Effect of starch source in pelleted diets on growth performance of pigs

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Context: formulation of pelletted diets based on nutritional values obtained from feedstuffs presented as mash

Nutritional values of feedstuffs

Feed tables → **formulation** → **Diet** → **delivery** → 

PERFORMANCE

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(presented as mash when characterised)

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Diet presented as mash

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Technology (steam, pressure…)

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Dry feeding

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Impacts of pelleting ← literature (digestibility, energy)

GRAINS = Main source of energy (starch) in Europe

Optimised formulation?

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Experimental design

2 batches of 224 pigs

Crossbred (Large White x Landrace) x Pietrain

gilts and entire males

2-phase feeding strategy *ad libitum*

16 pens of 7 pigs per treatment

3 treatments with different starch sources

- Wheat: only wheat (and wheat bran)
- Barley: only barley
- B / W: barley and wheat (and wheat bran)

Formulation based on mash values

→ net energy (NE): 9.4 MJ/kg

Pelleted diets

Diets

Formulation → nutritionnal values	All treatments	
	Phase 1	Phase 2
Crude protein	14.9 %	14.1 %
Crude fiber	4.7 %	
Crude fat	3.0 %	
Starch	**43.8 %**	**44.1 %**
Digestible lysine/NE	0.93 g/MJ	0.85 g/MJ
Net energy as mash (NE_{mash})	9.4 MJ/kg	

As fed
Phase 1: up to 70 kg BW
Phase 2: above 70 kg BW

Incorporation rates of feedstuff, %		Treatment		
		Barley	B / W	Wheat
Phase 1	Barley	83 %	42 %	
	Wheat		34 %	67 %
	Wheat bran		6 %	13 %
Phase 2	Barley	84 %	42 %	
	Wheat		34 %	68 %
	Wheat bran		7 %	14 %

+Soybean and sunflower meals, synthetic amino acids, vegetable oil (1.25%), minerals, phytases

Measurements

Body weight (BW)

at arrival, +4 and +8 wks,
at slaughter

Feed intake/pen

between two weighings

Hot carcass weight

Image Meater back **F**at
and **M**uscle thicknesses[1]

F3, M3 (mm): measured at the gluteus medius; F4, M4 (mm): average thickness at L1, L2, L3 & L4

Measurements and calculations

Body weight (BW)

at arrival, +4 and +8 wks,
at slaughter

Average daily gain
(ADG)

Feed intake/pen

between two weighings

Daily
feed intake (DFI) or NE intake
Feed conversion ratio (FCR)

Hot carcass weight

Image Meater back **F**at
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Carcass leanness (%)

www.uniporc.com Lean = 60.12 - 0.487 F3 - 0.133 F4 + 0.111 M3 + 0.036 M4
F3, M3 (mm): measured at the gluteus medius; F4, M4 (mm): average thickness at L1, L2, L3 & L4

Results over the 31 – 117 kg BW range

Starch source	Barley	B / W	Wheat	RSD	P-value
ADFI, kg/d	2.69[a]	2.70[a]	2.62[a]	0.09	0.04
ADG, g/d	1022	1034	1031	77	0.53
FCR, kg/kg	2.60[a]	2.59[a]	2.53[b]	0.06	0.01
Carcass leanness, %	61.2	61.4	61.7	1.9	0.19

Same ADG and carcass leanness for the 3 treatments

But significant lower ADFI and FCR with Wheat-based diet

→ different utilization of energy?

Statistical unit: the pen. RSD: residual standard deviation

ANOVA (SAS, v9.4), with the treatment (P-value), replication and batch as main effects.

Results over the 31 – 117 kg BW range

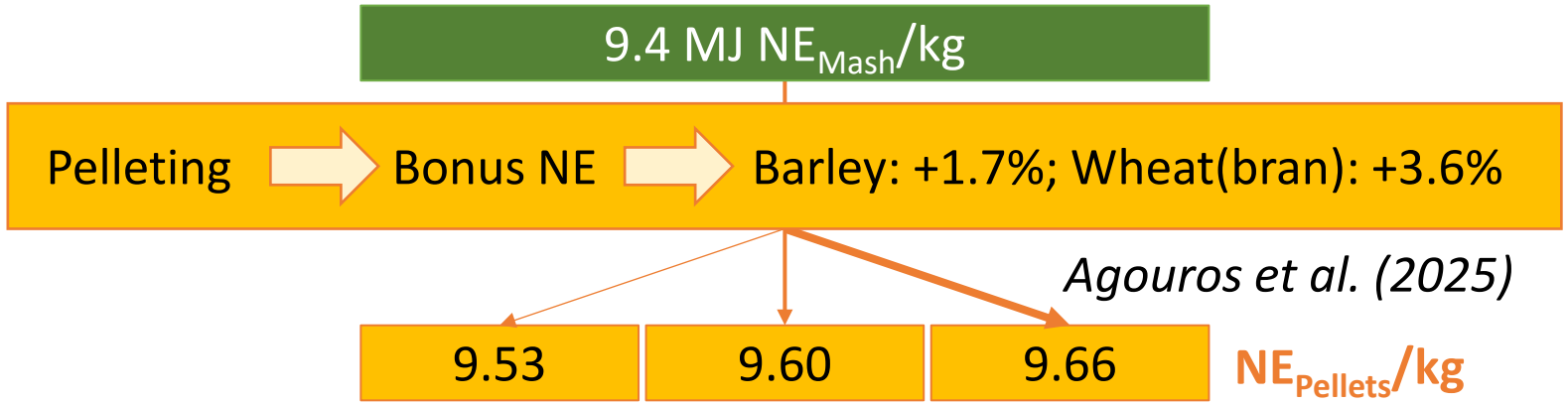
Starch source	Barley	B / W	Wheat	RSD	P-value
NE_{Mash}, MJ/d	25.3^{a}	25.4^{a}	24.6^{b}	0.8	0.03
NE_{Mash}, MJ/kg BW gain	24.5^{a}	24.3^{a}	23.8^{b}	0.6	< 0.01

Less NE_{Mash} apparently used with the Wheat-based diet

→ what about the effect of pelleting on the NE concentration of grains?

Statistical unit: the pen. RSD: residual standard deviation
ANOVA (SAS, v9.4), with the treatment (P-value), replication and batch as main effects.

Results over the 31 – 117 kg BW range



Starch source	Barley	B / W	Wheat	RSD	P-value
NE$_{Pellets}$, MJ/d	25.7	26.0	25.4	0.8	0.13
NE$_{Pellets}$, MJ/kg BW gain	24.8	24.9	24.5	0.6	0.16

No significant difference in NE efficiency
when the effect of pelleting on NE value of grains is accounted for

Statistical unit: the pen. RSD: residual standard deviation
ANOVA (SAS, v9.4), with the treatment (P-value), replication and batch as main effects.

Conclusion

Single-cereal based diets formulated to be iso-NE based on mash values **but pelleted** result in different growth performances.

Based on calculated NE values after pelleting
- pigs adapt feed intake to energy content
- they have the same energy efficiency

which is consistent with their similar growth rate and carcass leanness

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All differences were attributed to the variation in the dietary NE concentration induced by pelleting.

But what about the impact of pelleting on the concentration of other nutrients in the diet?

Thank you for your attention

Thanks to the technical **team**

Missing Loréna & Romain