Stiftung Tierärztliche Hochschule Hannover
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ECVCN - Residency Class 2016, Berlin, Germany

- Case report -

Grinding of protein source and performance in pigs

F. von und zur Mühlen

Case

- farm after new construction in east Germany
- 11,000 fattening places
- three phased fattening
- liquid feeding system
  - grain (grinding on farm: hammer mill)
  - rapeseed meal, soybean meal
  - moist by-products

➢ low daily gains, feed:gain > 3:1

http//:www.modellbahnshop-lippe.de

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top 25 % of farms in Germany: 872 g daily gains
feed:gain 2.77:1 (Deitmer et al. 2014)

Diet

	composition, % as fed		
	pre-fattening	fattening	finishing
Barley	22.7	21.8	23.5
Maize	6.50	7.16	0.96
Wheat	16.0	13.4	10.4
Triticale	14.0	10.9	16.5
Soybean meal	11.3	9.85	3.96
Rapeseed meal	4.45	4.09	5.04
Steamed potato peels (14.7% dm)	7.20	7.20	6.70
Brewer‘s yeast (8.02% dm)	11.6	12.7	12.9
By-product from bioethanol production (17.0 % dm)	-	9.2	16.9
Oil	2.09	1.38	0.37
Arbocel®	-	-	0.88
Mineral supplement	4.14	2.29	1.94

Diet

	calculated nutrient content, % (recommended*)		
	pre-fattening	fattening	finishing
Dry matter	88	88	88
Energy (MJ ME)	13.06	13.1	12.6
Crude protein	15.8 (14.5)	16.4 (12.5)	14.9 (8.90)
Crude fat	4.89	4.42	3.33
Crude fibre	3.70	3.84	4.73
Calcium	0.60 (0.58)	0.74 (0.52)	0.69 (0.40)
Phosphorus	0.52 (0.48)	0.51 (0.44)	0.52 (0.34)
pcD lysine	0.95 (0.79)	0.90 (0.68)	0.73 (0.48)
Methionine + cystine	0.65	0.63	0.57

*acc. to GfE (2008)

Possible causes

- reduced feed intake

A) due to the **DM content** of the ration

B) due to **demixing** of solid particles or within the solid phase

C) due to lacks of **feed hygiene**

D) due to **palatability** of components

- reduced digestibility of nutrients

A) due to **grinding of protein** source

B) due to **availability of protein** from sources

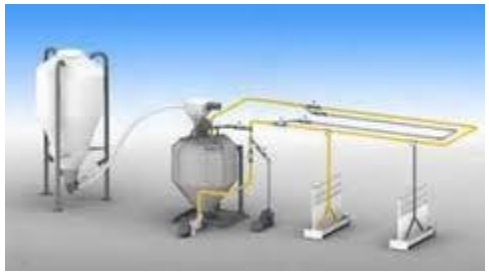
Reduced feed intake

A) due to the **dm content** of the ration

- recommended: 22 - 25 %*
- low dm content limits feed intake in pigs

→ analyses of the feed

→ dm content of 245 - 280 g dm/kg liquid diet



http//:www.schauer-agrotronic.com

*acc. to Kamphues et al. (2014)

Reduced feed intake

B) due to **demixing** of solid particles or within the solid phase

- distance from mixing tank to troughs
- higher risk in liquid feed (rising with increasing water content)
- influenced by viscosity (use of hydro-thermic pre-treatment) and consistency of the feed

→ analyses of dm content, XA, and nutrients (XP, XL, XF, Ca) in samples from mixing tanks and troughs

→ comparable results in samples from different localisations

(g/kg 88% dm)	mixing tank	trough	trough	mixing tank	trough
XA	51.9	53.5	52.3	43.4	41.2
XP	176	164	172	152	160
	pre-fattening			fattening	

Reduced feed intake

C) due to lack of **feed hygiene**

- the availability of nutrients and free water offer good conditions for bacteria, yeasts and moulds to grow in liquid diets
- depending on primary contamination of native sources

→ degradation of nutrients, forced gas formation, production of toxins

→ analyses of the used by products

(CFU/g)	steamed potato peels		brewer‘s yeast		by-product from bioethanol production
aerob bacteria	$< 10^5$	-	$< 10^5$	-	-
yeasts	$5.8x10^3$	$3.3x10^3$	$5.0x10^2$	$7.5x10^2$	$<10^3$
moulds	-	$<10^3$	-	$<10^3$	$<10^3$

Reference values for hygienic quality of liquid feed for pigs

types of pathogens	regular	considerably increased
aerob bacteria	$< 10^7$	$> 10^8$
yeasts	$< 10^5$	$> 10^6$
moulds	$< 10^4$	$> 10^5$

acc. to Kamphues et al. (2014)

Reduced feed intake

D) due to the **palatability**

- use of by-products
- use of rapeseed meal
- because of heat damage (e. g. toasting of soybean products)

→ data of the farm gave no hint on reduced feed intake at all

Digestibility of protein

A) - no further grinding of soybean meal on the farm
- macroscopic particle structure seemed very coarse

lower digestibility of protein

→ reduced daily gains

→ prolongation of fattening period

→ higher maintenance requirements

→ unfavourable feed conversion ratio

Particle size distribution

Effects of grinding intensity of protein source on protein digestibility are discussed controversely in literature:

precaecal as well as total tract digestibility of protein in pigs was not even numerically affected with decreased grinding intensity of the whole diet (hammer mill - roller mill; 2 stage grinding)

Wünsche et al. 1988, Arlinghaus 2013; Borgelt 2015; Bao et al. 2016

particle size distribution of soybean meal slightly improved apparent and true precaecal digestibility of amino acids in pigs

Fastinger a. Mahan, 2003

Digestibility of protein

A) - no further grinding of soybean meal on the farm
- coarse particle structure

→ sieve analysis of two different batches of soybean meal was performed

	batch A	batch B
amount of particles (%)		
> 1.00 mm	77.95	64.83
< 0.20 mm	1.06	1.68
GMD* (µm)	1514	1195

GMD* of soybean meal most commonly between 800 and 900 µm (Fastinger a. Mahan 2003)

*GMD (geometric mean diameter acc. to ASAE, 1995)

Case

Recommendation:

- to grind soybean meal with the existing hammer mill

→ feed conversion rate was improved
> 3.0:1 → 2.7:1

! protein quality and AA pattern in by-products !

General notes:

- keep on monitoring the dm content in feed
- be aware of demixing
- watch out for hygiene of by-products

Feed conversion ratio

What does an improvement of feed conversion from 3.0 to 2.7 mean?

→ 243 but 270 kg feed for 90 kg gain

Rough calculation for a farm comparable to the present:

- costs for feed:	**25 € / dt**
- reduction of 27 kg diet:	**6.75 € / pig**
- ~ 2.6 fattening periods/year	**28,600 pigs / year**
- milling: 6 kWh/dt, 20 cent/kWh	**9270 € / year**
	183,780 € / year

not takten into account: prolongation of fattening, costs for higher nitrogen excretion, milling costs

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