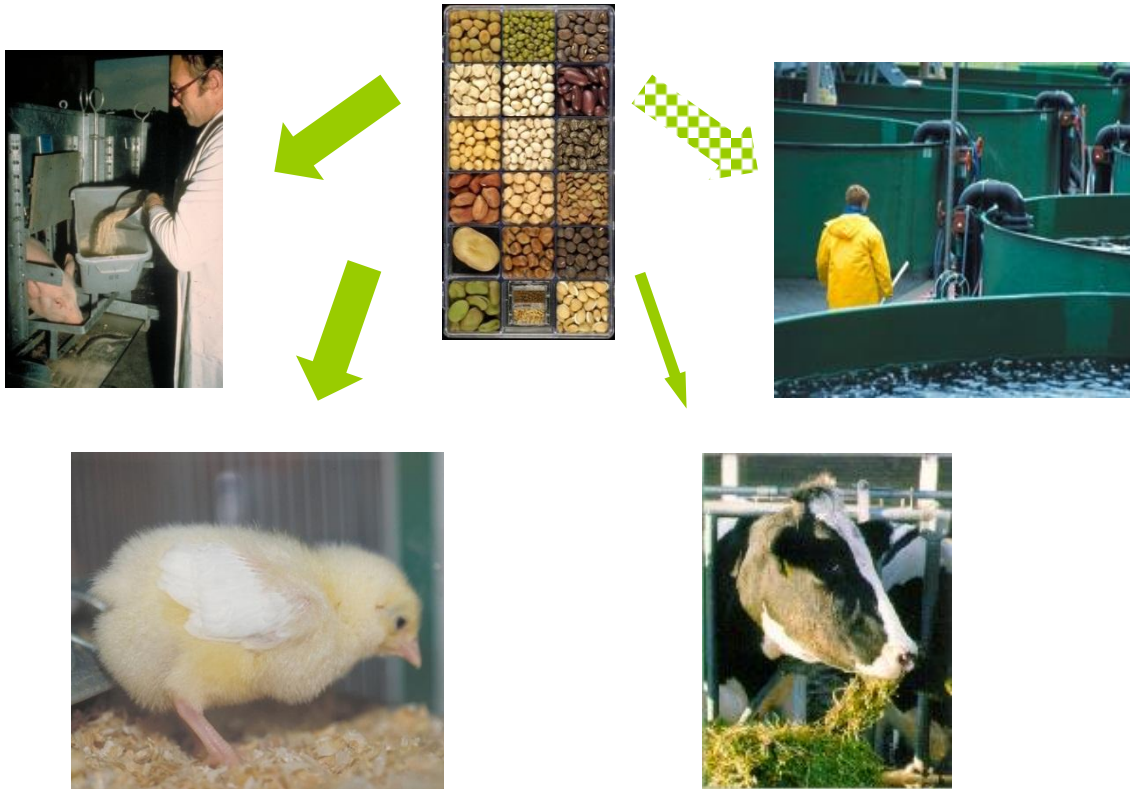


## Alternative sources of protein

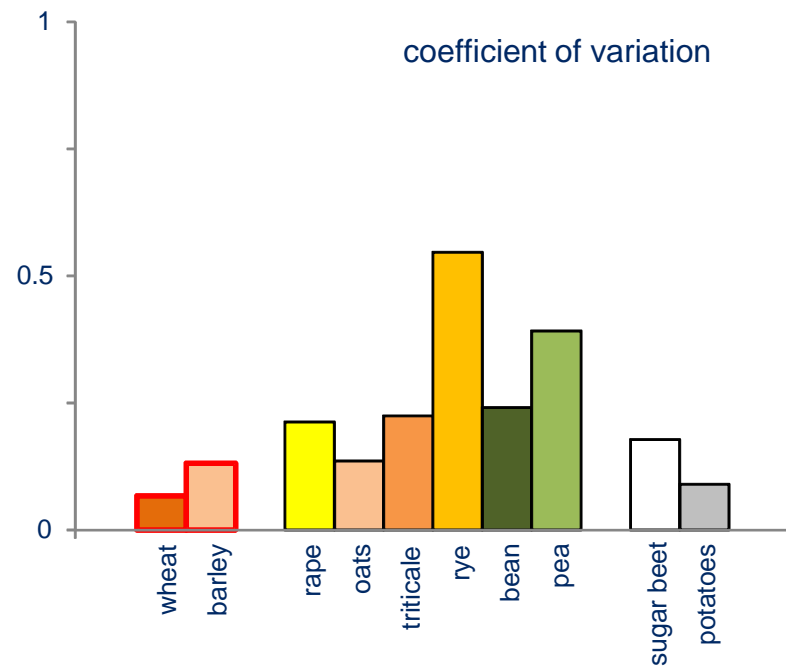
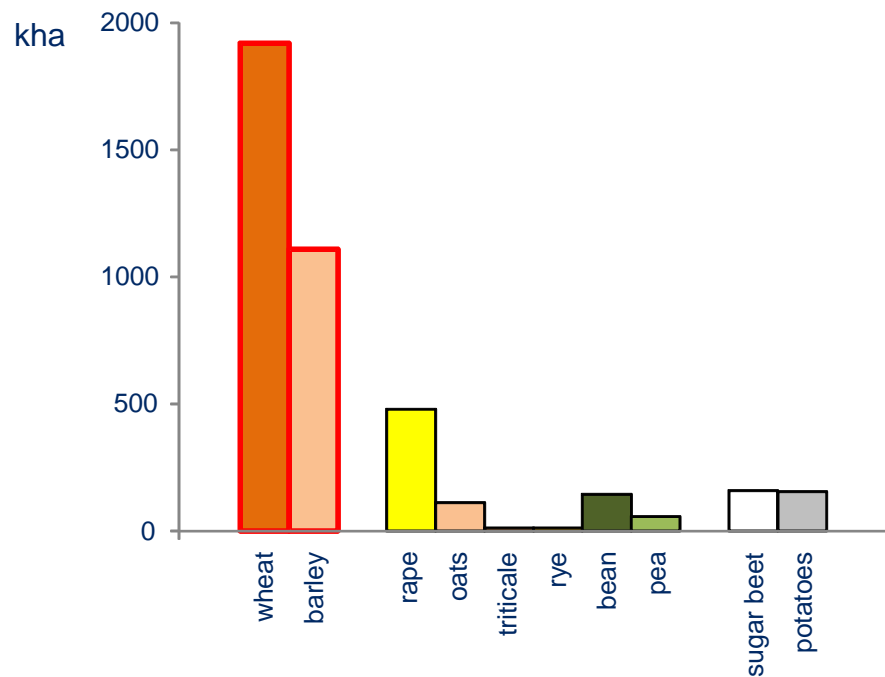
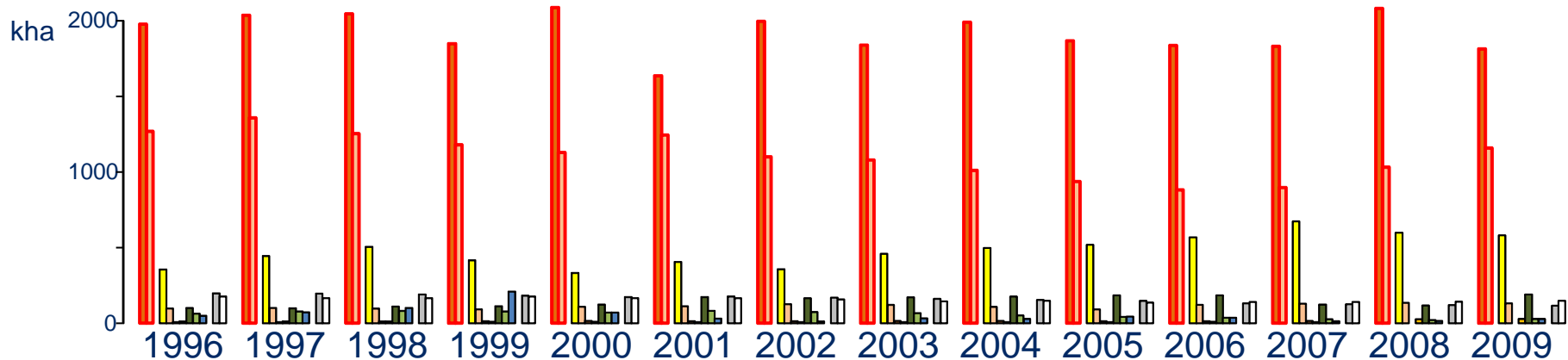


**Noel Ellis**

[http://www.aber.ac.uk/en/ibers/staff/staff-list/noel\\_ellis/](http://www.aber.ac.uk/en/ibers/staff/staff-list/noel_ellis/)

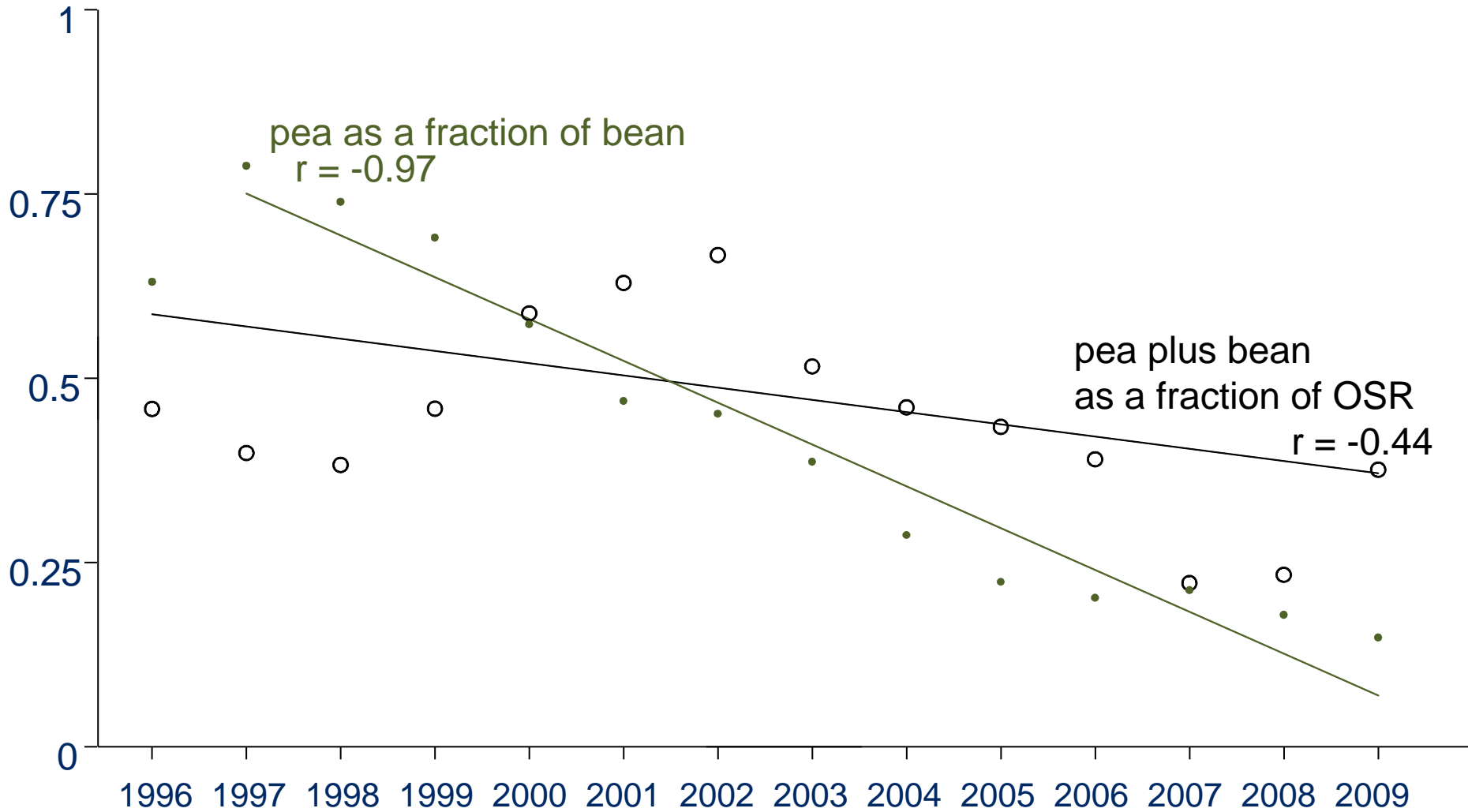
# Time series data for crop areas in UK

[http://www.ukagriculture.com/statistics/farming\\_statistics.cfm/](http://www.ukagriculture.com/statistics/farming_statistics.cfm/)

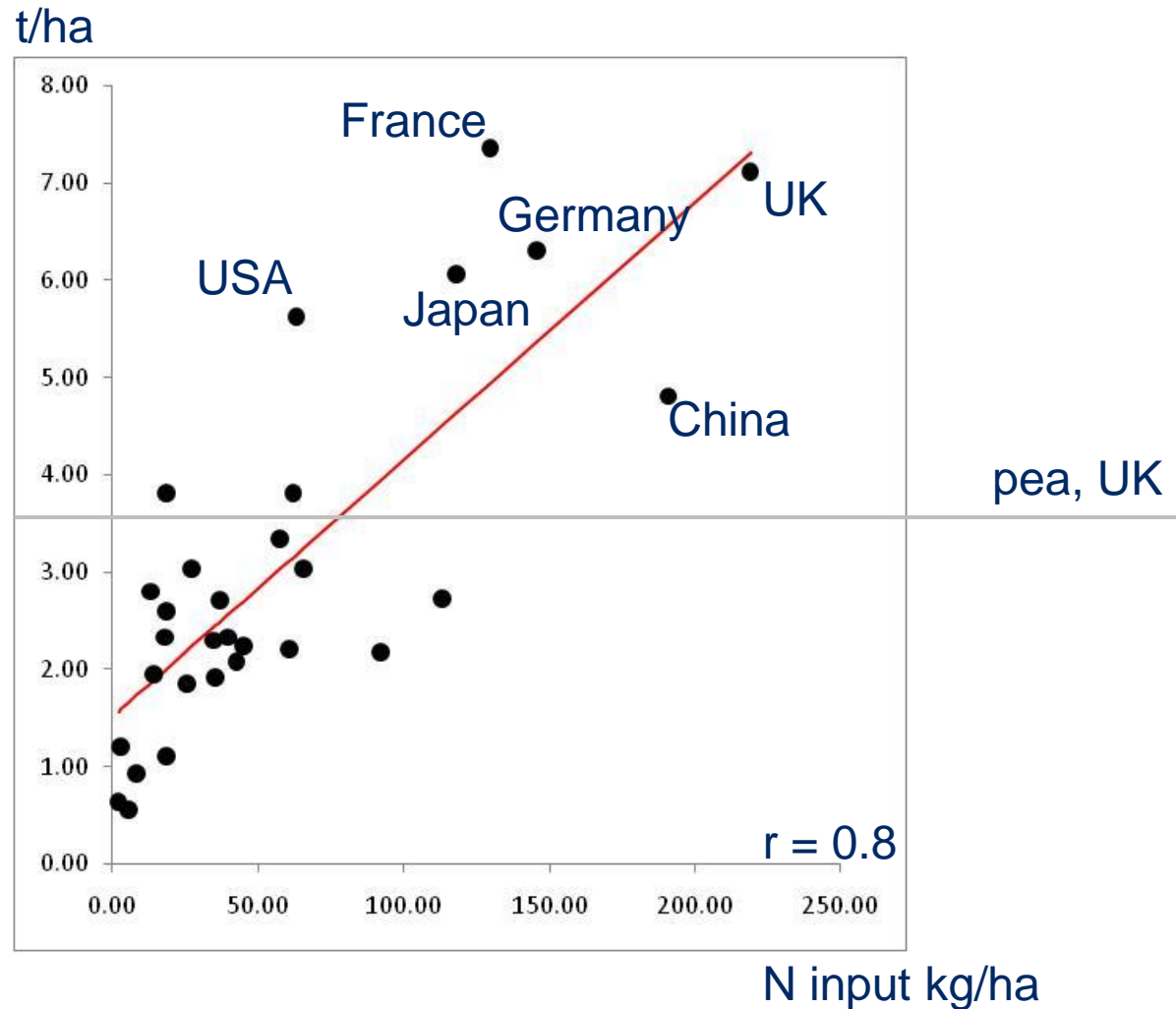


# UK break crops

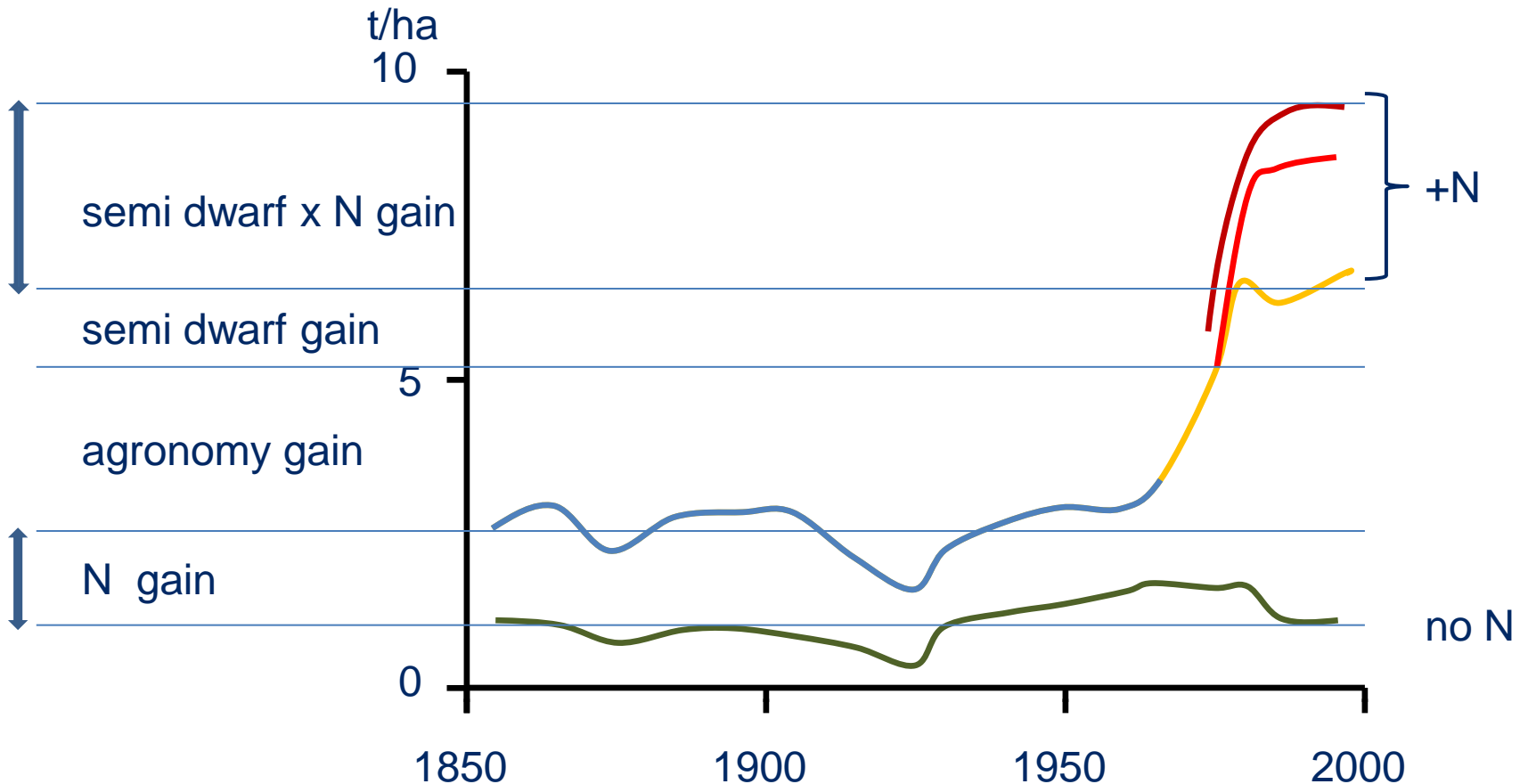
[http://www.ukagriculture.com/statistics/farming\\_statistics.cfm/](http://www.ukagriculture.com/statistics/farming_statistics.cfm/)



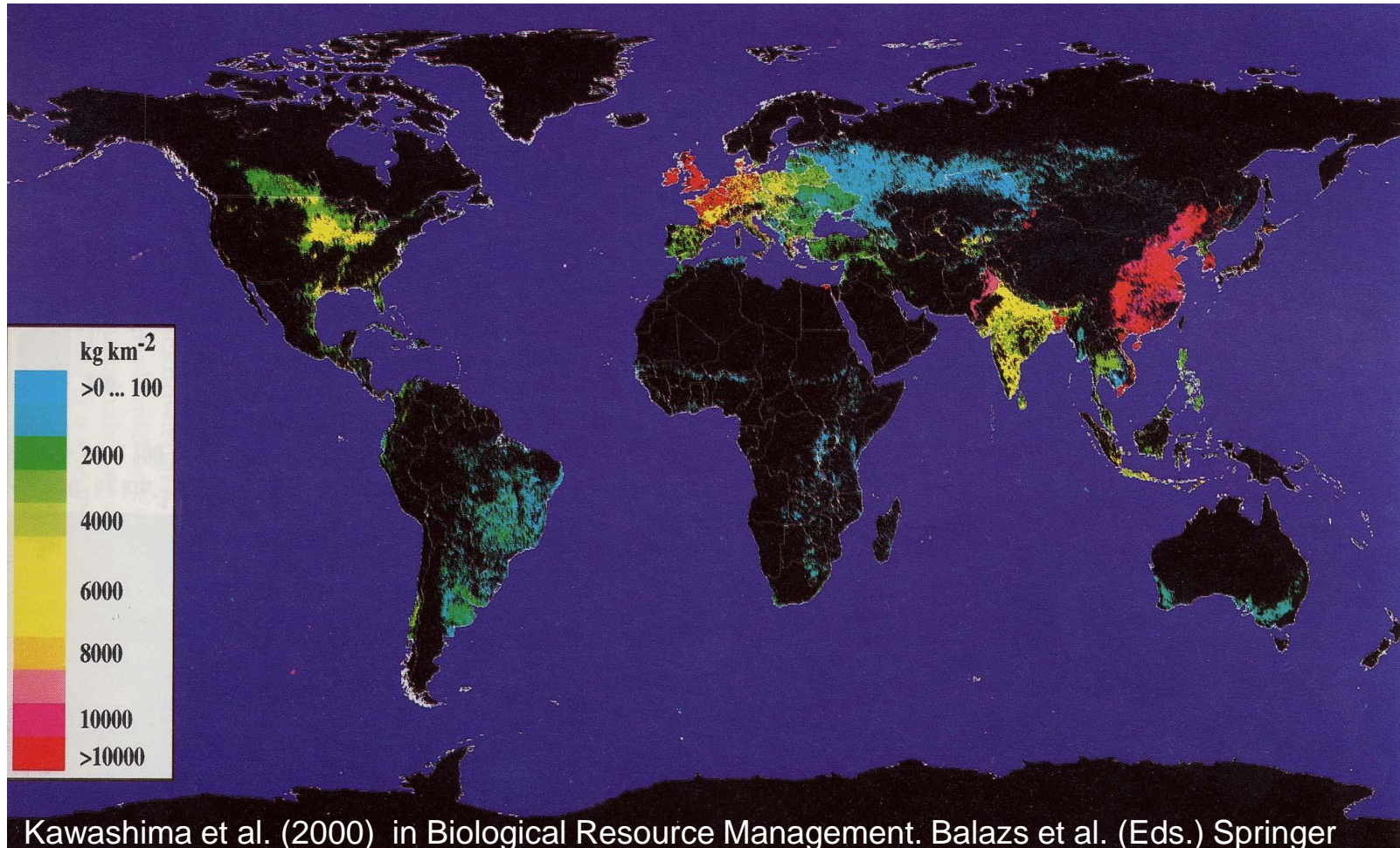
# Cereal crop yields



# Nitrogen input and cereal yield



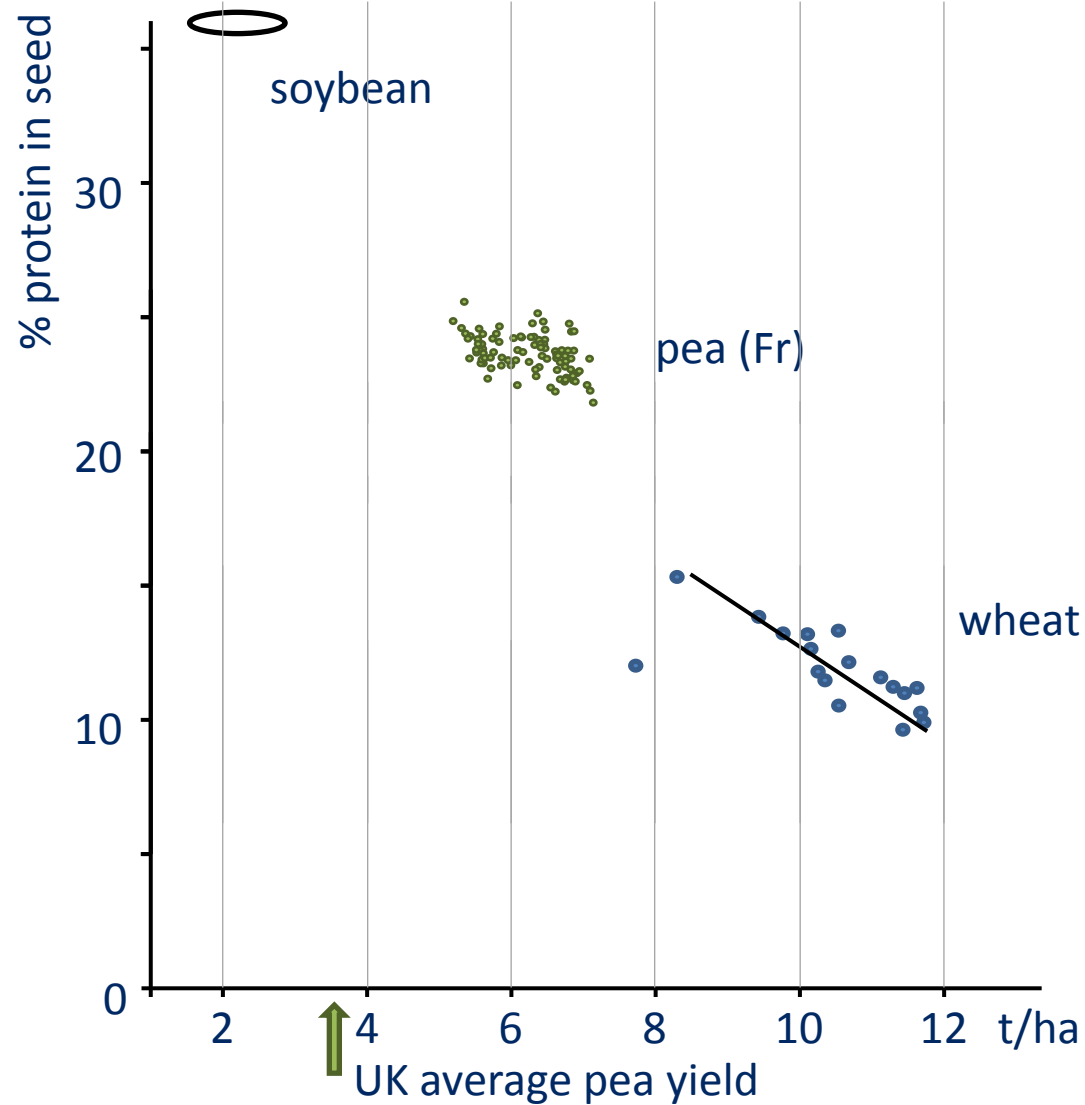
# Impact of nitrogen from agriculture



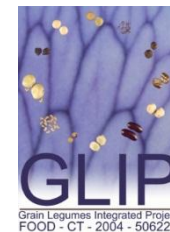
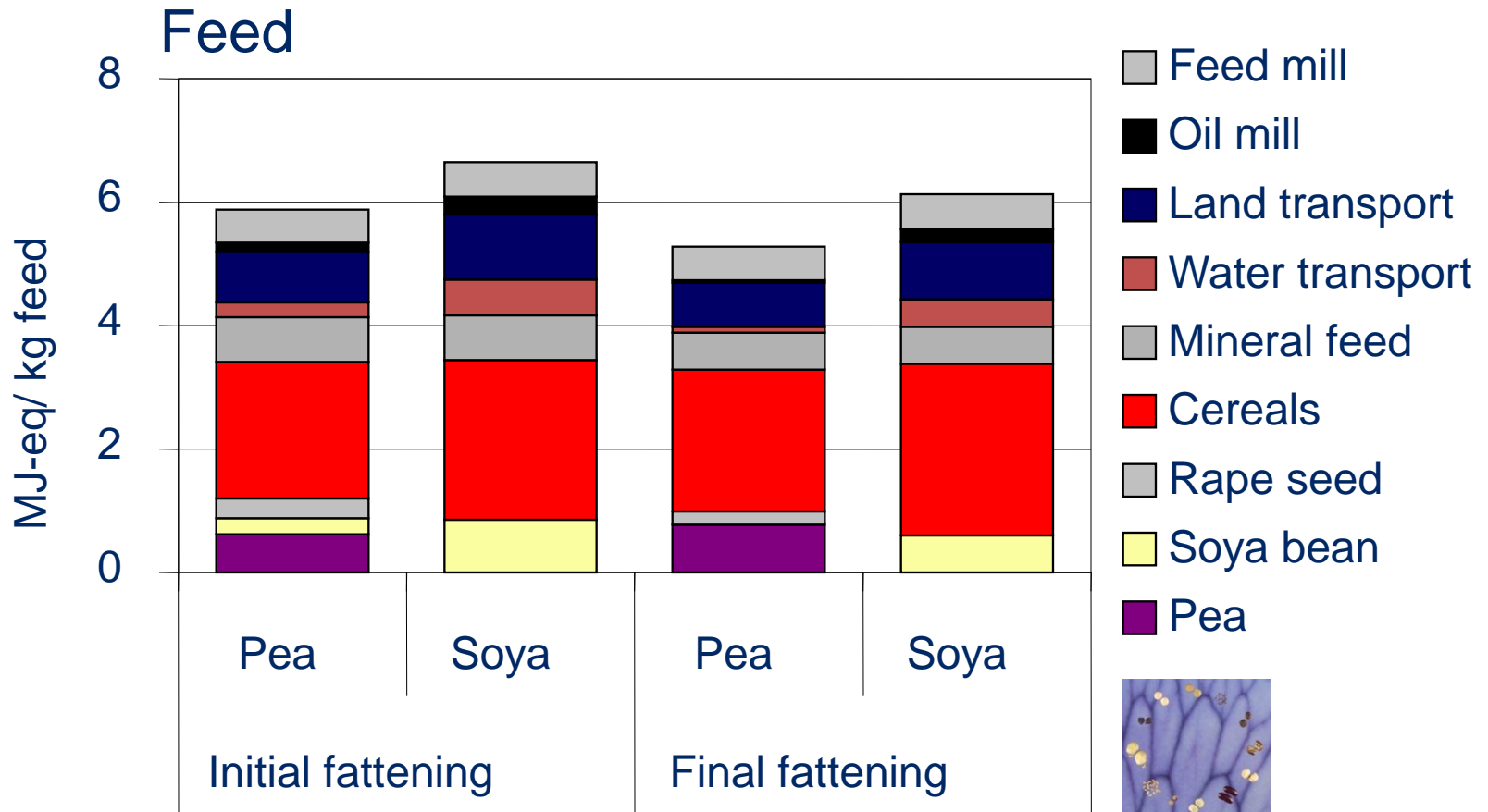
Liu et al (2010) PNAS 107:8035-8040

"Leguminous crops generally incorporated more of the available (and largely self-supplied) nitrogen ..."

# Protein content and yield

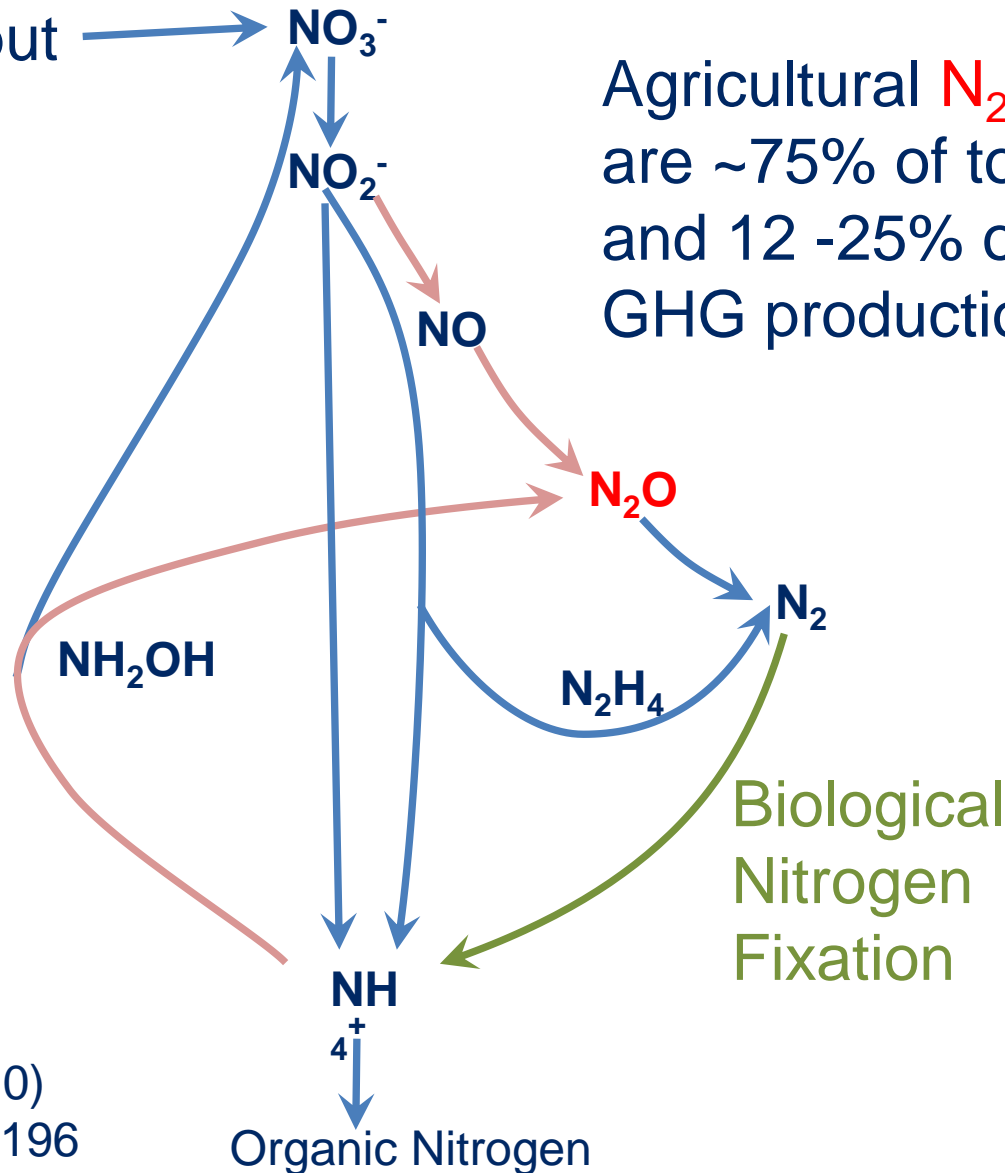


# LCA: non-renewable energy resources



# Impact of nitrogen from agriculture

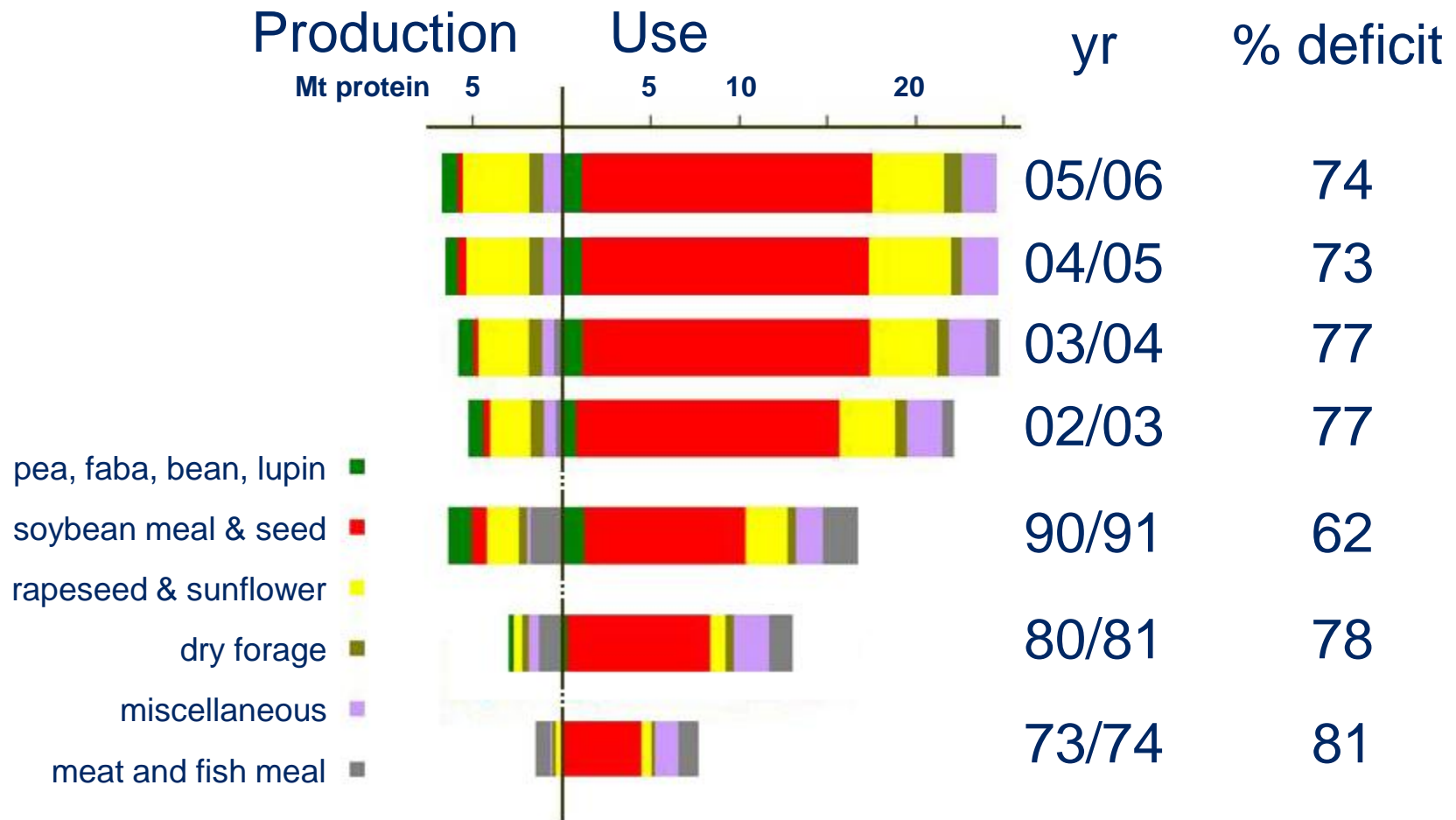
Agricultural  $N_2O$  emissions are ~75% of total and 12 -25% of total GHG production in the EU



From:  
Canfield et al (2010)  
Science 330: 192-196



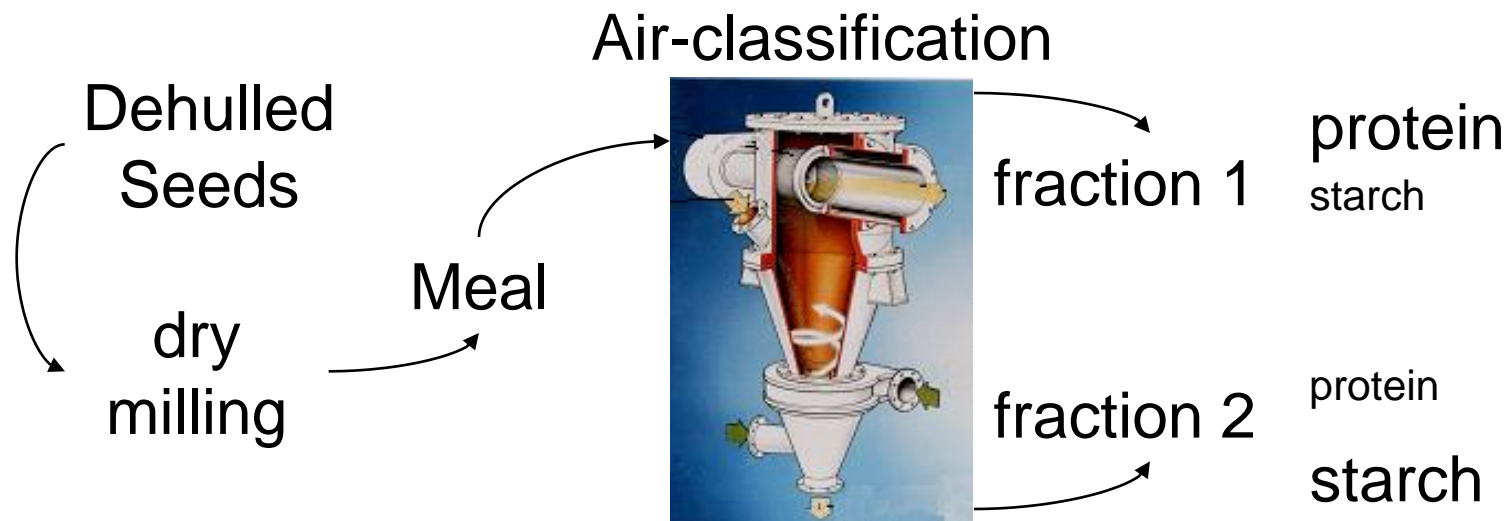
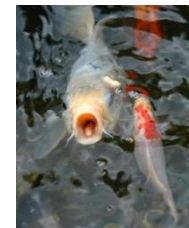
# High demand low production



# Uses

Fish feed for carnivorous species, like salmon, requires high protein and fat contents for nutritional and environmental purposes.

Replacing fish meal with plant protein concentrates makes aquaculture more sustainable.





# Uses

COLL-CT-2005-516231

EU Trigger  
Cliff Hedley, JIC/IFR



## Development of pea starch films with biodegradation properties.

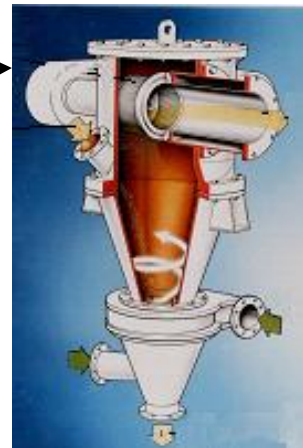


Dehulled  
Seeds

dry  
milling

Meal

### Air-classification



fraction 1

protein  
starch

fraction 2

protein  
starch



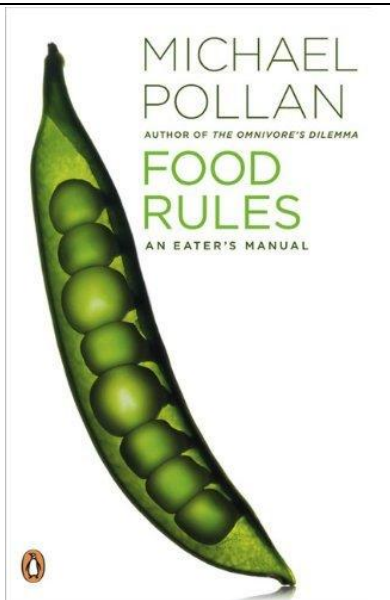
Fraunhofer Institut  
Verfahrenstechnik  
und Verpackung



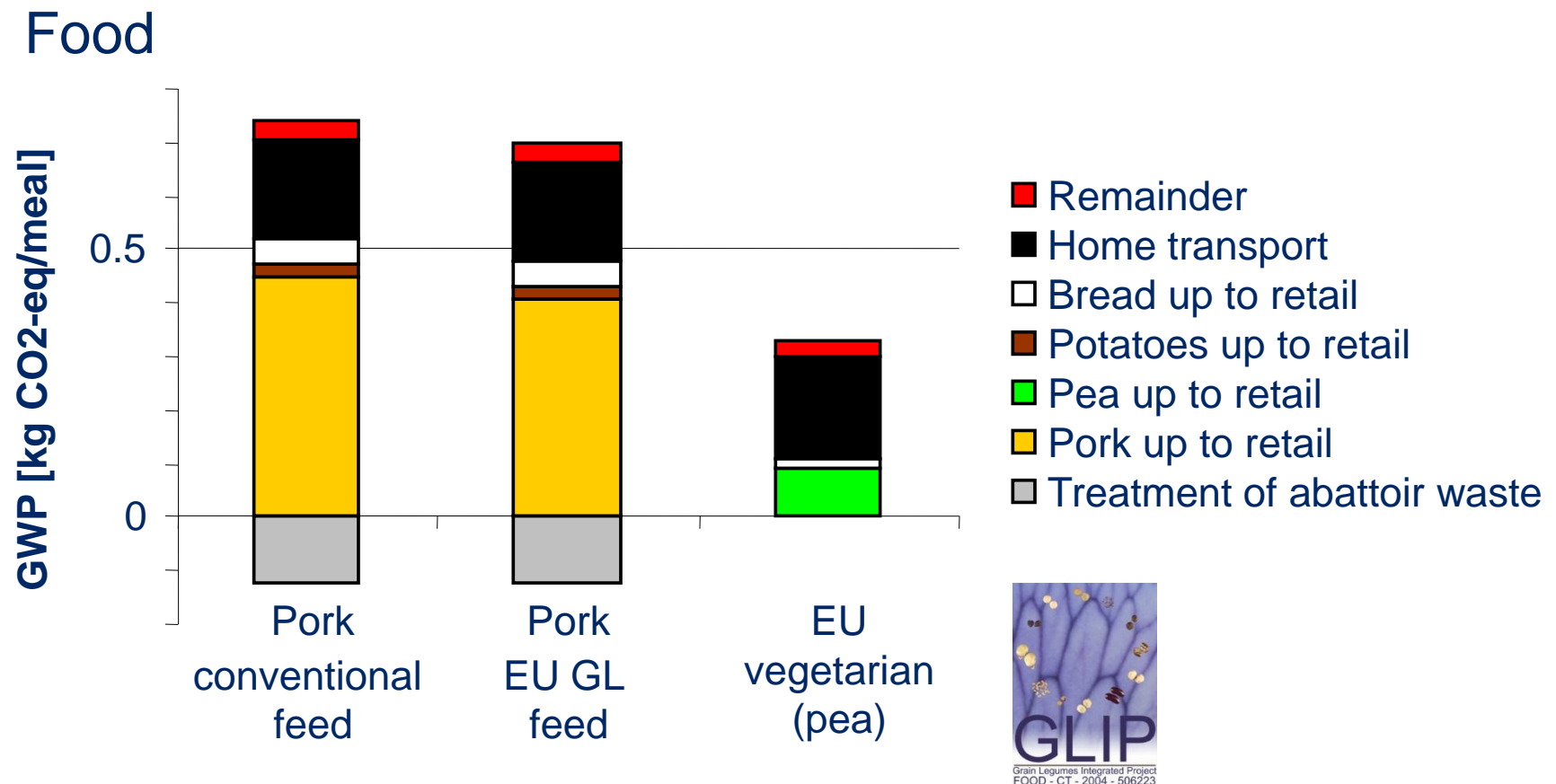


Health and nutrition

# Legumes, food and health



# Contribution to global warming potential





## Alternative sources of protein



Animal feed & pulse as food



N<sub>2</sub>O emission mitigation



Low energy demand



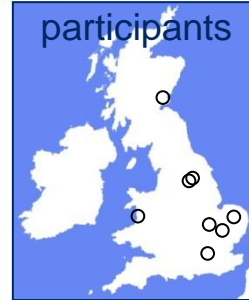
A varied diet

Noel Ellis

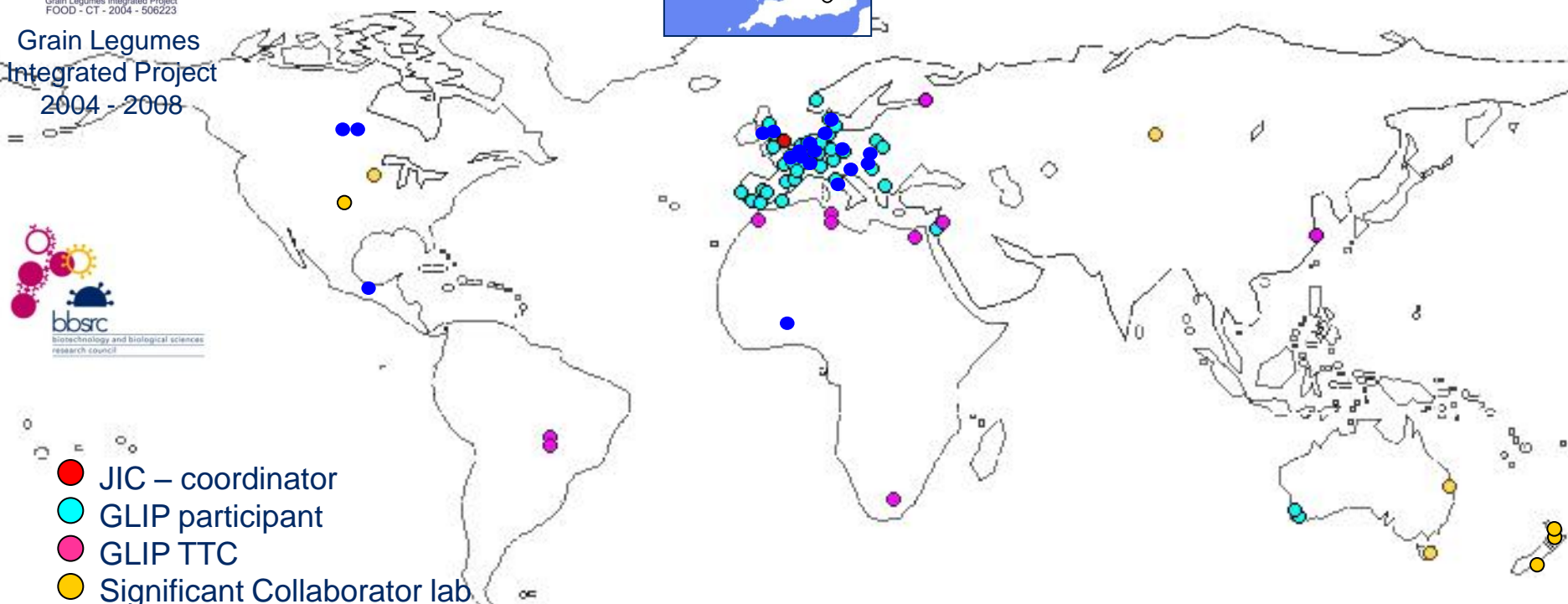
[http://www.aber.ac.uk/en/ibers/staff/staff-list/noel\\_ellis/](http://www.aber.ac.uk/en/ibers/staff/staff-list/noel_ellis/)



PCGIN / GLIP  
participants



Grain Legumes  
Integrated Project  
2004 - 2008



- JIC – coordinator
- GLIP participant
- GLIP TTC
- Significant Collaborator lab
- GL-TTP participant (20)



Sefydliad y Gwyddorau Biologol, Amgylcheddol a Gwledig  
**IBERS ABERYSTWYTH**  
Institute of Biological, Environmental and Rural Sciences

**Noel Ellis**

[http://www.aber.ac.uk/en/ibers/staff/staff-list/noel\\_ellis/](http://www.aber.ac.uk/en/ibers/staff/staff-list/noel_ellis/)