



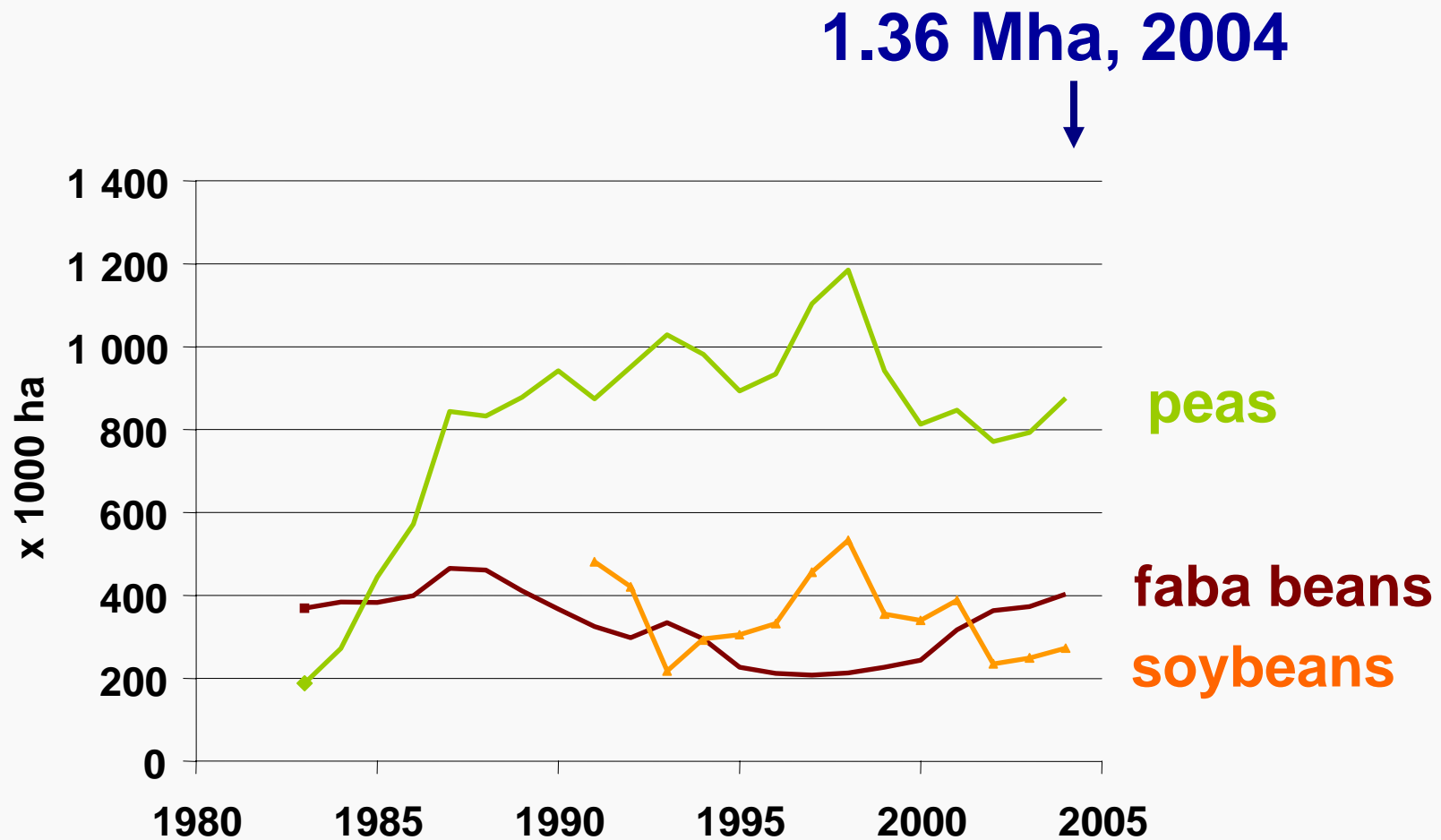
The University of  
**Nottingham**

**Pulse Crop Genetic Improvement Network**  
**29<sup>th</sup> September 2006**

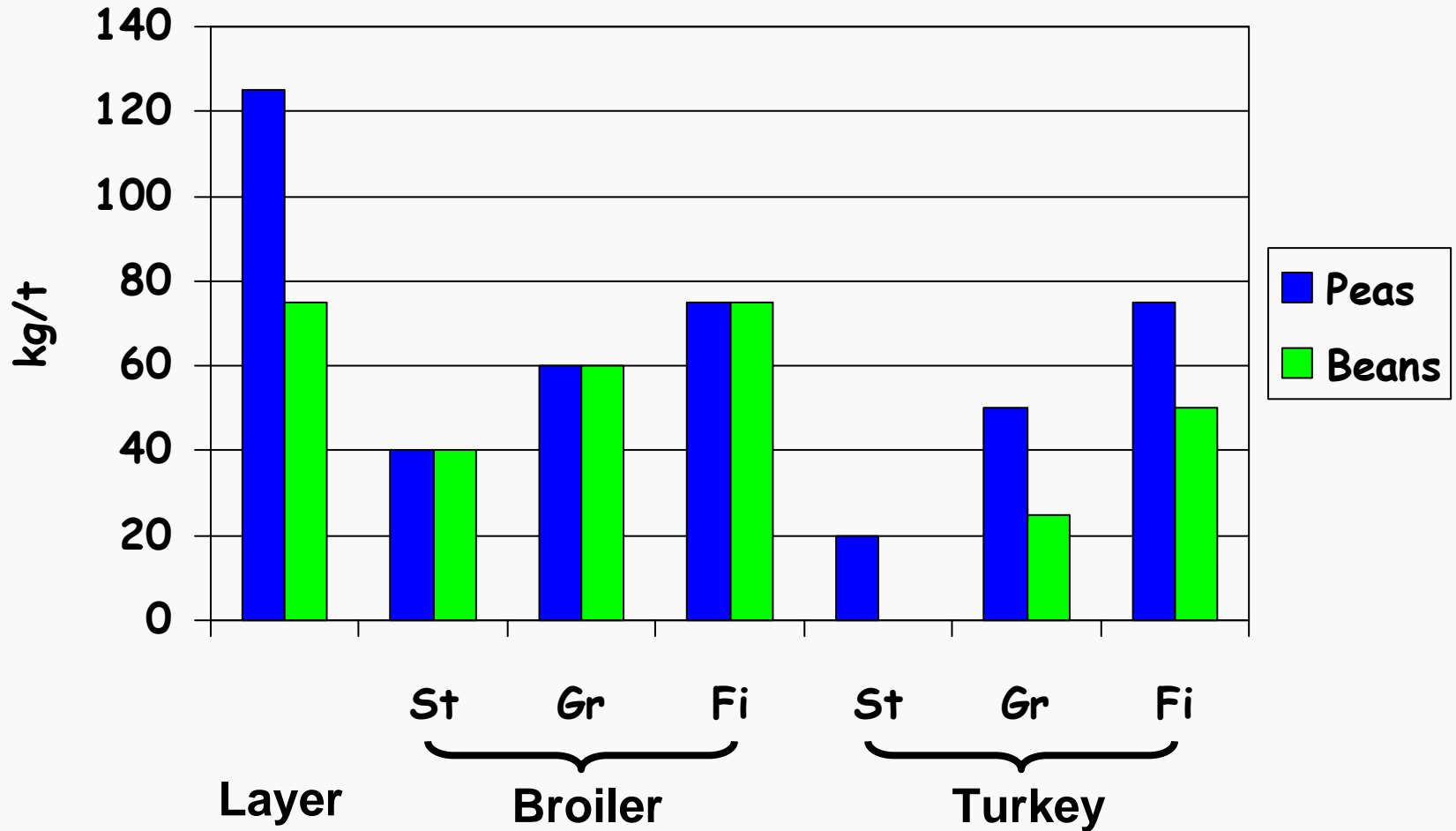
**Seed quality for animal feed with  
reference to poultry**

**Prof Julian Wiseman**  
**University of Nottingham**

# Major Grain Legumes; EU-15



# Use of Legumes: UK



# How much is used in the UK?

**'Extrupro' is 500 Rape + 500 peas or beans; widely used.**

**-Thus hard to break down into peas and beans individually.**

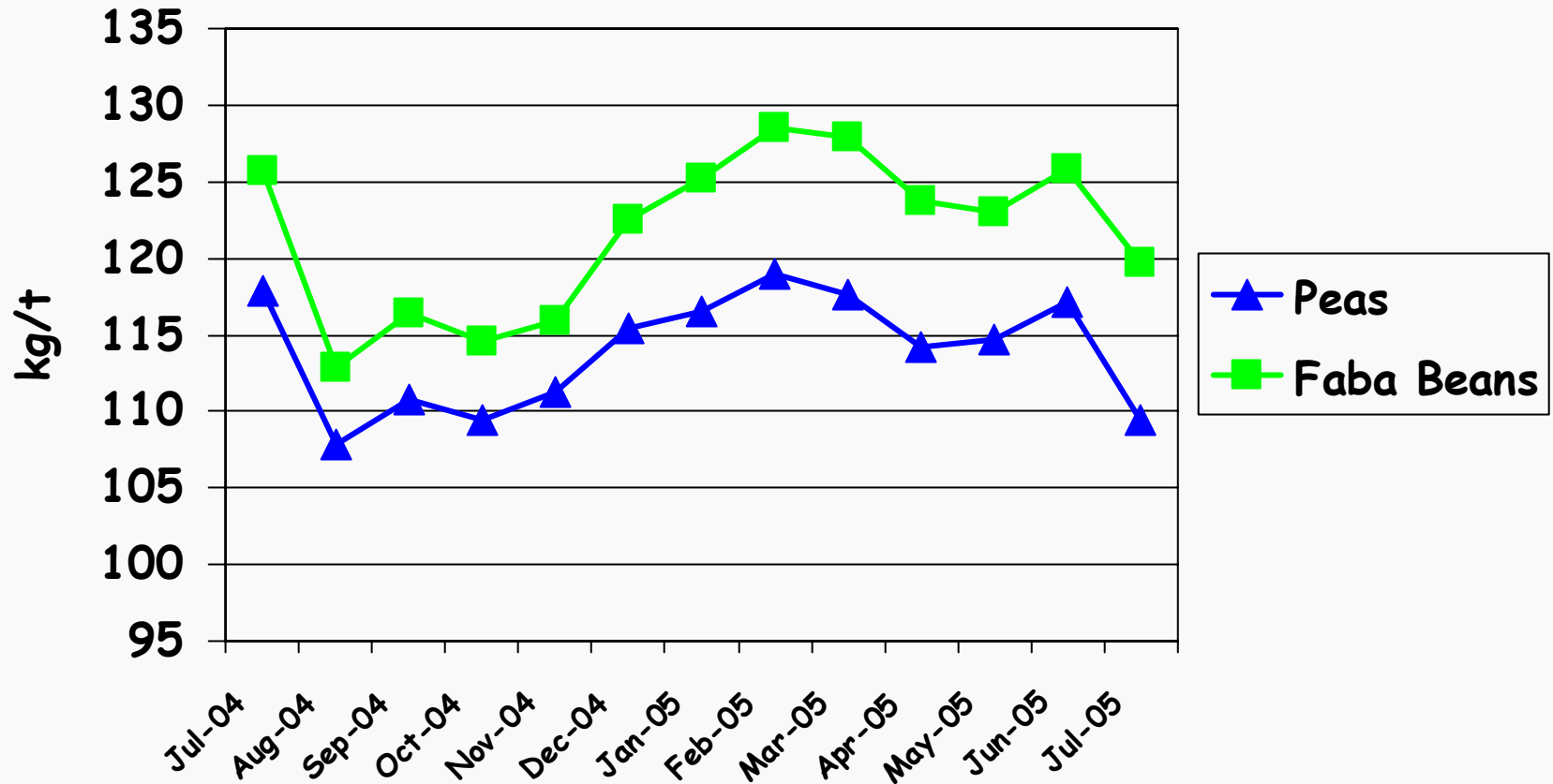
**-3.3 million tonnes broiler food**

**-100g/kg of these products included = 165,000 T peas and beans**

**-Soya is always used in poultry diets**

**-Level is price sensitive; applies to all raw materials**

# Inclusion in Finisher Broiler Diets



# Chemical composition of legumes

## Positive

### - Crude Protein

Amino acids

Essential vs non-essential

### - Starch

Energy-yielding

# Chemical composition of legumes

## Positive

### - Crude Protein

Amino acids

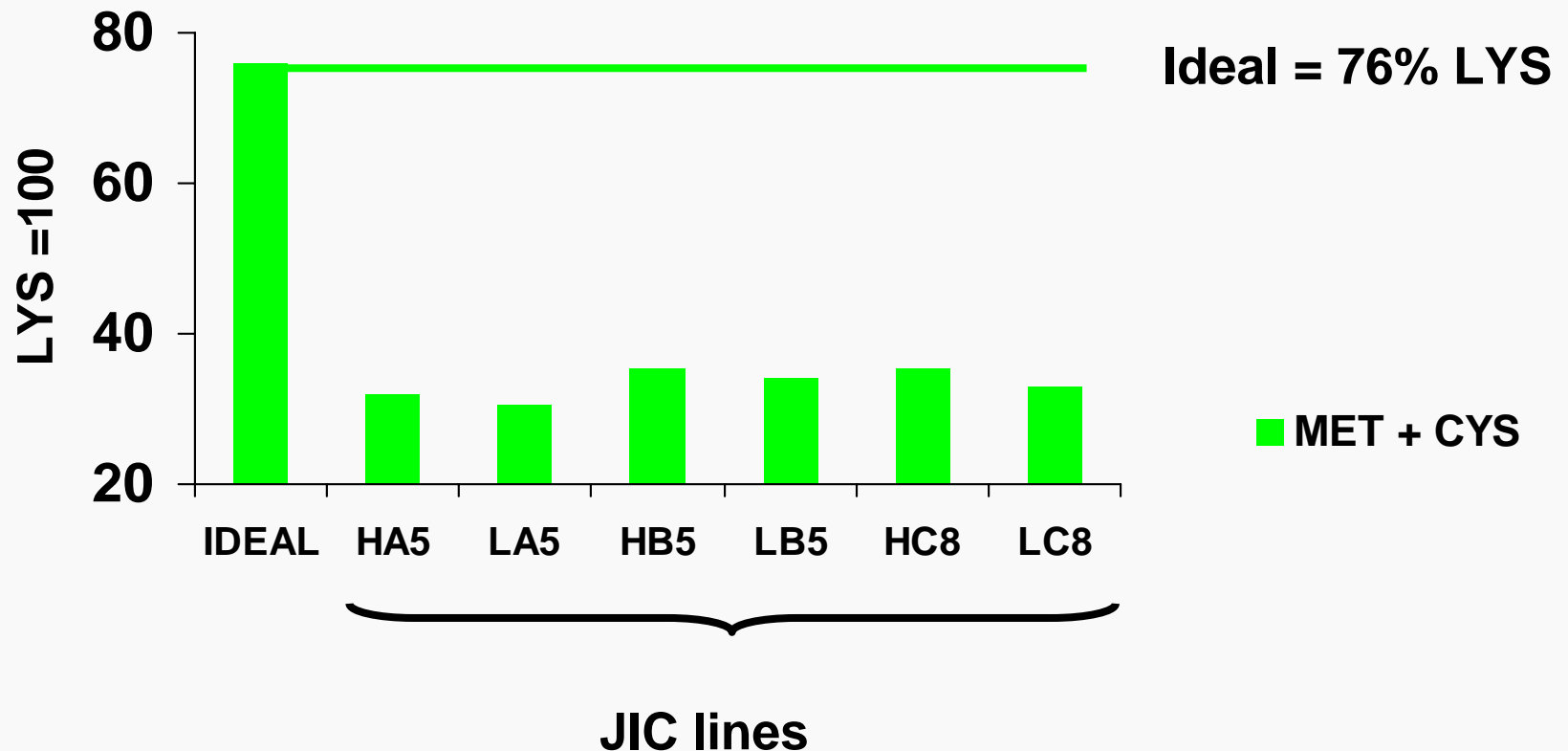
Essential vs non-essential

### - Starch

Energy-yielding

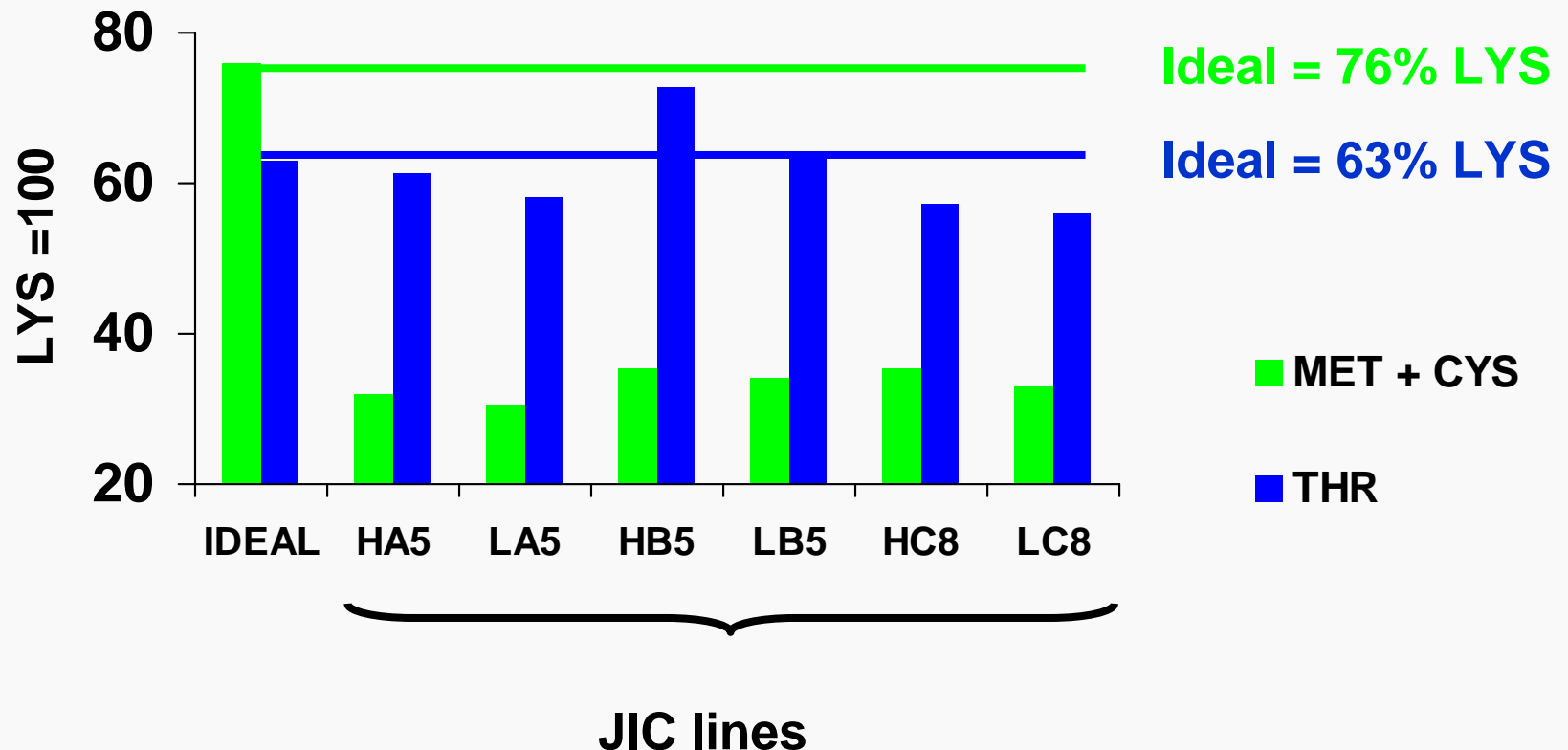
# Amino acid composition of pea protein

Concept of 'ideal protein'



# Amino acid composition of pea protein

Concept of 'ideal protein'



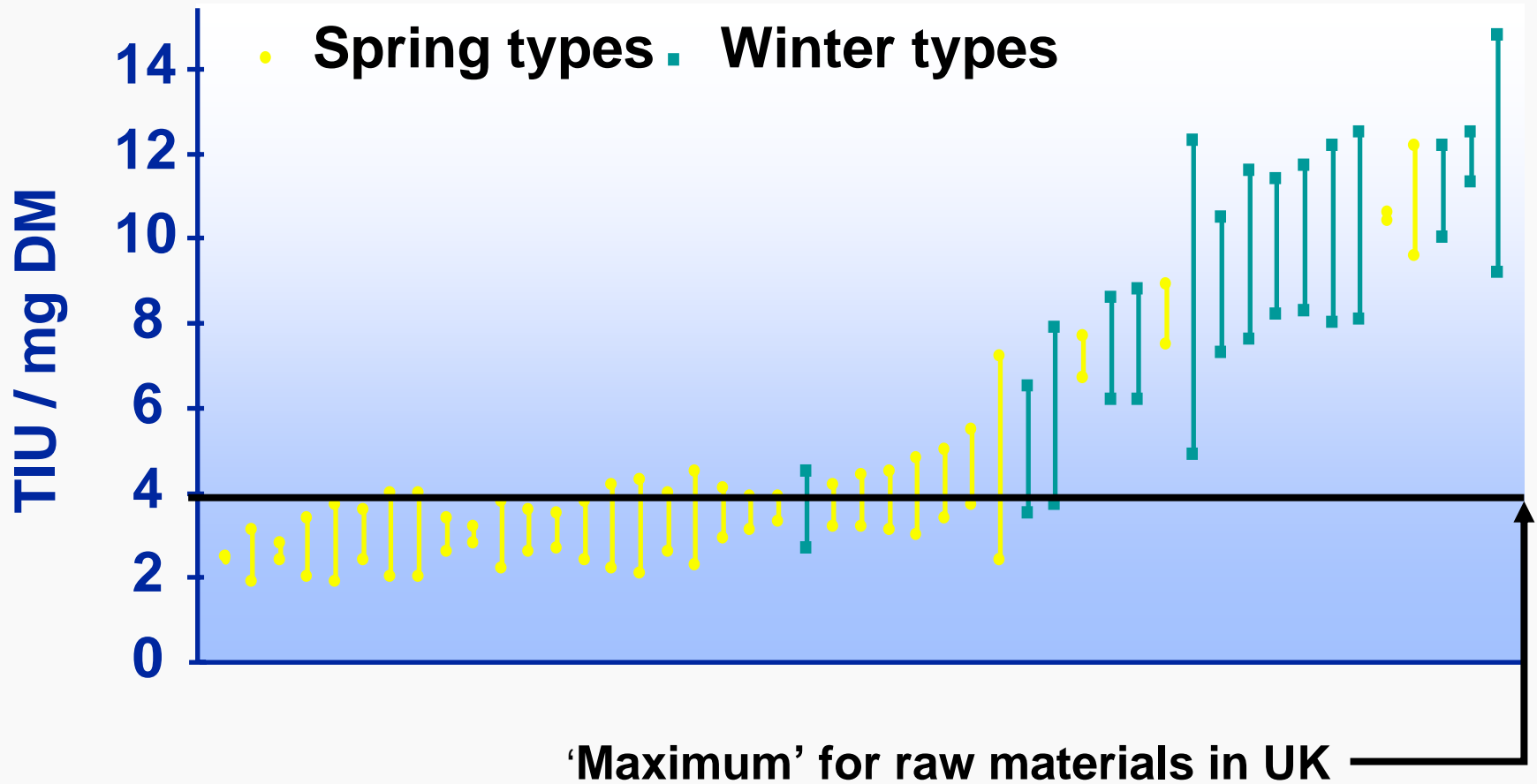
# Chemical composition of legumes

Positive	Negative
<ul style="list-style-type: none"><li>- Crude Protein<ul style="list-style-type: none"><li>Amino acids</li><li>Essential vs non-essential</li></ul></li><li>- Starch<ul style="list-style-type: none"><li>Energy-yielding</li></ul></li></ul>	<ul style="list-style-type: none"><li>Crude Fibre</li><li>Trypsin Inhibitors</li><li>Tannins</li><li>Vicine / convicine</li></ul>

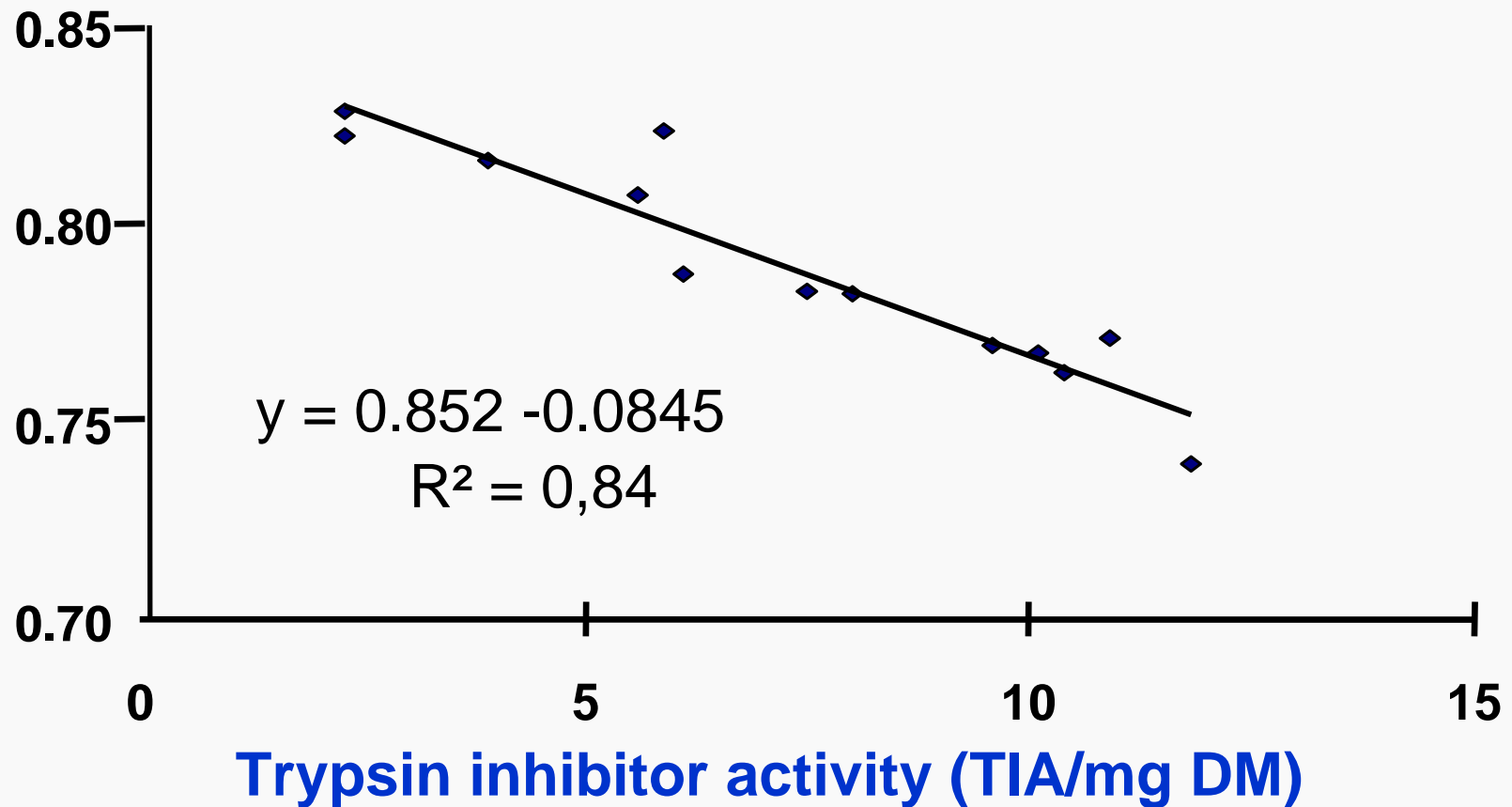
# Trypsin Inhibitors

- **Naturally-occurring**
- **Several compounds present with anti-trypsin activity**
  - **True trypsin inhibitors**
    - **Dependent on assays utilised**
    - **Bowman-Birk type predominate in peas**
      - **Two active binding sites**
  - **Tannins**
- **Interfere with protease activity**
  - **Reduction in protein / amino acid digestibility**
- **Hyper-secretion of trypsin**
  - **Pancreatic hypertrophy**
  - **Increased demand for sulphur amino acids**
- **Selection for low TI?**
  - **TIs are themselves high in sulphur amino acids**

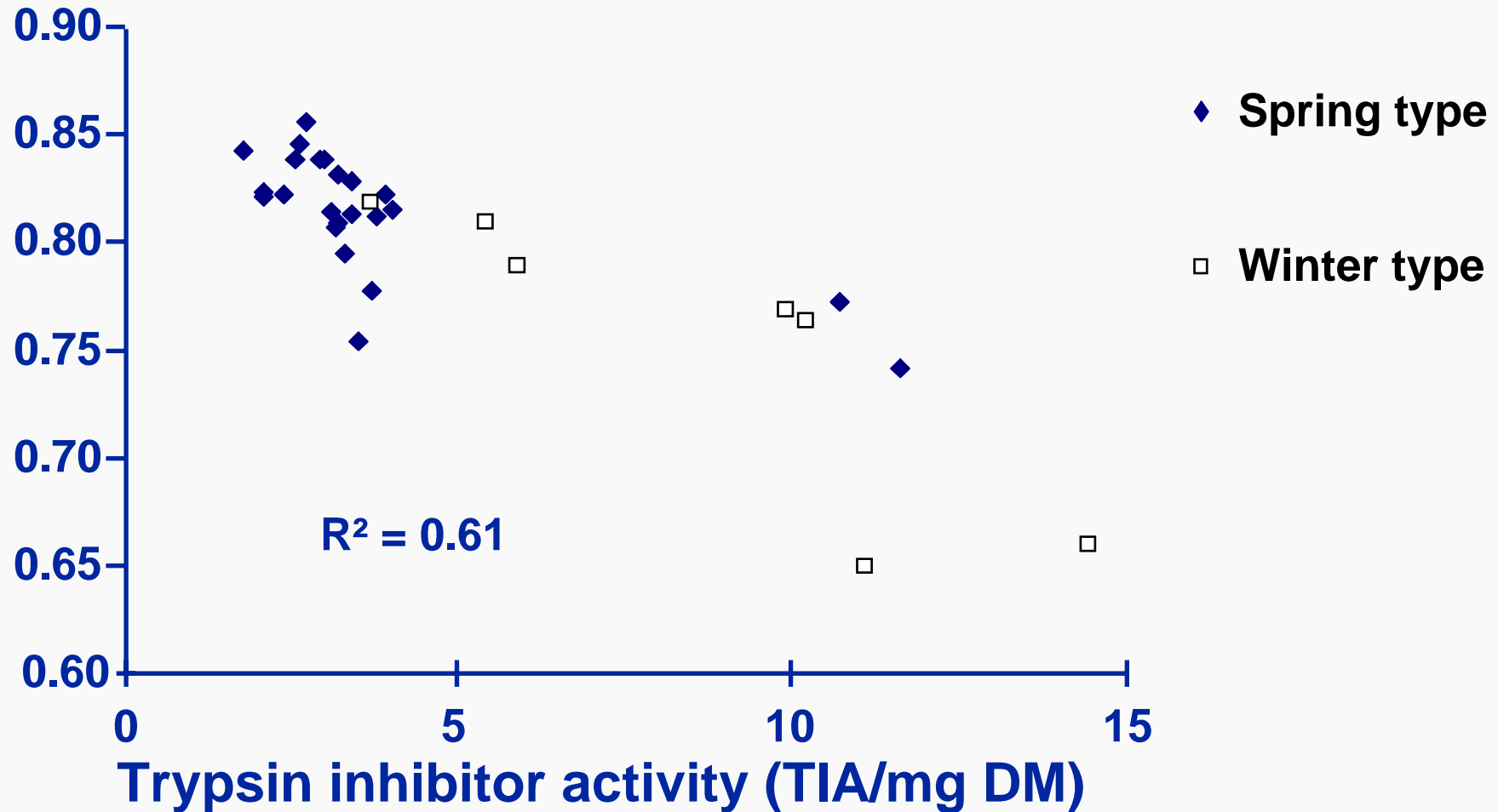
# TIA of pea cultivars (mean $\pm$ sd)



# Standardized ileal digestibility of pea protein based on TIA



# Standardized ileal digestibility of pea protein based on TIA

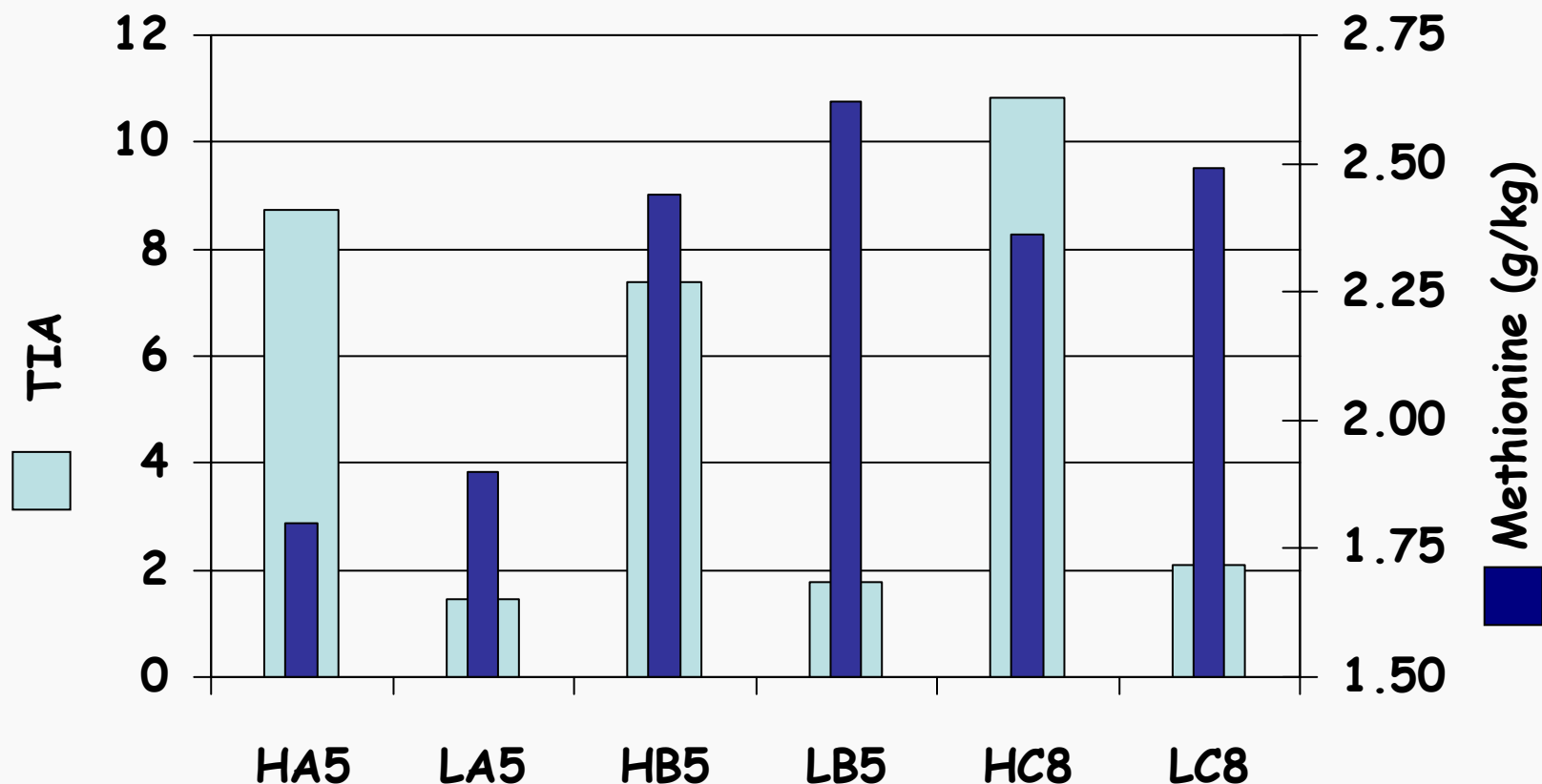


# Near isogenic lines of peas Allow assessment of true TIs

- A, B and C Lines near-isogenic, except for the *Tri* and closely linked genetic loci.
- *Tri* locus contains the *T11* and *T19* classes of genes encoding
  - major seed trypsin / chymotrypsin inhibitor proteins
  - relatively minor seed trypsin / trypsin inhibitor proteins
- Genetic locus also controls quantitative variation in trypsin inhibitor activity (TIA).

# Near isogenic lines of peas

## Allow assessment of true TIs

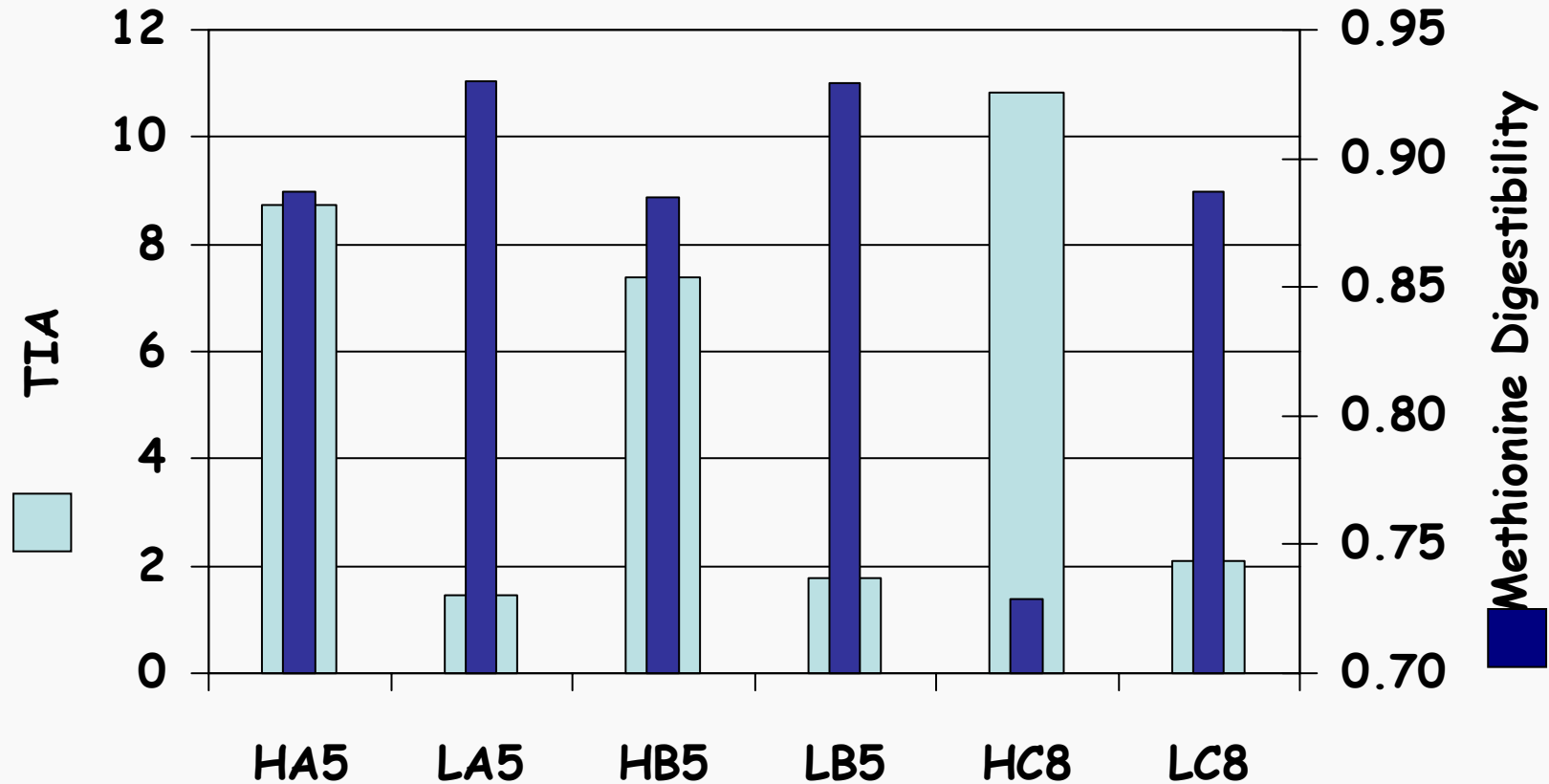


Lines LOW in TIA have HIGHER levels of Methionine

- 5.5, 7.4, 5.5% for A, B and C lines

Wiseman et al., 2003,2005

# Near isogenic lines of peas



Lines LOW in TIA have HIGHER levels of Methionine Digestibility

- 4.8, 5.0, 21.7% for A, B and C lines

Wiseman et al., 2003,2005

# Tannins

- Tannins
  - Polyphenols that complex with proteins (enzymes)
    - Reduce protein digestibility
  - Influenced to an extent by seed coat (Coloured vs White)
    - Peas 0.1 – 5.5; faba beans 0.1 – 6.6 mg/g

Sometimes not easy to correlate tannins with nutritional value

# Conclusions

- **Home produced legumes of potential value**
- **Limitations to their use:**
  - **Price**
  - **Variation in:**
    - **Quality**
    - **Supply**
  - **Lack of focus by breeders / growers on end users**



The University of  
**Nottingham**

**Thank you for your attention**