

Phosphorus requirements and retention in entire male and female pigs

A dose-response study

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Introduction

- Phosphorus (P) is an essential nutrient for pigs
- P-requirements of pigs based on a factorial model
- Largely based on "(near) maximum bone mineralisation" but limited insight in response to dietary phosphorus
- Studies in body P content largely conducted before 2003
- Limited data on entire male pigs

→ Insight required in the relationship between diet P and growth and tissue deposition in pigs

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Aims of the study

Determine the effect of P in grower, early finisher and late finisher diets in pigs on:

- Growth performance in relevant body weight ranges
- Ash deposition in the body
- Bone mineralisation
- Daily P retention and (whole) body P content
- Differences between entire male and female pigs

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Material and methods: design

Serial slaughter study, number of pigs

P-level % of CVB	25-50 kg		25-80 kg		25-125 kg	
	sow	boar	sow	boar	sow	boar
50	4	4	4	4	4	4
70	3	3	3	3	4	4
90	4	4	4	4	4	4
110	3	3	3	3	4	4
130	4	4	4	4	4	4
Total	18	18	18	18	20	20

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M&M, diet composition (partial)

	25-50 kg		50-80 kg		80-125 kg	
	50	130	50	130	50	130
P, % of CVB ¹⁾	50	130	50	130	50	130
Ingredients						
Maize starch	32.0	- 0.6	25.0	- 0.1	23.0	- 2.6
Plant oil	11.6	- 22.4	13.0	- 21.6	14.0	- 21.2
CaCO ₃	8.6	- 17.9	8.9	- 15.3	8.9	- 13.6
MCP	0.8	- 12.0	0.1	- 9.9	0.0	- 8.6
Nutrients, g/kg						
NEv, MJ	9.7	- 9.7	9.7	- 9.7	9.7	- 9.7
P	3.8	- 6.3	3.6	- 5.8	3.4	- 5.4
Dig. P (CVB)	1.3	- 3.4	1.2	- 3.0	1.1	- 2.7
DC P (vP/P)	0.35	- 0.54	0.33	- 0.52	0.30	- 0.50
Ca	5.0	- 10.3	5.0	- 9.0	5.0	- 8.2
Ca/dig. P	3.8	- 3.0	4.3	- 3.0	4.6	- 3.0
inositol-P	2.5	- 2.5	2.5	- 2.5	2.5	- 2.5
AID LYS	9.6	- 9.6	8.3	- 8.3	7.7	- 7.7

CVB 2.6 g, 2.3 g en 2.2 g dP/kg

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M&M, housing and management

- Individual housing, pens with concrete partly slatted floors
- Restricted feeding, 2.4 x M (0,73 MJ NE/kg^{0.6}), 2 meals/d
- Water ad libitum
- Slaughter:
 - 25, 50, 80, 125 kg BW
 - Carcass, blood and empty viscera collected
 - Gut contents collected and pooled for analysis
 - Small part of the front leg (metacarpus) removed
 - Frozen bodies ground and analysed

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M&M, observations



- Diet composition
- Digestibility: 35-40, 65-70, 100-105 kg BW
- Weekly: BW, FI
- After slaughter:
 - Empty body: DM, CP, EE, Ca, P
 - Gut contents: N, P
 - Metacarpus III/IV: weight, FFDM, ash, Ca, P



M&M, statistics



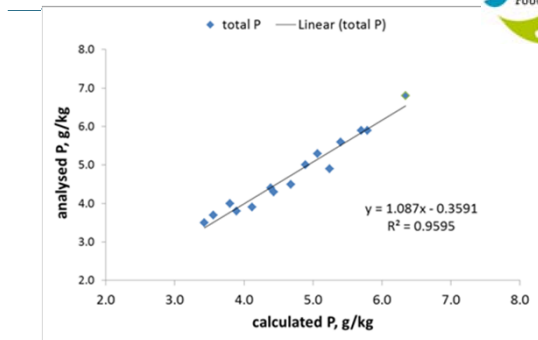
Regression analysis with P-level (%) as independent variable

- Linear and quadratic effects of P-level
- Effect of sex
- Interaction sex and L, Q effect of P-level

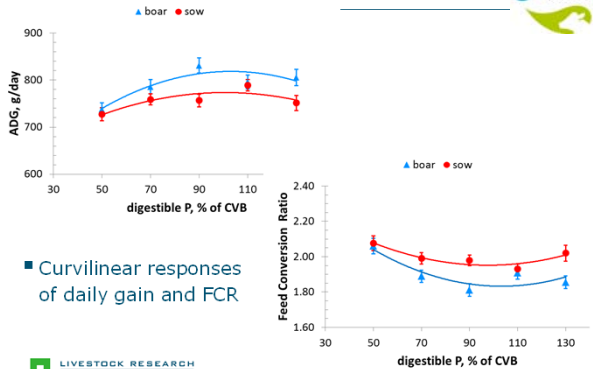
Linear and broken-line regression analyses with dP (g/kg) as independent variable



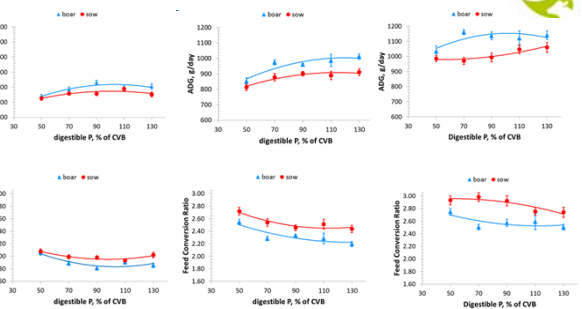
Results, analyses of diets, P



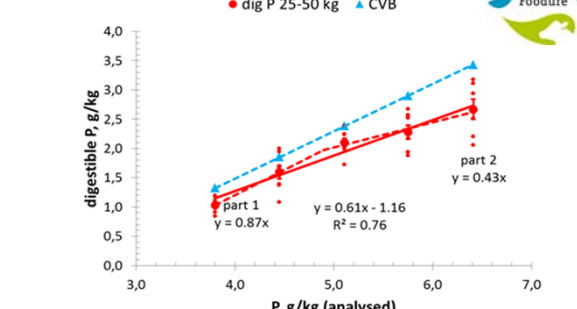
Results, growth performance 25-50 kg



Results, growth performance

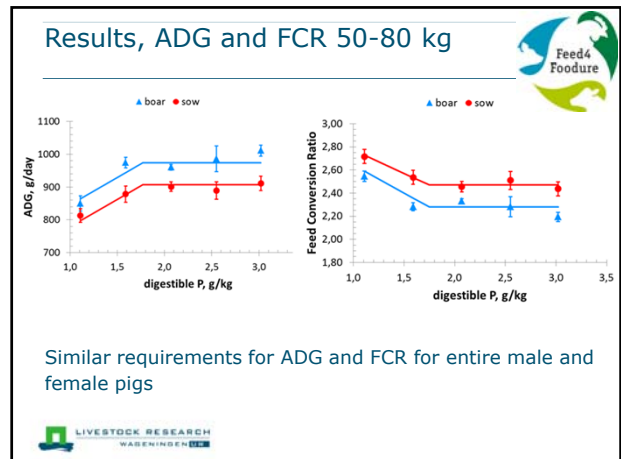
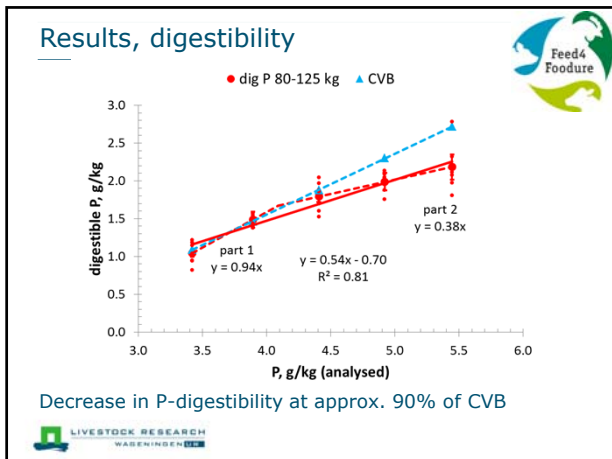


Results, digestibility



Decrease in P-digestibility at approx. 90% of CVB

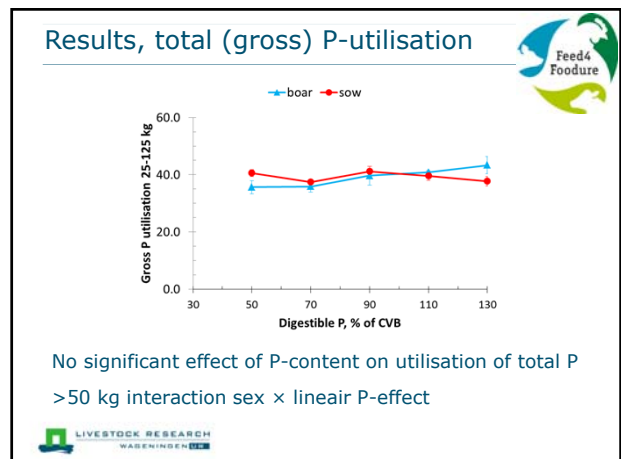
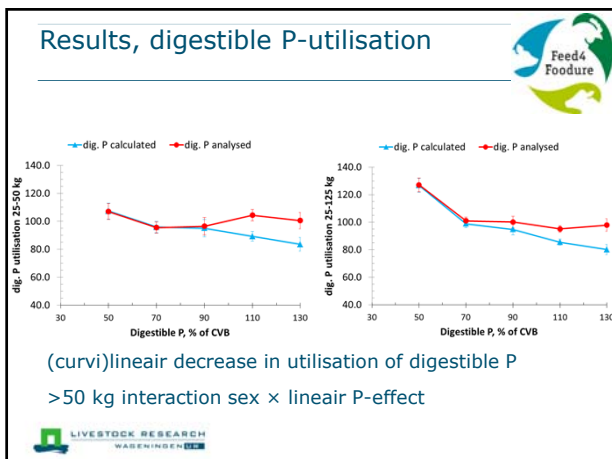
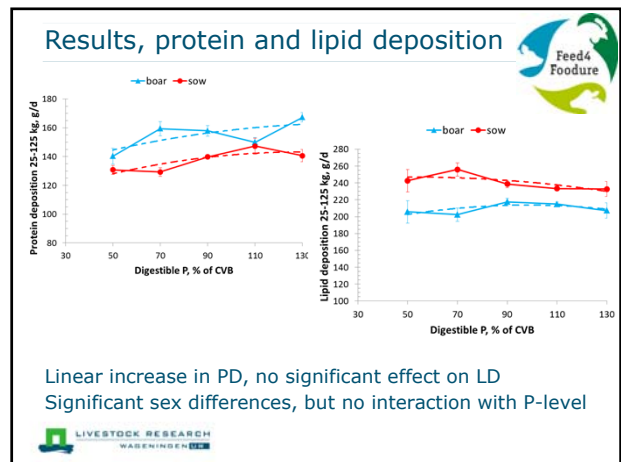




Results, growth performance

	Plateau		Inflection point, dP	
	boar	sow	P-sex	all pigs
25-50 kg				
ADG	806±7.6	770±7.6	<0.001	1.81±0.24
FCR	1.87±0.02	1.96±0.02	<0.001	1.69±0.16
50-80 kg				
ADG	974±11	907±11	<0.001	1.77±0.14
FCR	2.29±0.03	2.46±0.03	<0.001	1.77±0.16
80-125 kg				
ADG	1145±19	1039±19	<0.001	2.12±0.48
FCR	2.54±0.04	2.82±0.04	<0.001	1.70±0.42

No significant sex differences in requirements for ADG and FCR



Results, P in LW at 25 and 125 kg



25 kg: 5.27±0.37, present forfait: 5.33

125 kg: see table

	P-niv					P-effect						
	50	70	90	110	130	Gem.	SE	PL ¹⁾	PQ ¹⁾	Sekse	S×PL ¹⁾	S×PQ ¹⁾
Gem.	3.88 ^a	4.10 ^a	4.79 ^b	5.22 ^c	5.58 ^c	4.71	0.13	<0.001	0.945	0.015	0.045	0.428
Beer	3.64	3.82	4.53	5.22	5.62	4.57	0.08					
Zeug	4.13	4.38	5.05	5.21	5.54	4.86	0.08					

Present forfait: 5.37 g/kg

No indications to discriminate between gilts and boars

Actual P-content depends on P-supply



Metacarpus



Quadratic increase in ash content (g/kg) in FFDM

Linear increase in total ash mass (g) because of increase in bone weight

Little variation in P-content in bone ash (Ca/P ~ 2,16)

In progress

- Bone breaking strength (left)
- Ash content
- Relationship breaking strength and ash content / weight
- Relationship bone ash (and P) – body ash (and P)



Conclusions



No significant differences in P-requirements for ADG and FCR (!) between males and females.

Daily retention and body content of Ca and P linearly increased (i.e. no plateau) with dietary P-level

Lower daily retention and body content of Ca and P in males at low dietary P-levels (interaction)

Results will be used to derive nutrient recommendations

Discussion

- What level of body mineral content is required?
- How to address the reduction in P-digestibility?

Optimal implementation: in nutrient response models



Bedankt voor uw aandacht !



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