46:26:28%	1.465
Bannink *et al.* (2011)	• 27.4 kg FPCM • 19.4 kg DMI • Diet: 51:27:23%	1.412
Gastelen *et al.* (2015)	• 24.9 kg FPCM • 16.7 kg DMI • Diet: 54:26:20%	1.491
Dutch dairy herd average	• 29.7 kg FPCM • 20.3 kg DMI	1.463

Effect of farm

- No effect of region found, only trend (R_{unadj}^2=23.1%, F=2.83, p=0.098).
- Too low number of n