Session 5

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The effect of genetic improvement on emissions from livestock systems

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Faraday Partnerships

Introduction

- Pressure to reduce GHG emissions is increasing
- Possible options include changes in:
  - *Management of manure*
  - *Management of animals*
  - *Feeding*
  - **Genetics**
- What effect has past/current selection already had?

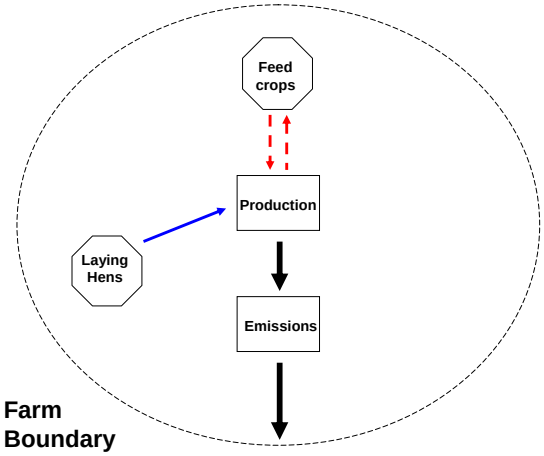
Aim

To model the effect of genetic improvement on emission from commercial livestock systems of CH_4, NH_3 and N_20 per unit product

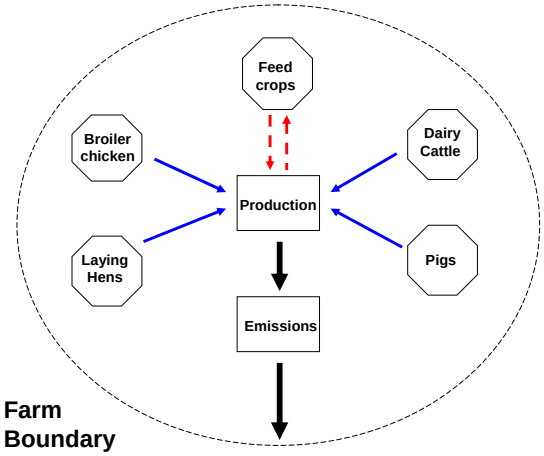
- over the last 20 years

- over the next 15 years

The Life Cycle Assessment model



The Life Cycle Assessment model



Sub-models

- Full life cycle of all animals considered
- Industry structure and production systems typical for the UK in 2007 taken into account

e.g.

	%
Cage production	64
Barn eggs	6
Free range (non-organic)	28
Organic	2

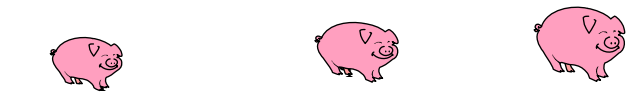
Sub-models

- Full life cycle of all animals considered
- Industry structure and production systems typical for the UK in 2007 taken into account

e.g.

	%
Autumn calving herds	50
Herds fed maize silage	20
Low ave. yield herds	25
Medium ave. yield herds	50
Non-organic herds housed on straw	34
Organic	2.5

Approach



1988 — 2007 — 2022 — Management fixed

Predicted (using genetic trends) — **Predicted** (using genetic trends)

UK Industry input:

- 2007 production levels for different commercial systems
- Rates of genetic improvement achieved in purebreds over the last 10-20 years
- Uptake rate of improved genetics by the commercial level

Annual rates of genetic change

Daily gain	0.80 g
FCR	-0.02 kg/kg
Mortality	-0.07 %
KO	0.10 %
Eggs per breeder hen	0.90

Annual rates of genetic change

Lifetime daily gain	8.5 g
FCR	-0.02 kg/kg
No. born alive per litter	0.16 piglets

Effects on GHG emissions

Emission (kg) per tonne product (‘07)

	CH_4	NH_3	N_20	GWP_{100}
Layers	7.5	28.0	3.8	3791
Broilers	4.9	23.0	3.4	3448
Pigs	48.8	27.8	2.3	4689
Dairy	18.9	3.4	0.6	958

% change through genetic improvement (1988-07)

	CH_4	NH_3	N_20	GWP_{100}
Layers	-30	-36	-29	-25
Broilers	-20	-10	-23	-23
Pigs	-17	-18	-14	-15
Dairy	-25	-17	-30	-16

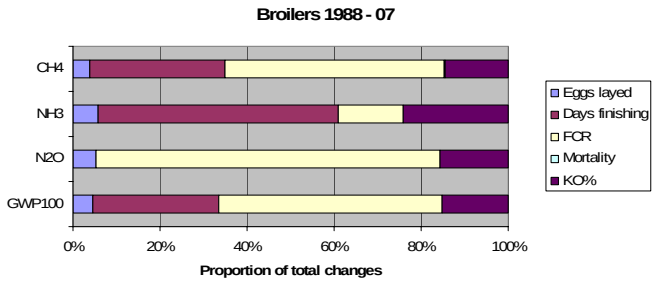
% annual reductions in GWP

	1988-07
Layers	1.3
Broilers	1.2
Pigs	0.8
Dairy	0.8

% annual reductions in GWP

	1988-07	2007-22
Layers	1.3	
Broilers	1.2	
Pigs	0.8	
Dairy	0.8	

Where's the benefit coming from?



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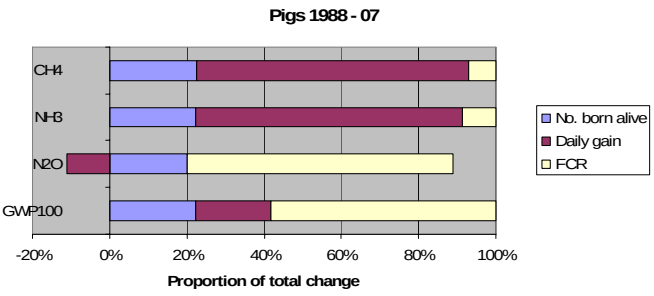

Conclusions

- Past genetic improvement has already helped reduce emissions per unit product substantially
- These results are likely to be an under estimate of the true overall benefits, especially for pigs
- The rates of improvement presented can likely be maintained if current selection practice continues
- Use of new technology or new traits may deliver even greater gains

Acknowledgements

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