



Using legumes in UK pig diets

Green Pig

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Overview



- Protein sources in UK pig diets
- Pulses in pig nutrition
- Constraints
- Green Pig project

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Protein sources in UK pig diets

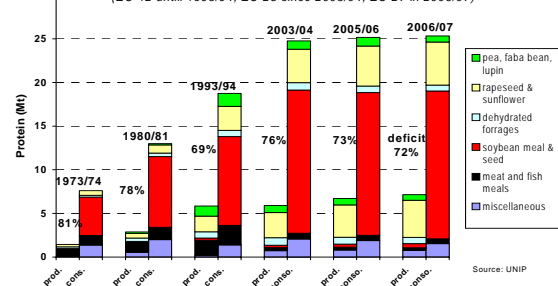


- Several feedstuffs are used as protein sources:
 - Oilseed by-products (rapeseed meal, soybean meal and sunflower meal)
 - Milk products (whey, skimmed milk powder)
 - Animal products (fishmeal)
 - Pulses (peas, faba beans)
 - Cereals (maize gluten feed but also wheat, barley)

Large amount of protein is imported



EU : Balance of Materials Rich in Protein in the EU
(EU-12 until 1993/94, EU-25 since 2003/04, EU-27 in 2006/07)



UK soybean meal supply



- Soybean meal supply to the UK comes from direct import or UK produced from imported soybeans
- Data from Oilworld (2008) in 000's tonnes

	2006	2007
Import	1,834	2,097
UK crush	446	478
Export	87	50
Net UK supply	2,193	2,525

Soybean meal use by livestock sector



- No official figures available
- Use of SBM in pigs estimated (BPEX, 2008)
 - Averaged inclusion level of SMB in pig diets
 - Total feed usage per pig from weaning to slaughter
 - Number of pigs sold per sow
 - Number of sows in the UK
- SBM use for producing pigs in UK for 2007
 - ~300,000 tonnes
 - ~12% of total UK SBM usage

Looking for alternatives?



- Challenges for SBM use
 - Feed miles (main imports from Brazil, Argentina)
 - GM confusion (Brazil: non-GM; Argentina: GM)
 - Deforestation
 - Dependency on import
 - Pollution potential
- Potential to use home grown pulses as an alternative
- All else being equal, replacing UK SBM supply for pigs (2007) would have required ~500,000 tonnes of pulses

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Pulses in pig nutrition



- Nutritional composition of peas and faba beans
- Adapted from Crépon (2006) and all in g/kg DM

	White-flowered pea	Coloured-flowered pea	White-flowered faba bean	Colour-flowered faba bean
Crude protein	245	276	300	315
Starch	501	430	435	430
Crude Fibre	64	85	89	88
Sugars	50	51	37	43
Fat	15	18	18	16

Pulses in pig nutrition



- Peas and faba beans can substantially contribute to meet desired crude protein and energy levels in pig diets
 - DE levels vary from 14.4-17.5 MJ/kg
 - Not dissimilar to that of cereals
- Why are peas and faba beans not used at higher inclusion levels?
 - Good gross nutritional characteristics
 - Expected environmental benefits
 - Home grown means reduced feed miles
 - Low input of nitrogen fertiliser (natural N-fixation)
 - Benefit in crop rotations

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Constraints



- Use of pulses in pig nutrition is subject to constraints
 - Nutritional quality (digestibility, amino acid composition)
 - Anti-nutritional properties
 - Availability, consistency and price
 - Processing

Constraint: nutritional quality



- Standardized ileal digestibility of crude protein and amino acids in pulses is lower than in soybean meal

	Peas (6 cultivars)	Faba beans (6 cultivars)	Soybean meal
Crude protein	80	76	88
Lysine	85	82	91
Methionine	77	67	93
Cystine	68	58	84
Threonine	76	74	87
Tryptophan	61	68	87

Adapted from Jezierny *et al* (2008) and in %

Constraint: nutritional quality



- Ileal digestibility of crude protein and lysine, and digestible energy content differ between varieties
- Example below is from French peas

	Ileal digestibility crude protein (%)	Ileal digestibility lysine (%)	Digestible energy (MJ/kg DM)
Laser	60.9	66.5	16.9
Frijaune	62.0	65.9	16.4
Baccara	77.6	83.1	15.8
Messire	82.7	85.8	16.3
Solara	85.2	83.0	15.8

Adapted from Crépon (2006)

Constraint: nutritional quality



- Peas and faba beans have lower levels of crude protein and amino acids than in soybean meal
- Difference between varieties

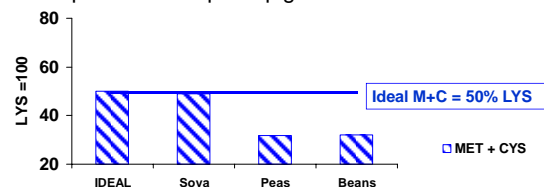
	Peas (6 cultivars)	Faba beans (6 cultivars)	Soybean meal
Crude protein	24.9	30.8	54.1
Lysine	1.79	1.90	3.18
Methionine*	0.23	0.20	0.67
Cystine*	0.35	0.37	0.74
Threonine	0.90	1.06	2.00
Tryptophan*	0.23	0.26	0.69

Meike Rademacher (unpublished) and in %

Constraint: nutritional quality



- Ideal protein concept for pigs



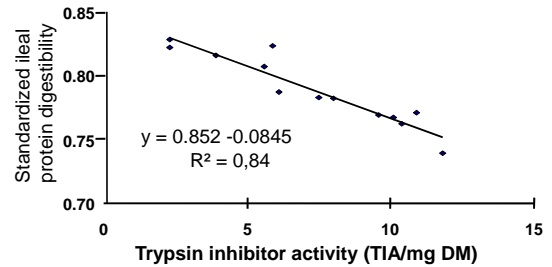
- Soya is balanced for M+C; peas and beans are deficient
- Thus in the absence of surplus M+C from other sources, a pulse based diet will result in reduced performance

Constraint: anti-nutritional properties



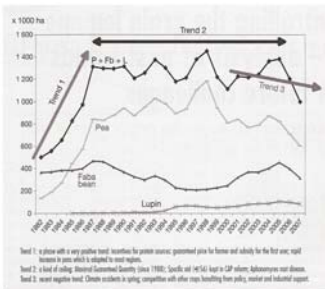
- Pulses have relatively high levels of secondary plant metabolites better known as anti-nutritional factors (ANF)
 - Trypsin inhibitor activity is high in some white-flowered peas
 - Condensed tannins usually moderate to high in colour-flowered pulses
 - Presence of vicine and convicine in mature faba beans
- Increased intake of ANF decreases protein digestibility
- A threshold for observable ANF activity may exist

Constraint: anti-nutritional properties



Grosjean et al., 2000

Constraint: availability



- Recent decline:
 - Technical problems (e.g. crop diseases in peas)
 - Economics (unattractive prices)
- UK production
 - ~900,000 tonnes (2005)
 - ~650,000 tonnes (2008)

Figure 2. Trends in areas of grain legumes in the EU and major factors related to each of the major phases (Garnery-GC-199, 2006).
Data from 1980 with 2010 and 2008, 2010 and 2008, 2010 and 2008.

Constraint: availability



- UK grows pulses mainly for human consumption:
 - Discarded ones end up in UK feeding industry
- Consequence: variability in availability and quality
 - Difficult to instil confidence in its increased use in pig feeding
 - Different focus for the two industries concerned
 - Crop producers: pulse yield and protein content
 - Pig nutritionists: protein quality (AA profiles, digestibility)
- Green Pig facilitates communication between crop producers and pig nutritionists

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Green Pig: Overall Aim



To assess the potential of using **home grown legumes** in **growing/finishing pig diets** in order to **reduce the environmental burden** of pig production in the UK

- Joint project between **plant breeders, crop growers, pig nutritionists** and **pig producers**



Green Pig Objectives



• 8 related objectives

1. Initial environmental system analysis
2. Identify constraints
3. Identify varieties that overcome constraints and characterize their physico-chemical properties
4. Literature review on pulse amino acids and ANF
5. Nutritional studies in growing/finishing pigs
6. Translate to applicable management strategies
7. Environmental system analysis with info from 2-6
8. Dissemination of findings and applications

Green Pig: Approach



- Life cycle analysis of environmental consequences of exchanging SBM with UK grown pulses in pig diets
 - Carbon foot print, acidification and eutrophication
- Sampling and analysis of UK peas and beans varieties
 - Assessment of amino acid profiles and ANF contents
 - Small scale nutritional evaluation studies in pigs
 - Dose-response and metabolism studies using varieties with best amino acid profile and minimal ANF contents
 - Large scale demonstration trials (growing and finishing pigs)
- Rerun life cycle analysis with new data from the project
 - Environmental consequences and economical assessment

Green Pig: Progress and expectation



- 3½ year project (July 2008 – December 2011)
 - Time table centred around Harvest 2008, 2009 and 2010
- Progress
 - Development of LCA components
 - Evaluation of recommended list samples (Harvest 2008)
 - Different varieties and sites
 - Amino acid composition, ANF characterisation and nutritive value for monogastrics
- Green Pig's anticipated outcome: instil confidence in increased use of "fit for purpose" home grown pulse varieties for the UK pig feeding industry

Thanks for your attention



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