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NH_3 emissions & N use efficiency of livestock production

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EAGER

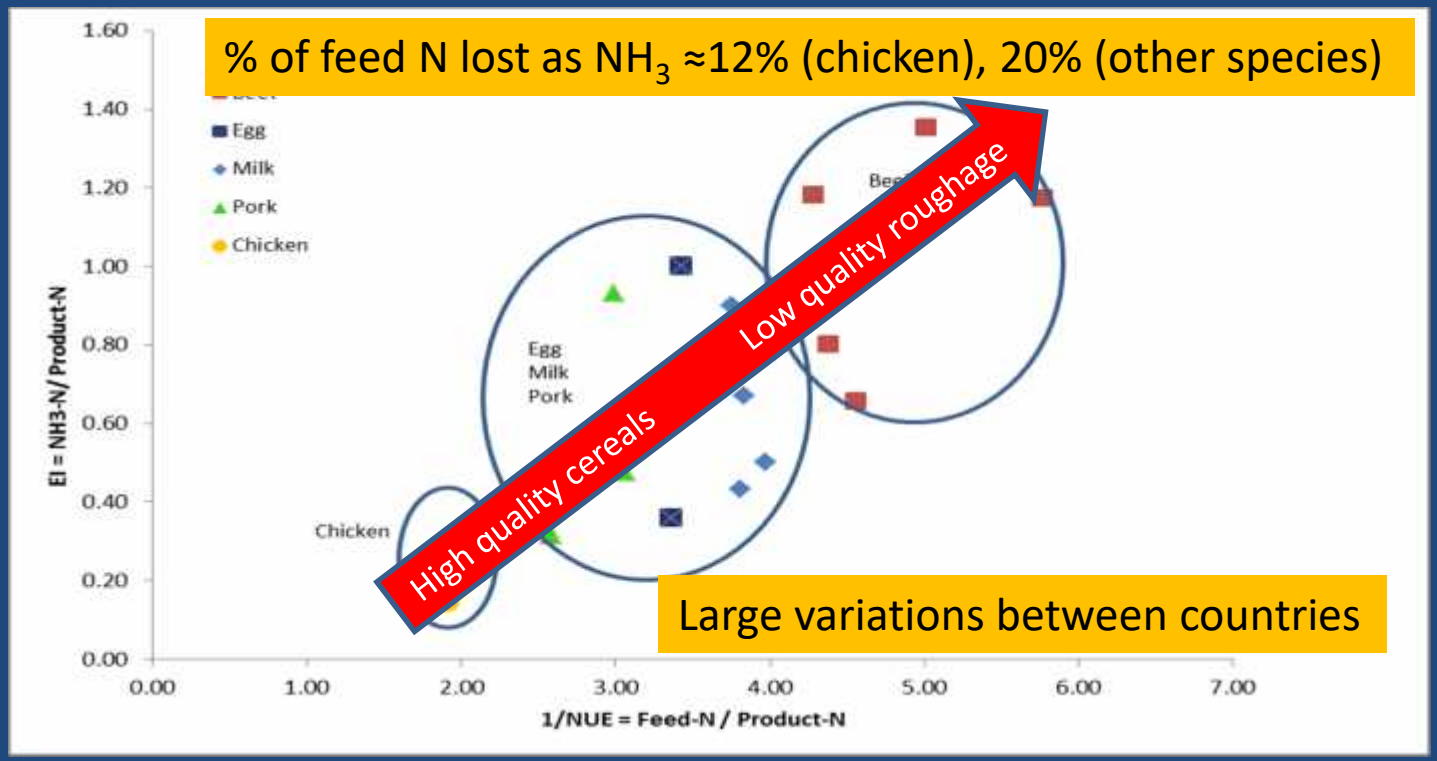
- European Agricultural Gaseous Emissions Inventory Researchers Network
- A core group of scientists improving and harmonizing national NH_3 emission inventory calculations
- www.eager.ch

NH_3 emission intensity of livestock products

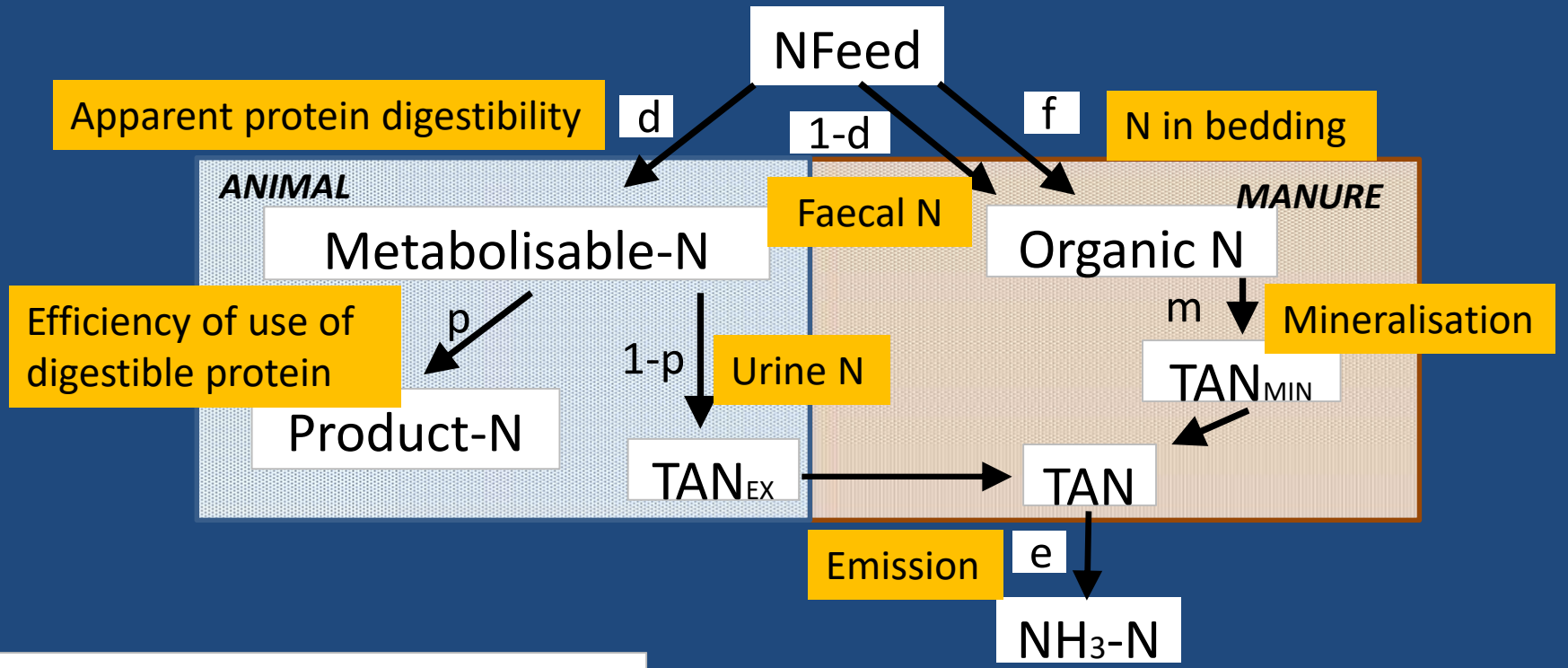
- Headline figure in policy support
- Analogous to the GHG emission intensity
  - GHG emission per unit mass of product
- Prefer NH_3–N emission per unit of product N
  - Allows for a direct comparison between products
- Calculate NH_3–N emission intensities:
  - For a range of products (milk, beef, eggs, chicken meat, pork)
  - In W European countries (A, CH, DE, DK, NL, UK)

Comparing products

- Emission intensity (EI) = NH_3-N/product N
- N use efficiency (NUE) = product N/feed N
- Plot EI versus 1/NUE
  - Linear relationship
  - ≡ NH_3-N versus feed N
- Separate data point for each country

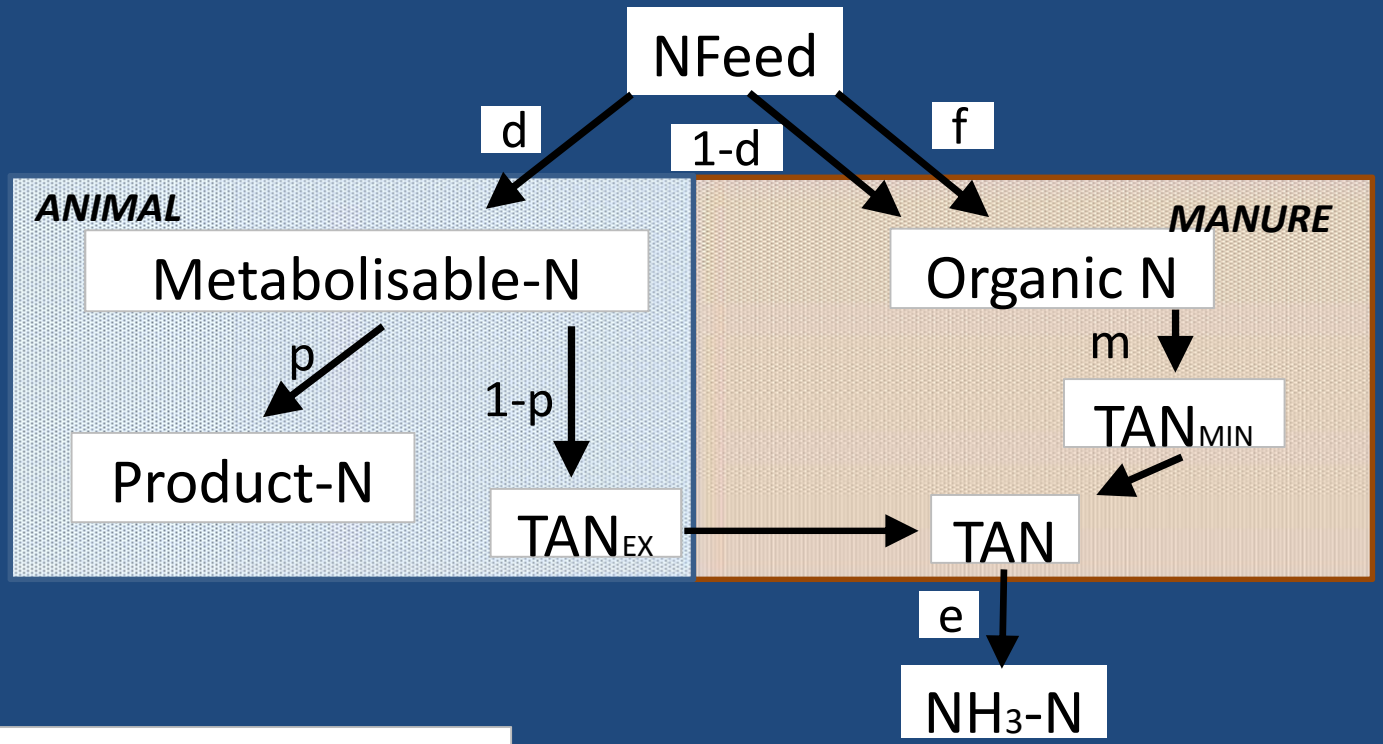

% of feed N lost as NH_3 ≈12% (chicken), 20% (other species)
Egg
Milk
Pork
Chicken
Egg
Milk
Pork
Chicken
High quality cereals
Low quality roughage
Large variations between countries
EI = NH3-N/ Product-N
1/NUE = Feed-N / Product-N
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00

Conceptual model



TAN = total ammoniacal N

Conceptual model



TAN = total ammoniacal N

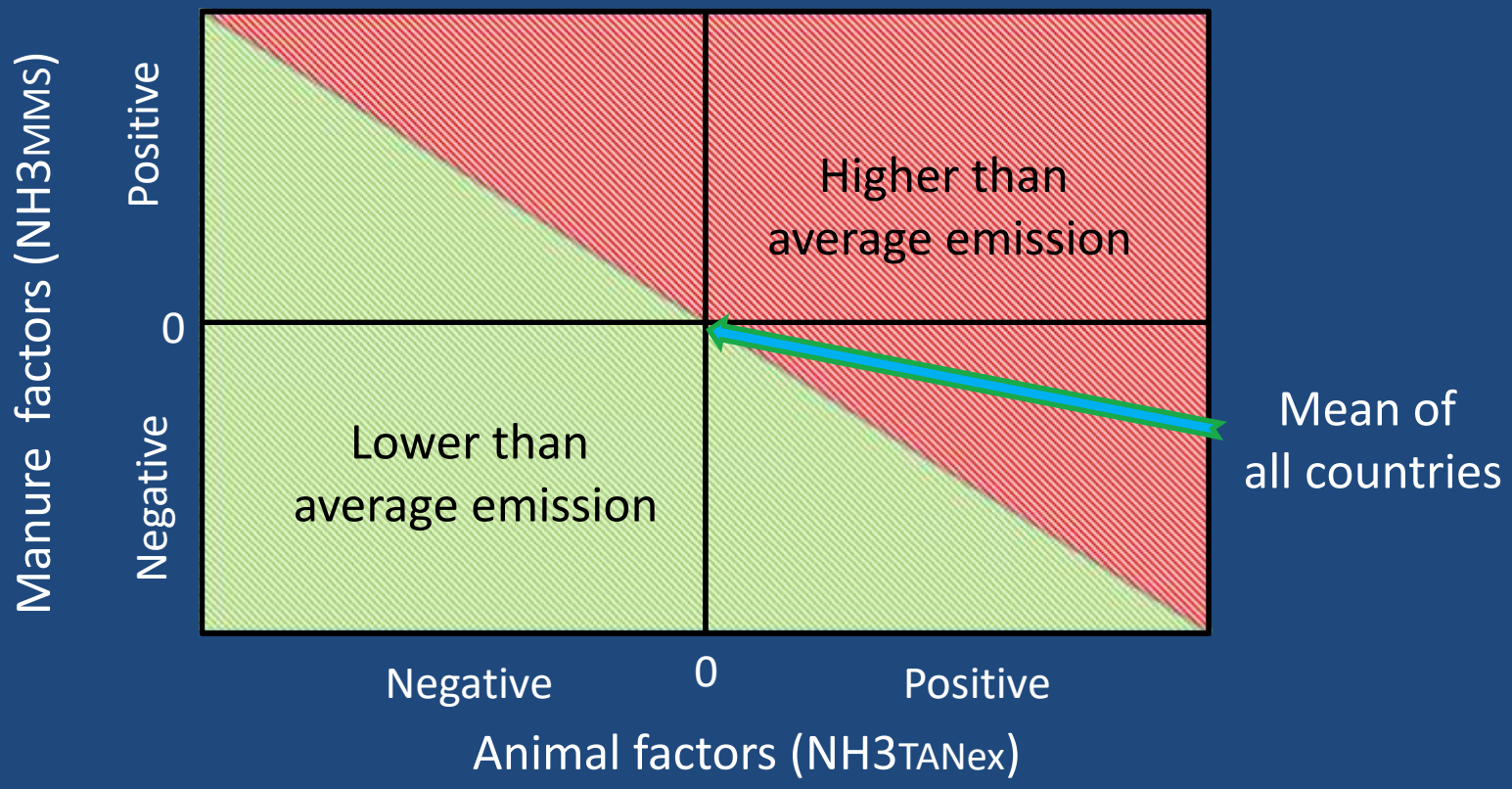
Polar plots

Mean of country emissions (A) =

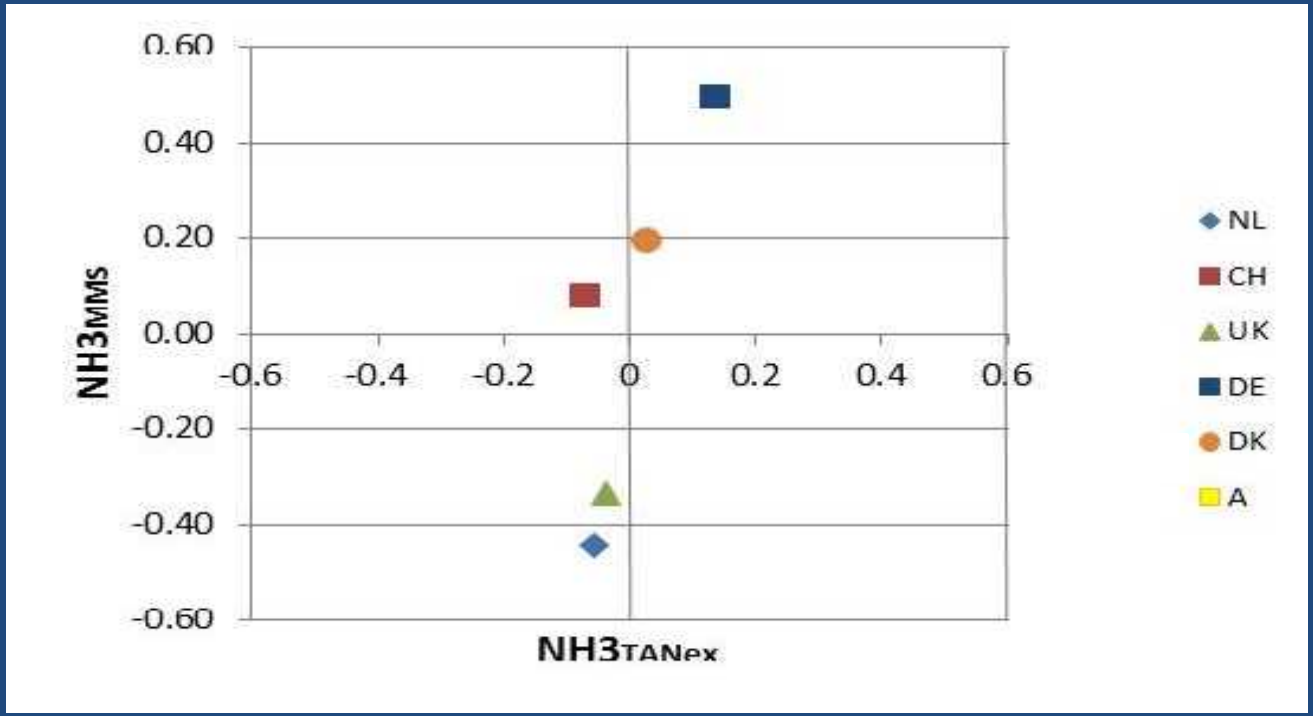
mean TAN_{EX} x mean emission/ TAN_{EX} (M)

- $NH3_{TANex}$ = ((mean M * model TAN_{EX}) - A)/A
- $NH3_{MMS}$ = ((model M * mean TAN_{EX}) - A)/A
- Animal factors impact on $NH3_{TANex}$
- Manure factors impact on $NH3_{MMS}$
- Plot $NH3_{MMS}$ against $NH3_{TANex}$

Polar plot


Manure factors (NH3MMS)
Positive
0
Negative
Higher than
average emission
Lower than
average emission
Mean of
all countries
Negative
0
Positive
Animal factors (NH3TANex)

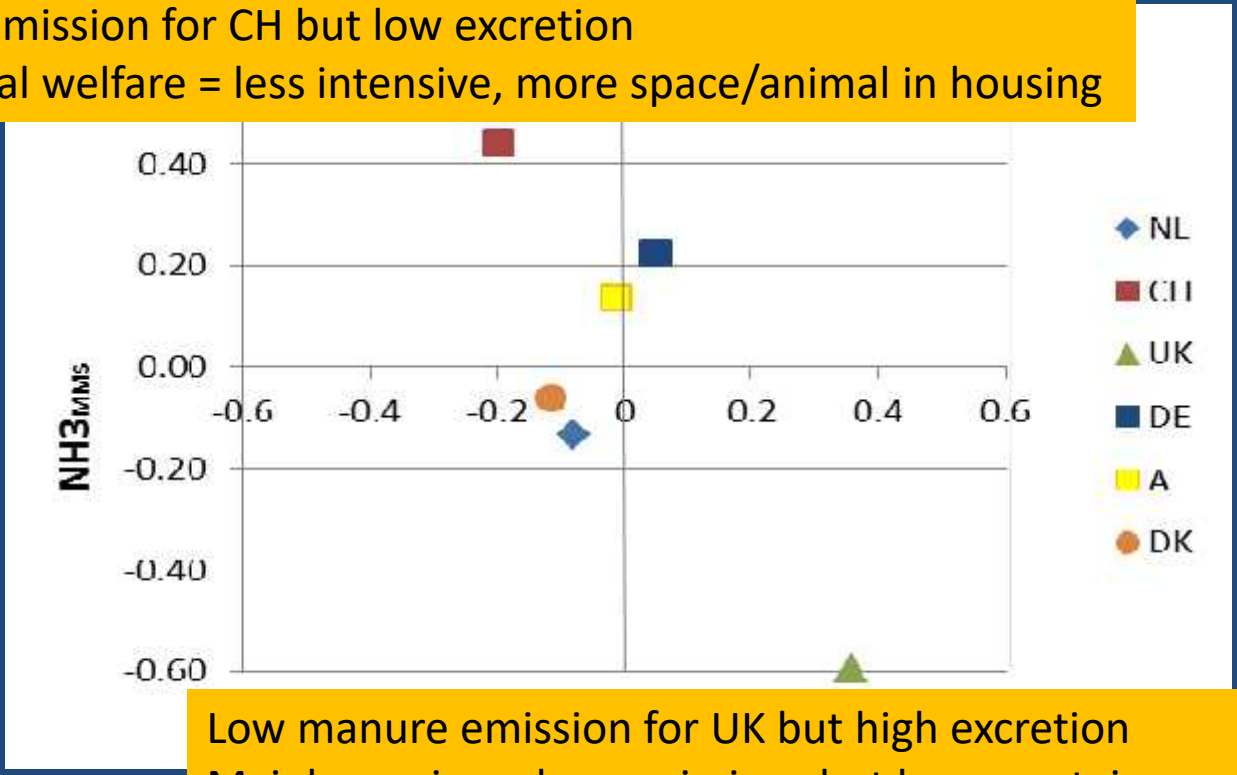
Broiler (chicken meat)



Similar excretion
Large variations in manure emissions

Beef

High manure emission for CH but low excretion
Focus on animal welfare = less intensive, more space/animal in housing



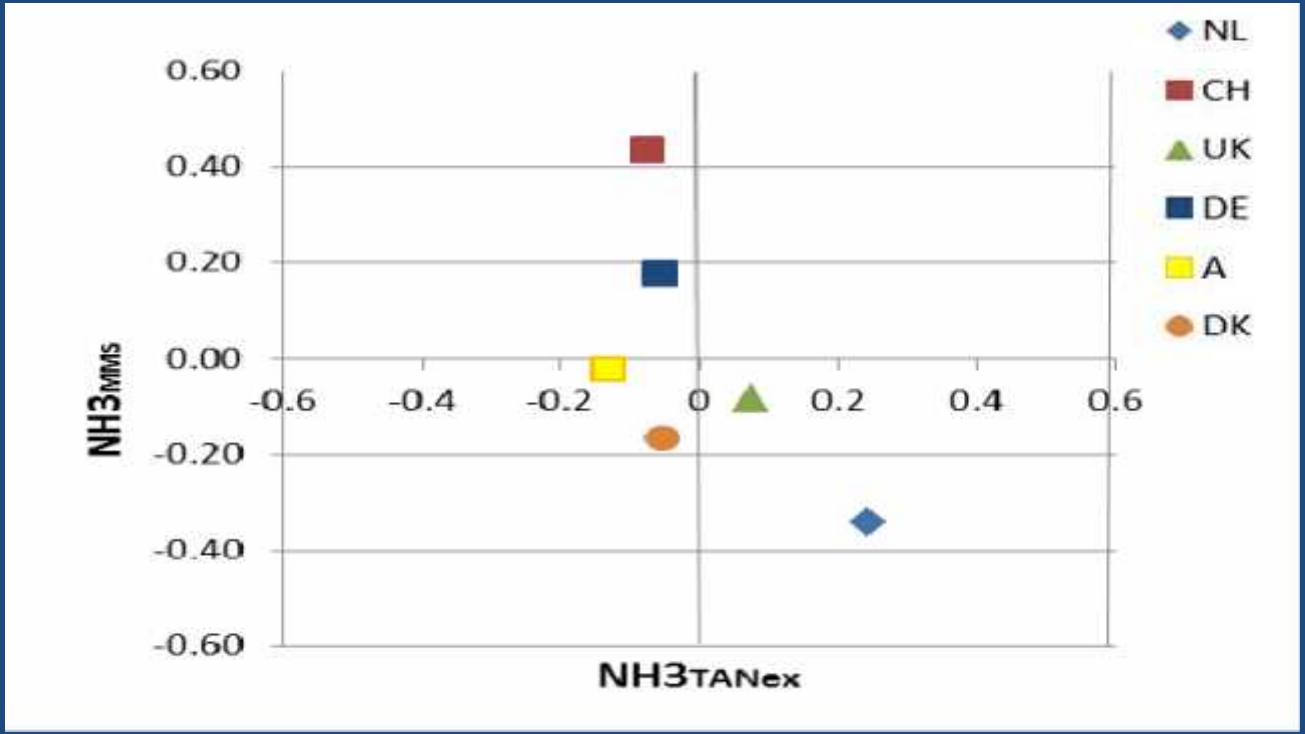
Low manure emission for UK but high excretion
Mainly grazing = low emissions but large protein surplus in diet

Conclusions

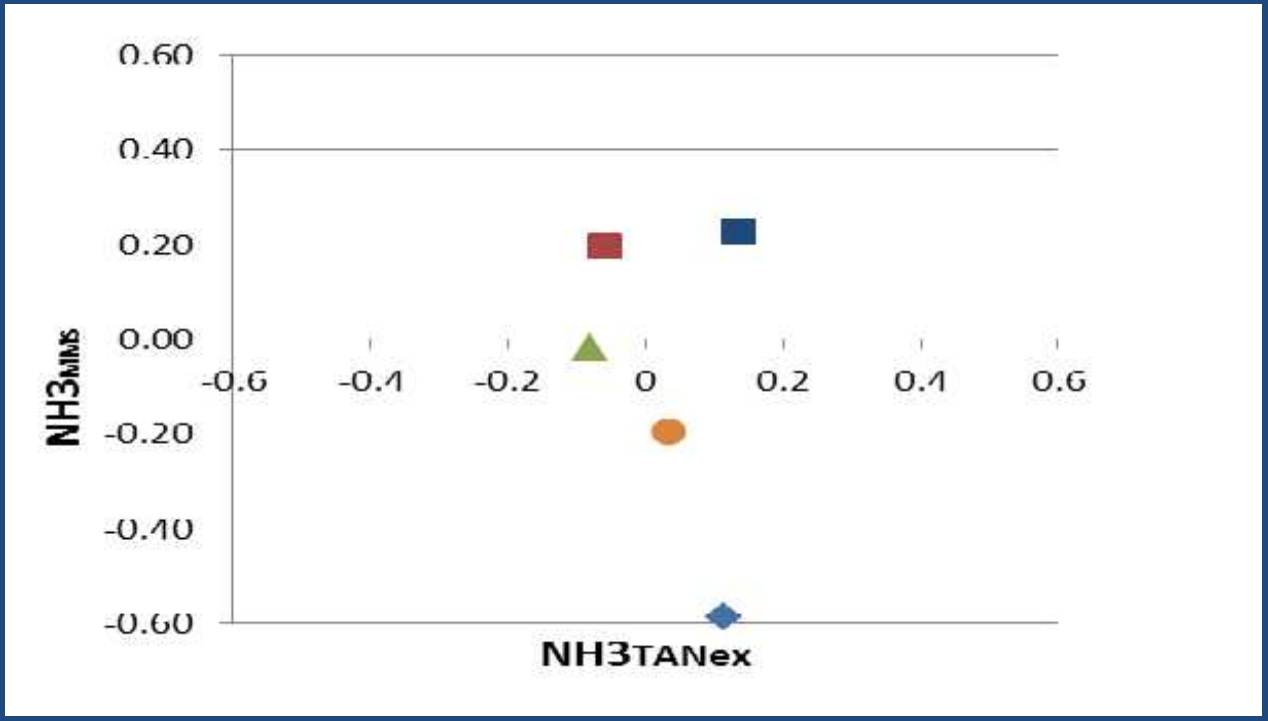
- Across animal products, about 20% of feed N is lost as NH_3 (chickens about 12%)
- Large differences in feed N required for 1 kg product
- Large differences in NH_3 emission intensities
  - Chicken lowest, beef highest
- High emission intensities may reflect trade-offs
  - Animal welfare
  - Conversion of inedible plant products to edible animal products

Thank you

Milk


NL
CH
UK
DE
A
DK
0.60
0.40
0.20
0.00
-0.20
-0.40
-0.60
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
NH3MMS
NH3TANex

Eggs



Pork