Long-range Transboundary Air Pollution

Experience from the UK and the Task Force on Reactive Nitrogen

Using synthetic essential amino acids to reduce emissions of ammonia from livestock

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Key message

The use of feeds supplemented by synthetic amino acids by the pig and poultry sector has the potential to reduce ammonia emissions while also saving money for producers.

Green Economy: *the example demonstrates significant synergy between environmental and economic objectives.*

LRTAP
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Amino acid requirements in livestock

- Pigs and poultry require a certain level of essential amino acids in their diet.
- Selective breeding of crops for increased yield has left some cereal crops with an imbalance of amino acids when used as livestock feed

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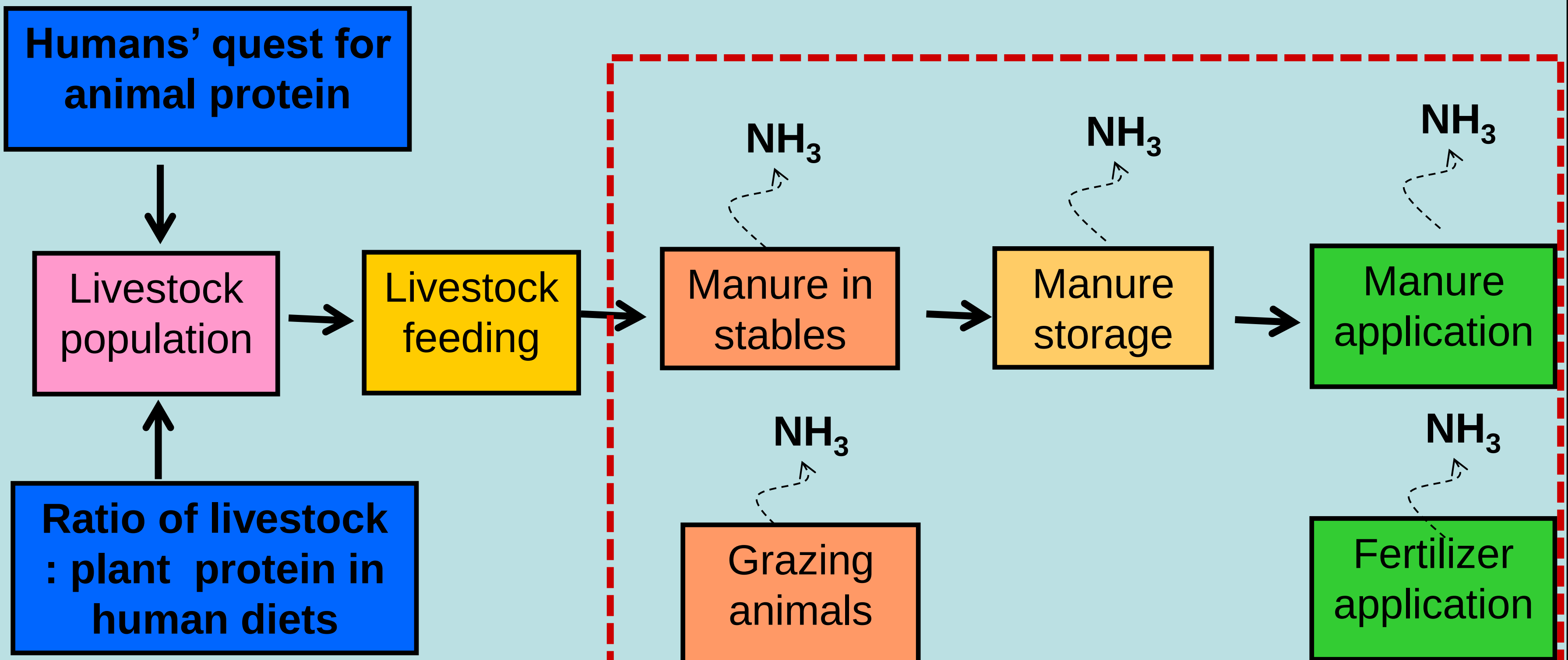
First Step: Avoid overfeeding of protein

- To meet the dietary requirements for amino acids, pigs and poultry have been fed more protein than required…
  - Increases their N excretion
  - Losses of ammonia (and NO_3, N_2O, N_2) in farm system



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Second step - synthetic amino acids

- Synthetic amino acids (such as Lysine or Tryptophan)
  - Chemically synthesized
  - Recently from genetically modified microbial strains
- Provide essential amino acids (EEAs)
  - Minimize total protein inputs
  - Less expensive than protein rich feeds such as legumes
  - More stable price than feeds like soya

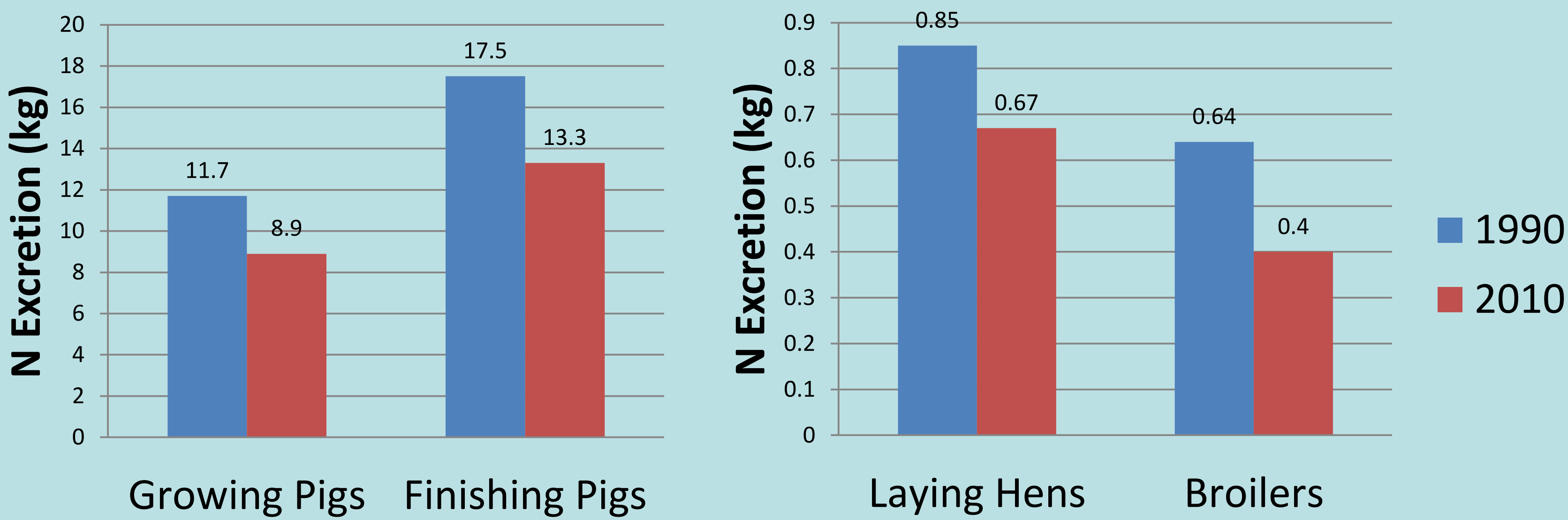
How has this worked in practice? Protein reduction

- Protein reduction with synthetic amino acids
  - *Weaners, (15-20 kg), from 22-23% protein to c. 20%*
  - *Growers, (38/40-65 kg), 20% protein to 18%.*
  - *Finishers, (75-120 kg), 17/18% protein to 15.5%.*
  - *Sows (in pig), 16% protein to 12-13%.*
  - *Sows (lactating), 18-20% protein to 15-16%.*
  - *Creep diet, up to 26-27% protein to 22-23%.*
- *Reducing total dietary-N concentrations by c. 2% and maintaining levels of EAA resulted in a **14% reduction in N excretion by pigs** – this benefit propagates*

How has this worked in practice? Reduction in N excretion and pollution

Reductions in the excretion of urine-N, the source of emissions of ammonia and of nitrate in the first winter after manure application can be even greater: (in one study up to 40%), which can translate to matching reductions in NH_3 and nitrate (though smaller reductions for N_2O)

Reduced excretion & NH_3 emission per animal



- Reductions due to a) use of **synthetic EAAs** and b) adoption of **phase feeding** (where protein intake is matched to needs at each stage of the animal's growth).
- Has resulted in estimated reductions in ammonia emissions per animal place of c. 24% (pigs) and 29% (poultry).

Source UK NAEI

Impacts for air pollution abatement

- Emissions in 2012 (UK National Atmospheric Emissions Inventory)
  - Pig production 17 kt NH_3
  - Laying hen production 7.4 kt NH_3; Other poultry 8.7 kt NH_3
- Best Practice UK Appraisal Guidance: monetary value of **£1,972 per tonne of ammonia** giving a damage total cost of £33.5m from pigs and £31.7m from poultry.
- Applying the above savings leads to an air quality improvement of £17.2 million. This equates to a health saving of about 420 life years.
- **Next question**: how to tune diets in dairy/beef systems...