Trade-offs of N-reducing dietary measures on enteric methane emission and phosphorus excretion in lactating cows

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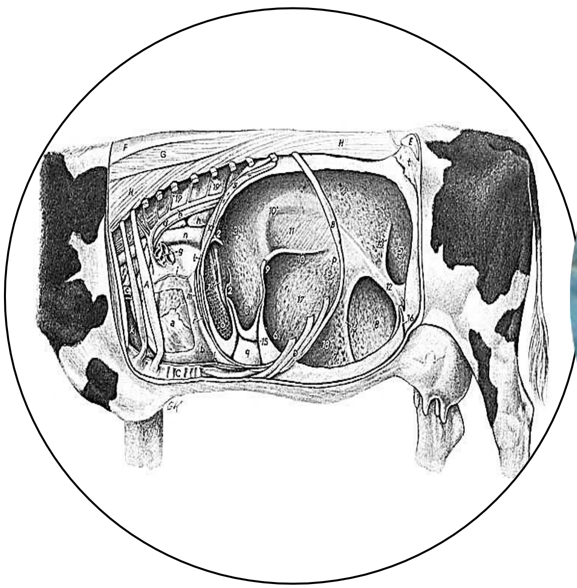

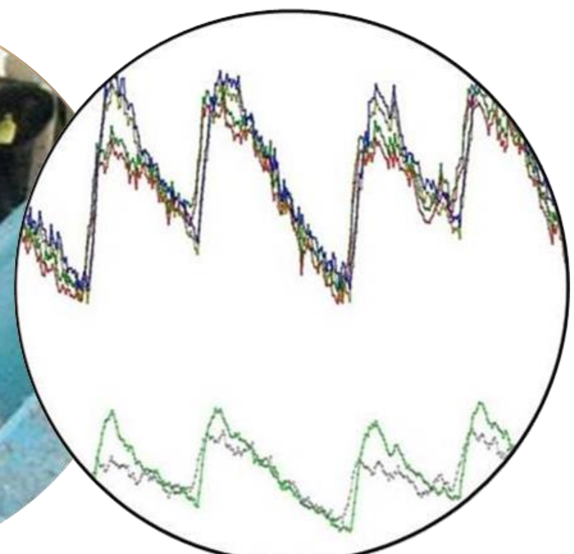

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N (& P ?) reducing feeding measures

- On-farm feed production
  - Forages, legumes, cereals
- Purchased feeds
  - concentrates
  - by-products
- Impact on
  - N excretion
  - P excretion
  - Fermentability / composition / CH_4
- Relationships between N/P excretion and enteric CH_4 emission, and any trade-offs ?

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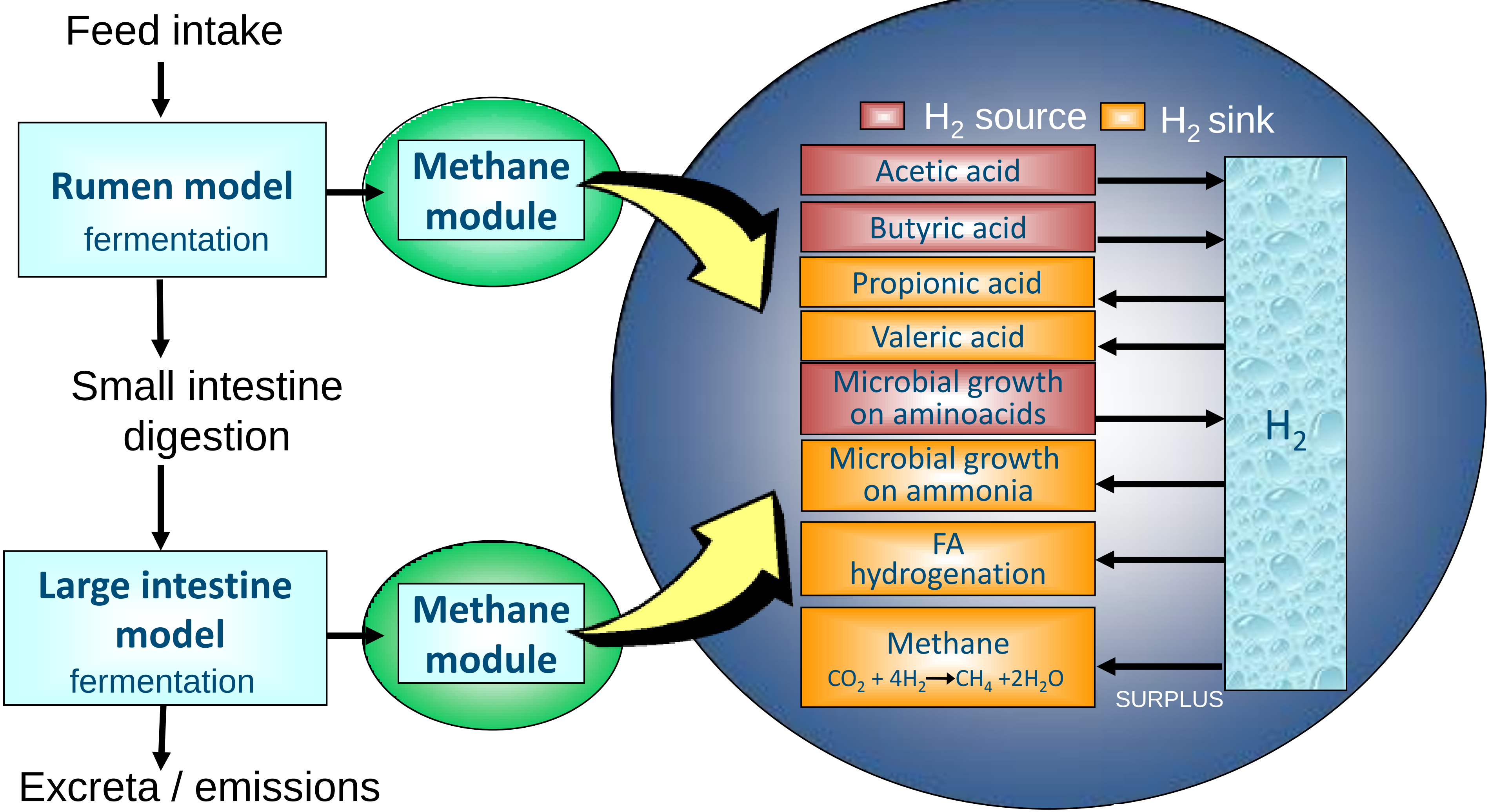
Enteric fermentation model used

(Dijkstra et al, 1992; Mills et al, 2001; Bannink et al, 2006, 2008, 2011)



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Simulating N reducing measures (Reijs, 2007)

- Feed intake capacity calculations (Zom et al., 2002)

- By grassland management
  - 100 kg available N/ha from animal manure
    150 vs. 350 kg artificial fertilizer N/ha

  - Late cut (4500 kg DS/ha) vs. early cut (3000 kg DS/ha)

- High vs. low feed intake level; 40% vs. 20% concentrates

- N-poor substitutes for grass silage
  maize silage (50%); straw, beet pulp, potatoes (15%)

- FPCM (3.32% milk protein, 4% milk fat); 1 g P/kg milk

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Assumptions (Reijs, 2007)

- NE_L content (MJ/kg DM)

grass silage HF-EC, HF-LC, LF-EC, LF-LC:	6.3, 5.8, 6.0, 5.7
straw, beet pulp, maize silage, potatoes:	3.5, 7.3, 6.6, 7.2
concentrates:	7.2

- N content (g N/kg DM)

grass silage HF-EC, HF-LC, LF-EC, LF-LC:	35, 26, 23, 18
straw, beet pulp, maize silage, potatoes:	8, 16, 12, 16
concentrates:	24

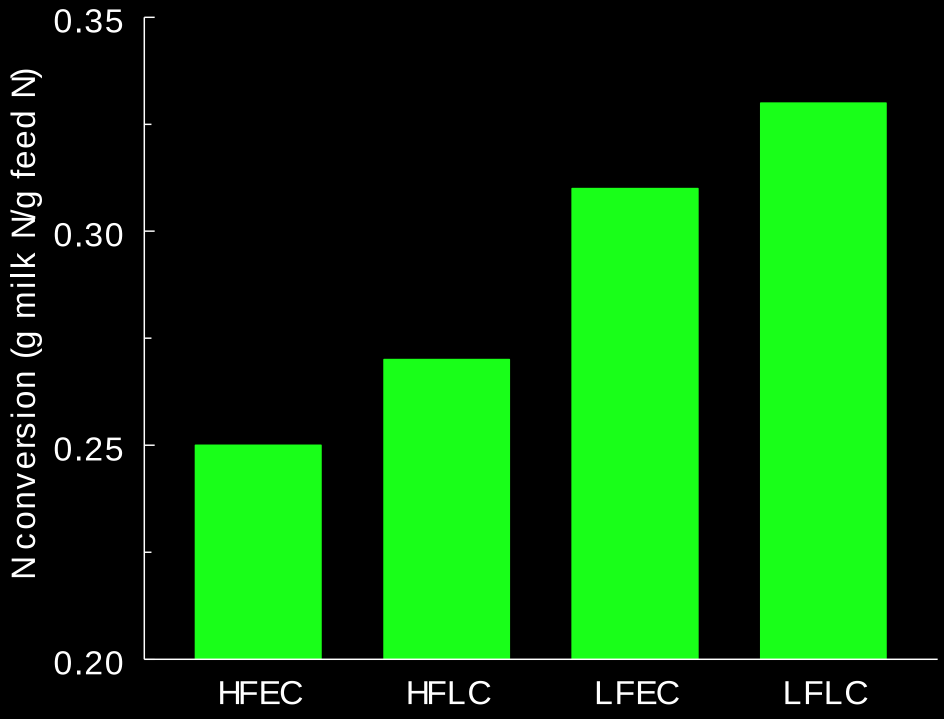
- P content (g P/kg DM: Van Middelkoop, 2012)

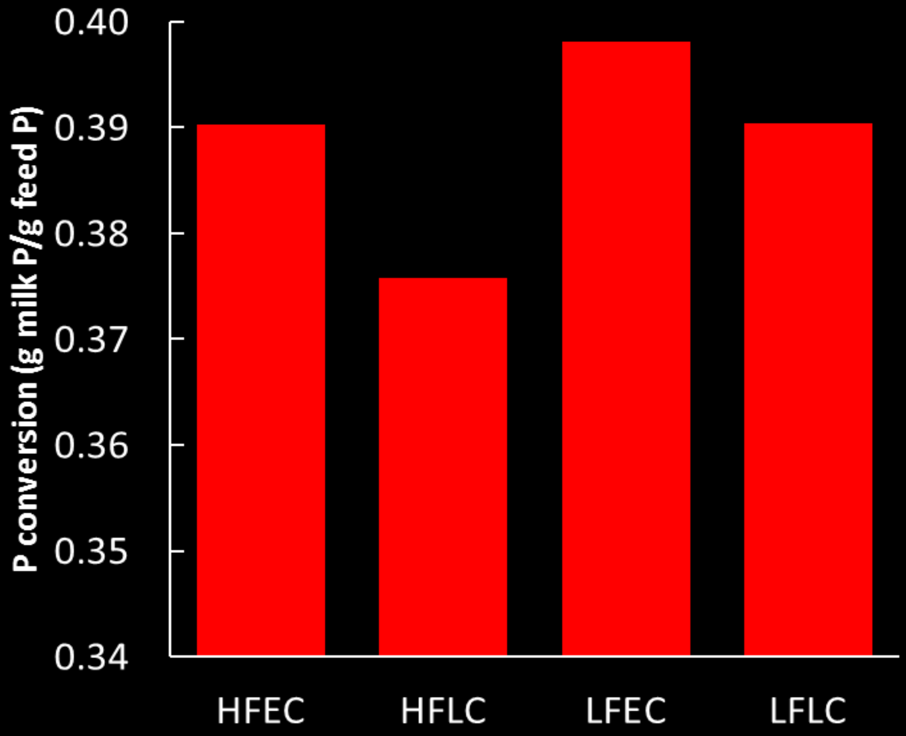
grass silage HF-EC, HF-LC, LF-EC, LF-LC:	4.0, 3.5, 3.6, 3.1
straw, beet pulp, maize silage, potatoes:	2.5, 0.7, 2.0, 2.4
concentrates:	4.5

Simulation results: mean & range

	Mean	*Range*
Feed intake (kg DM/d)	19.6	16.0 – 22.4
Milk production (kg FPCM/d)	27.5	19.1 – 33.8
N intake (g N/d)	509	311 – 730
P intake (g P/d)	71	53 – 91
Apparent OM digestion (%)	75	70 – 82
Apparent N digestion (%)	69	59 – 78
Apparent P digestion (%)	39	34 – 45
N excreted (g/d)	365	211 – 558
P excreted (g/d)	44	30 – 57
Methane emission (g/d)	407	334 – 441

Grassland management: N & P





HF, high N fert.
LF, low N fert.

EC, early cut
LC, late cut

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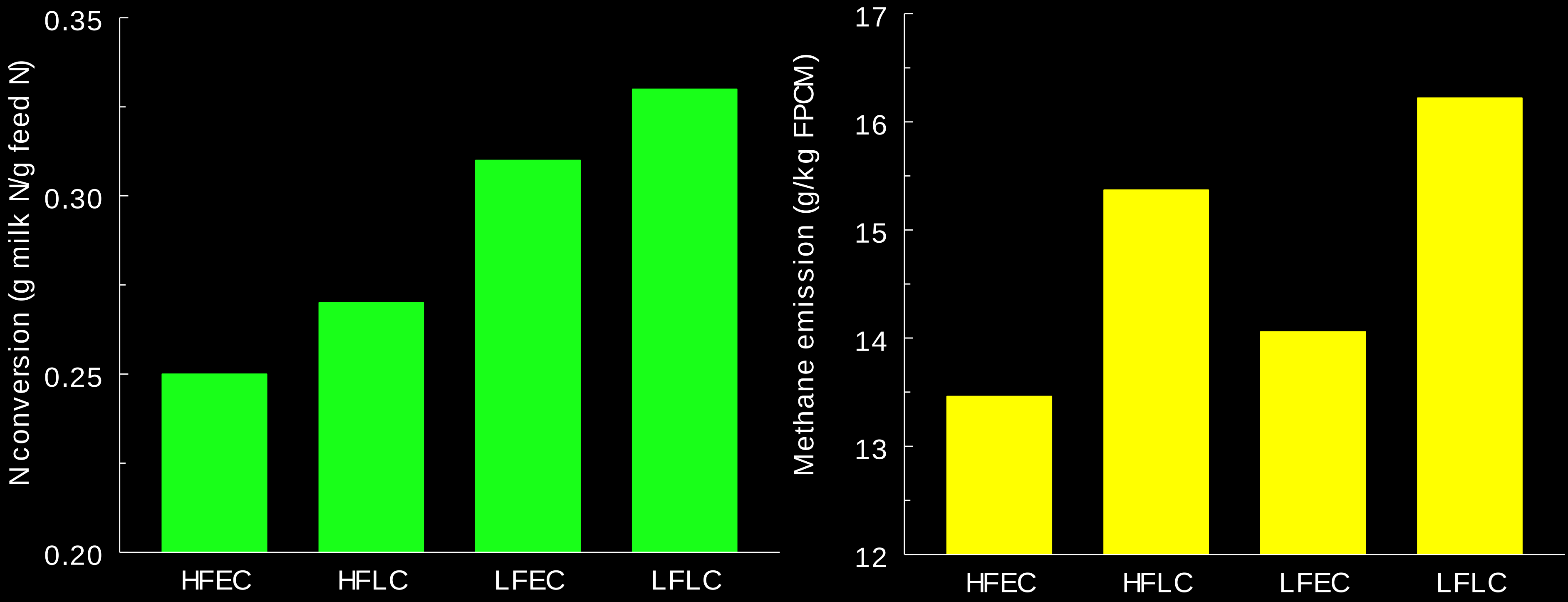
Grassland management: N & CH_4



HF, high N fert.
LF, low N fert.

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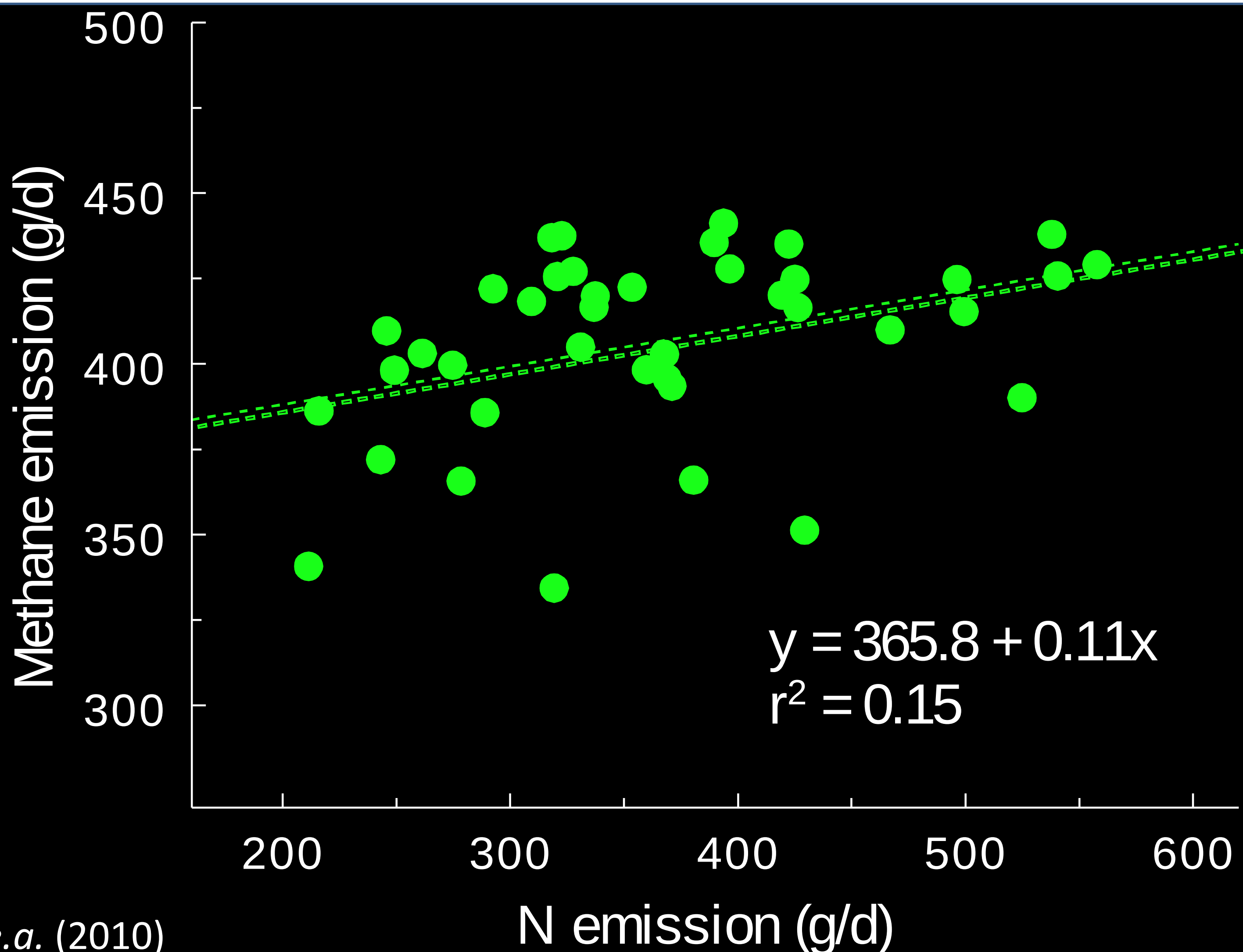
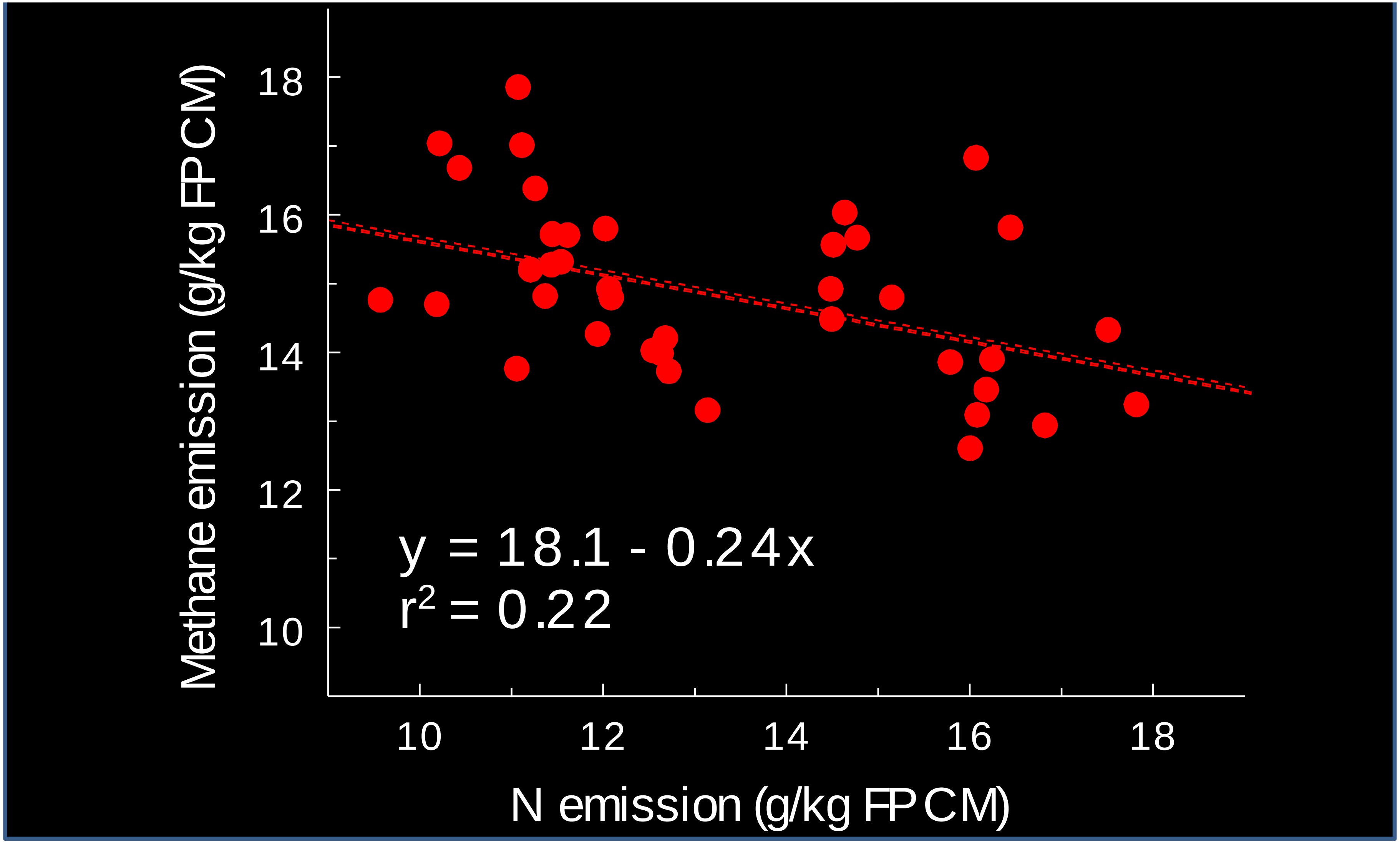
N excretion & CH_4 emission



Dijkstra *e.a.* (2010)

N excretion & CH_4 per kg milk



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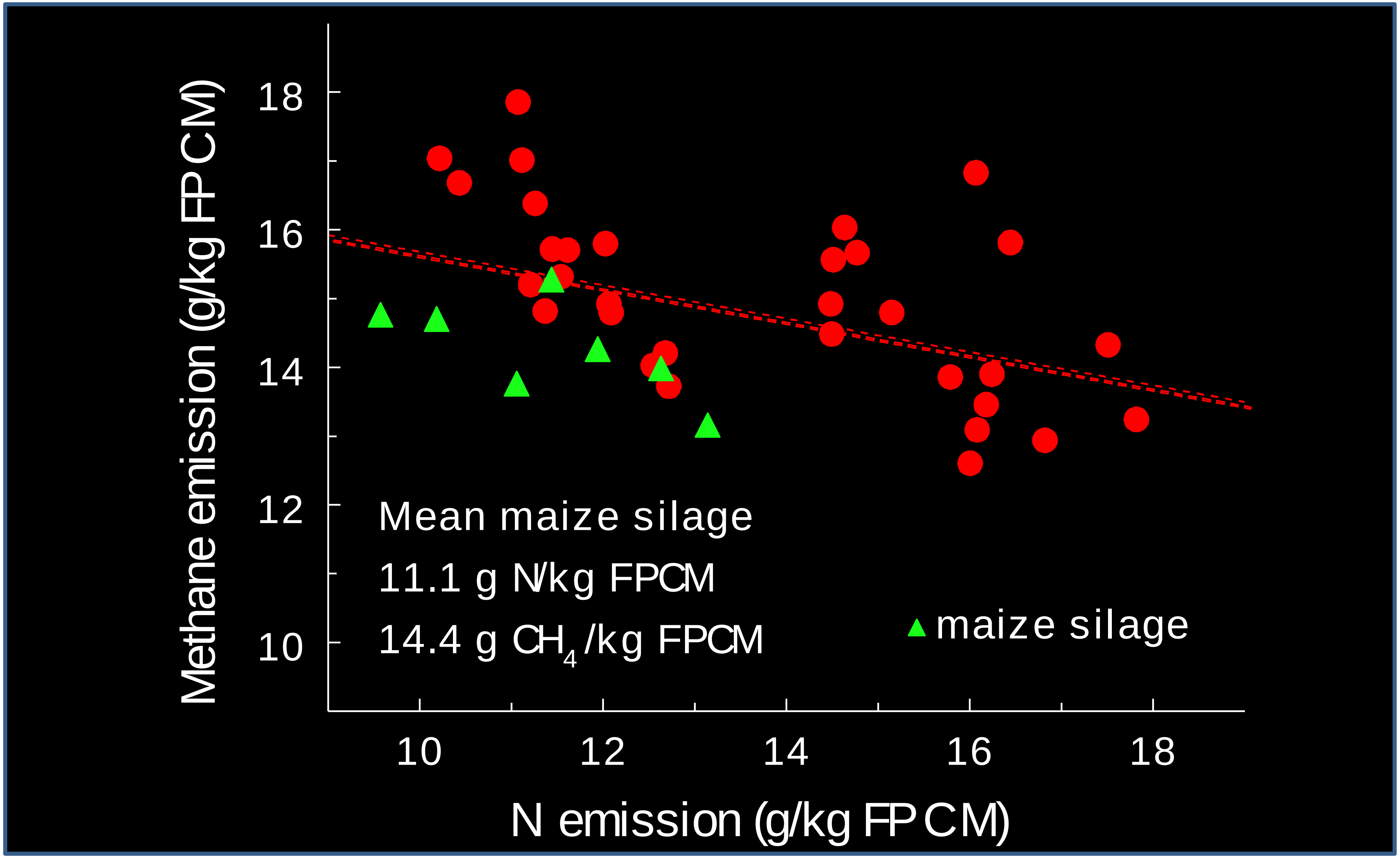
N excretion & CH_4 per kg milk



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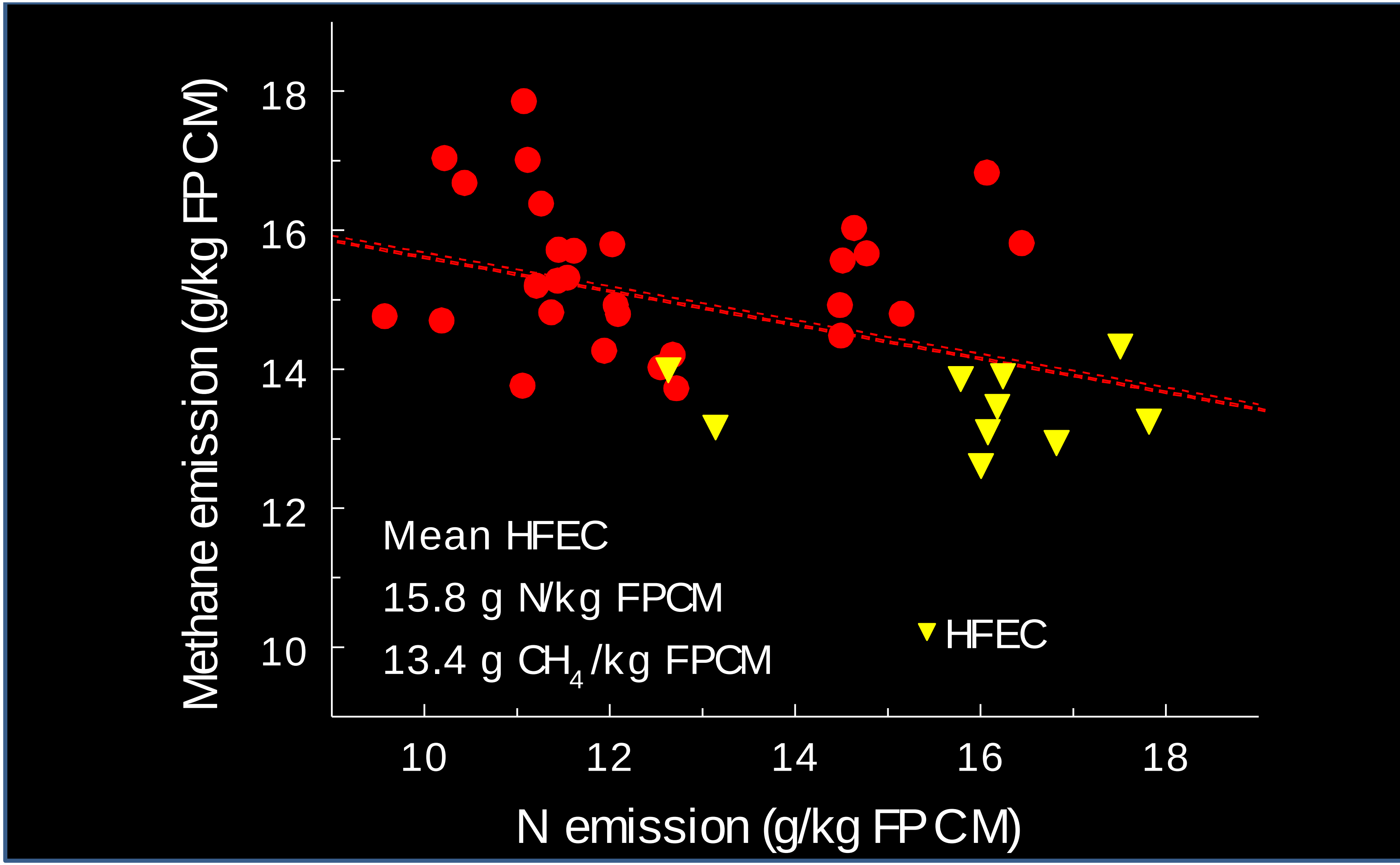
N excretion & CH_4 per kg milk



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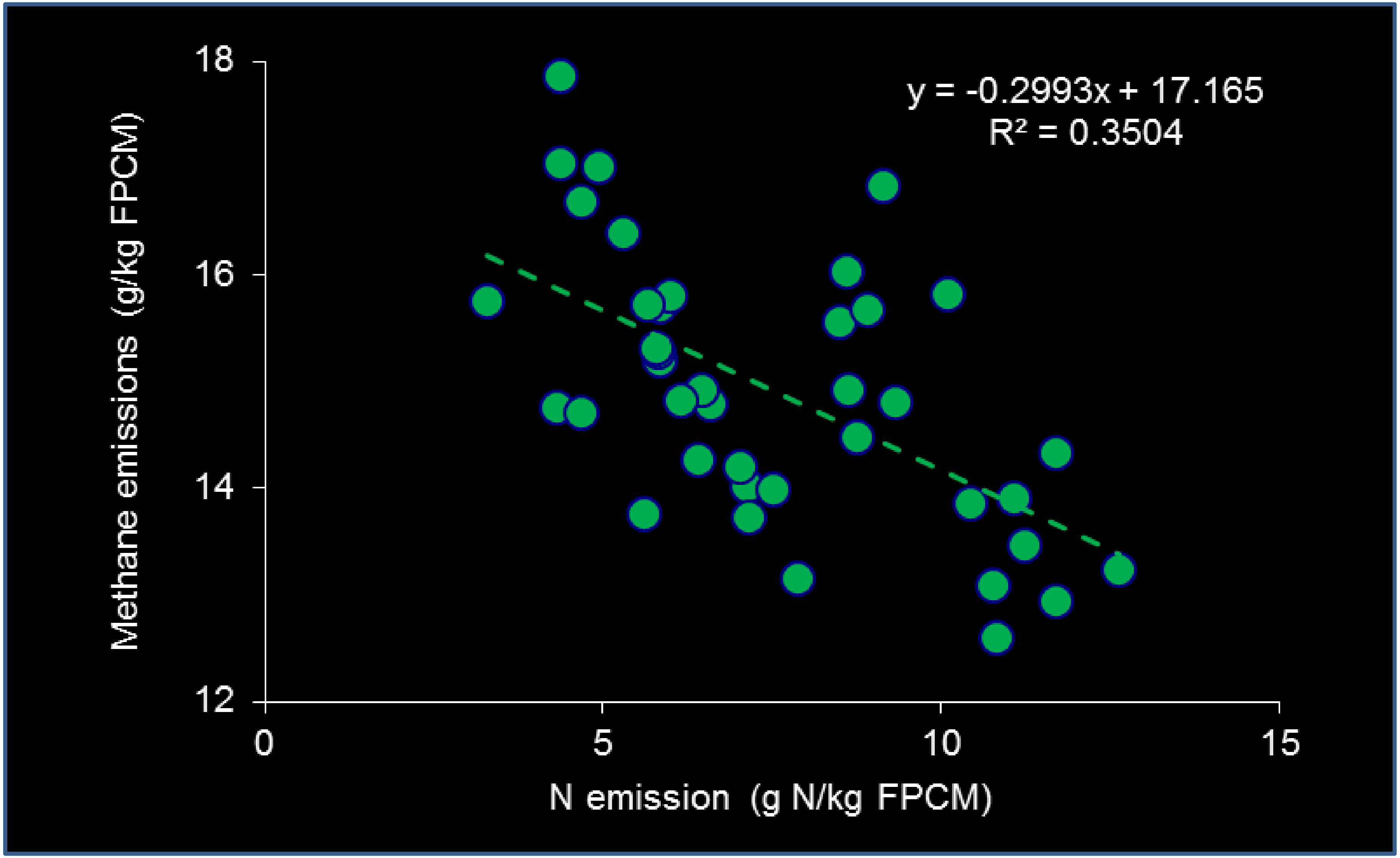
CH_4 & urine N per kg milk



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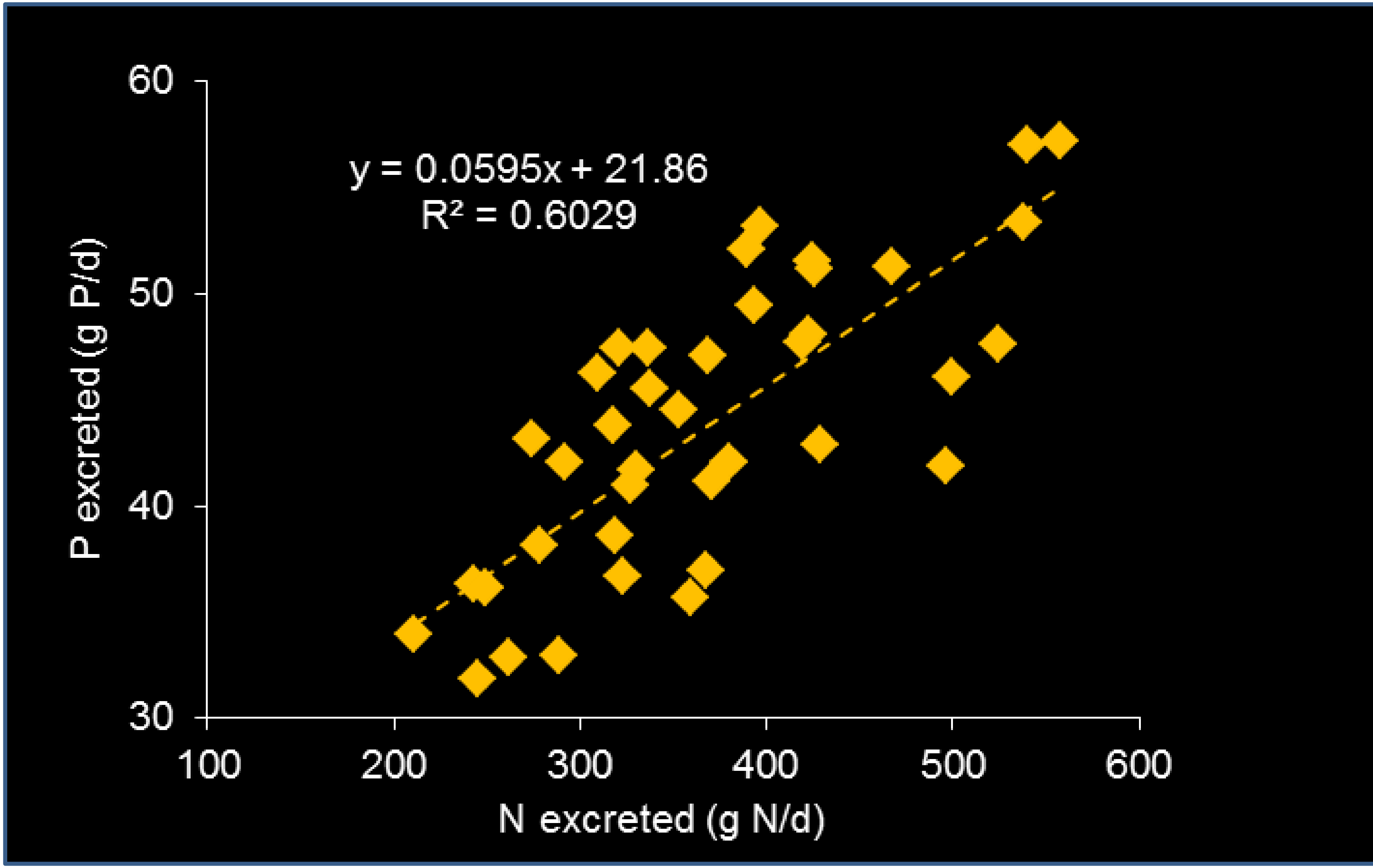
P & N excretion



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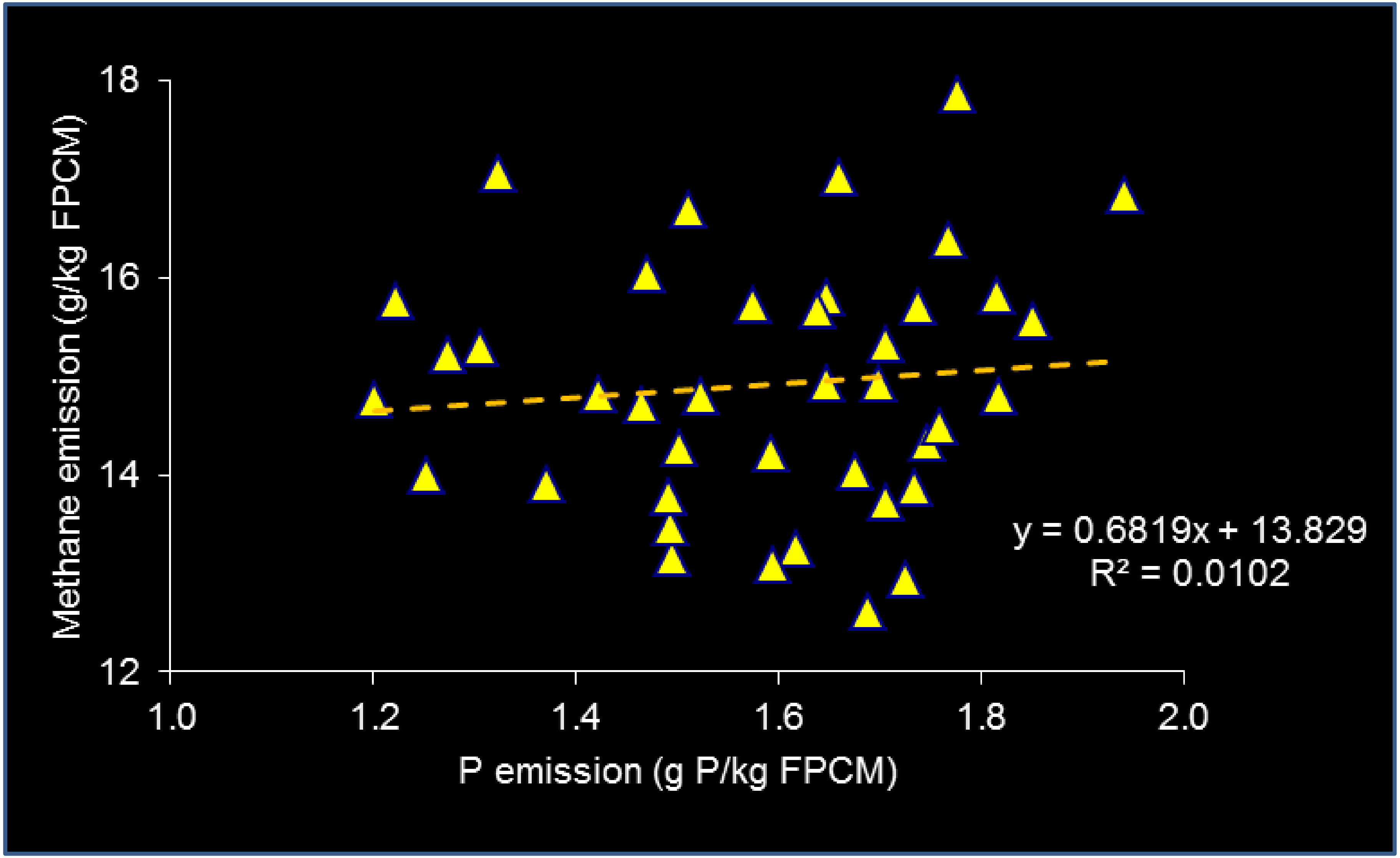
CH_4 & P per kg milk



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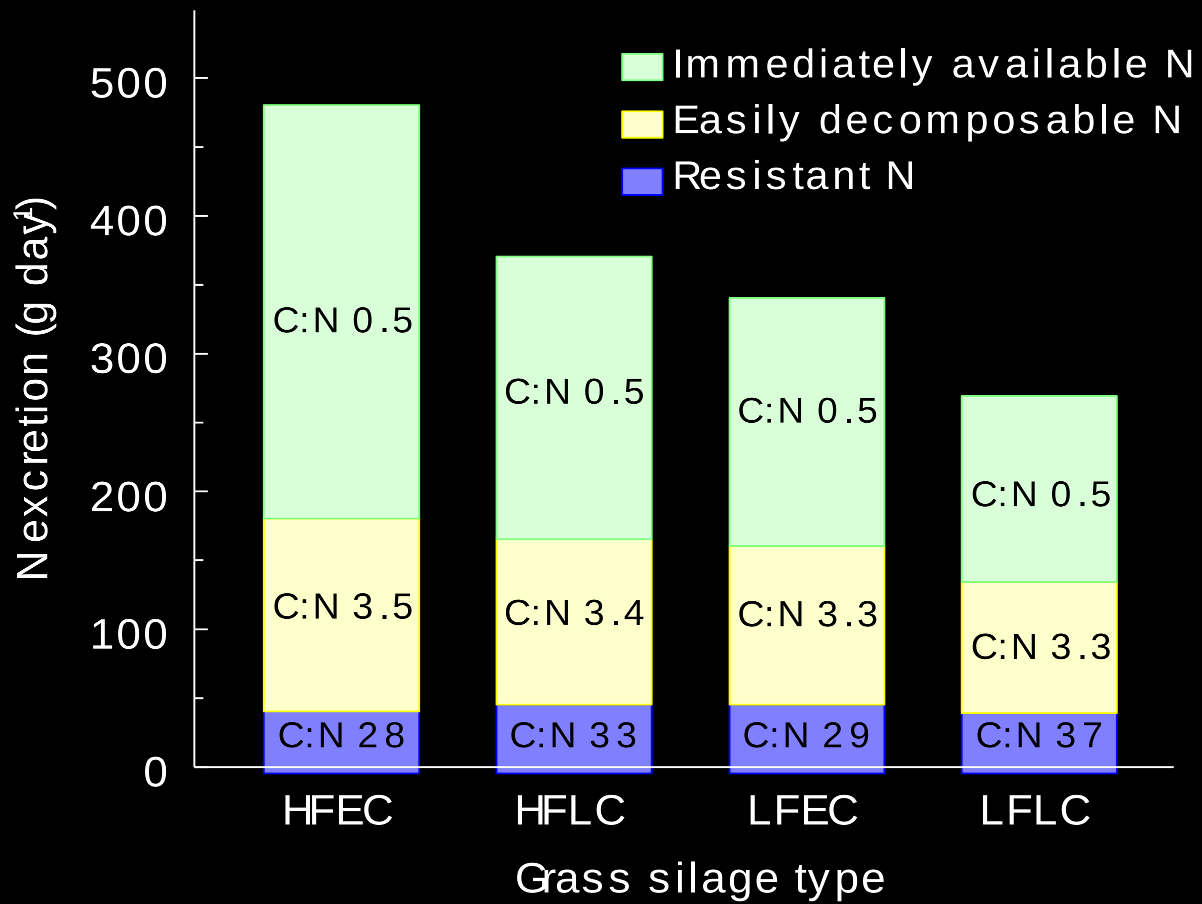
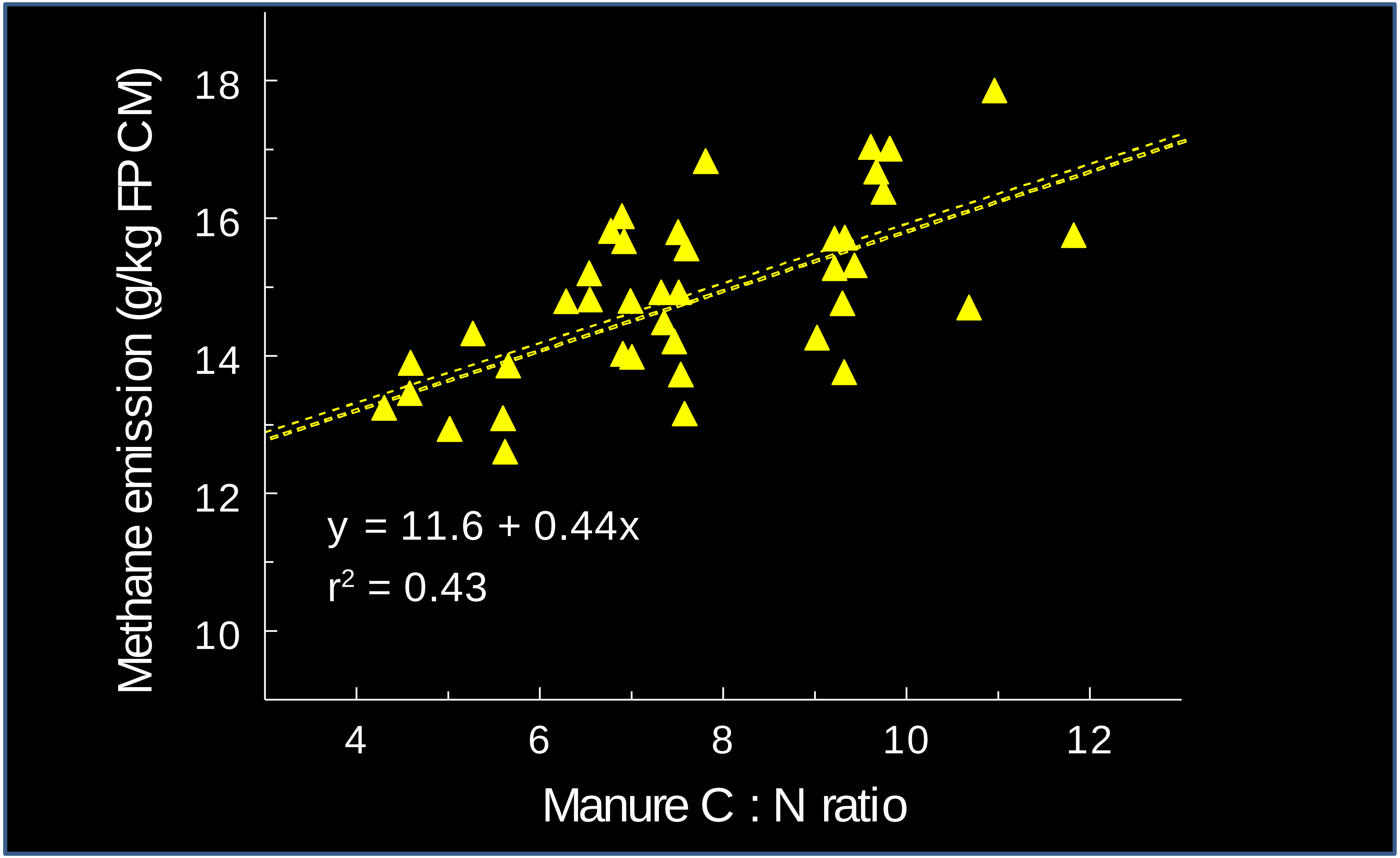
Grassland management: excreta aspects



HF = high N fertilization; LF = low N fertilization

EC = early cutting; LC = late cutting

Excreta C:N & CH_4 per kg milk



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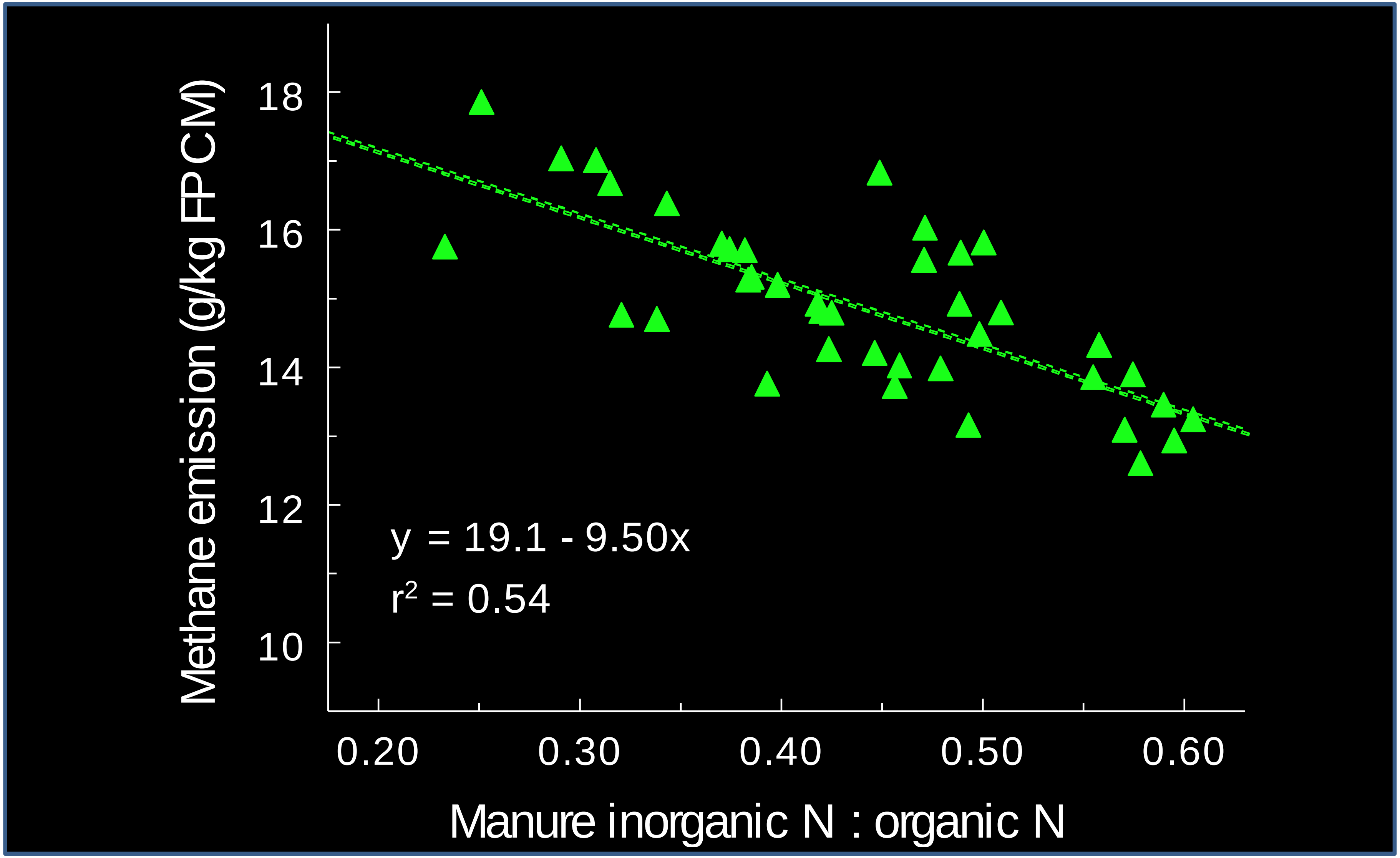
N composition excreta & CH_4 per kg milk



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Concluding

- As well-known, high potential to reduce N emission
  - Affects DM intake, milk yield
  - Also affects CH_4
  - e.g. grassland management
- At least expect lower N excretion may increase CH_4 emission
- Dietary N and P content related, but no relationship for P excretion and CH_4 emission
  - Variation in P excretion determined by milk yield
  - Variation in N excretion: N digestibility & milk yield
- Relationships manure characteristics and enteric CH_4 to be explored further (trade-offs manure CH_4, soil emissions)
- Trade-offs cow level might be relevant for those at farm level
  - What would be missing in current farm models ?

Low Emission Animal Feed

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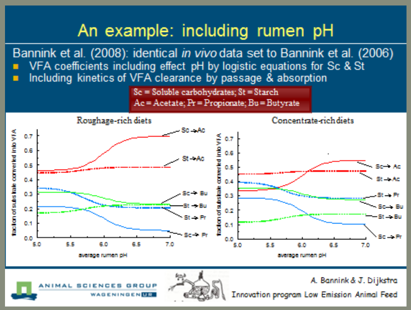
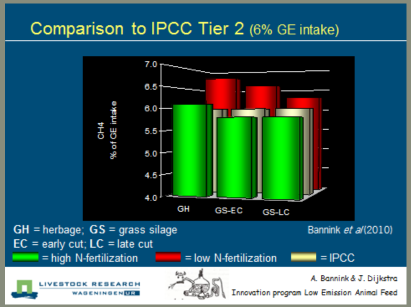
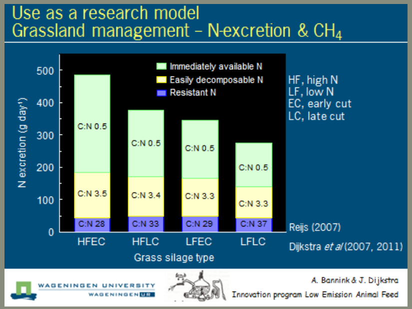
Productschap Zuivel

for research & experimentation







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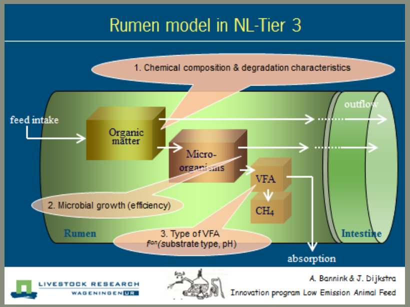
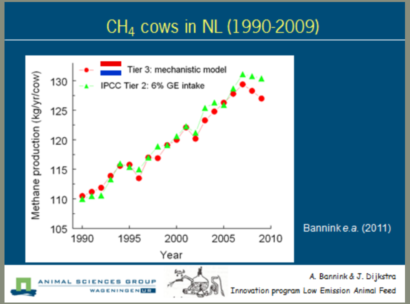
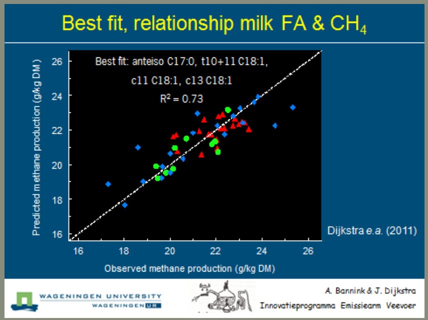
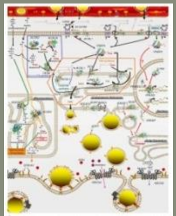
for inventory (Tier 3)

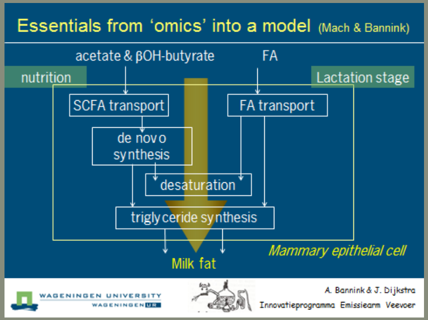




for practice (on farm)







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