Bakery products and legume seeds in the diet of growing-finishing pigs

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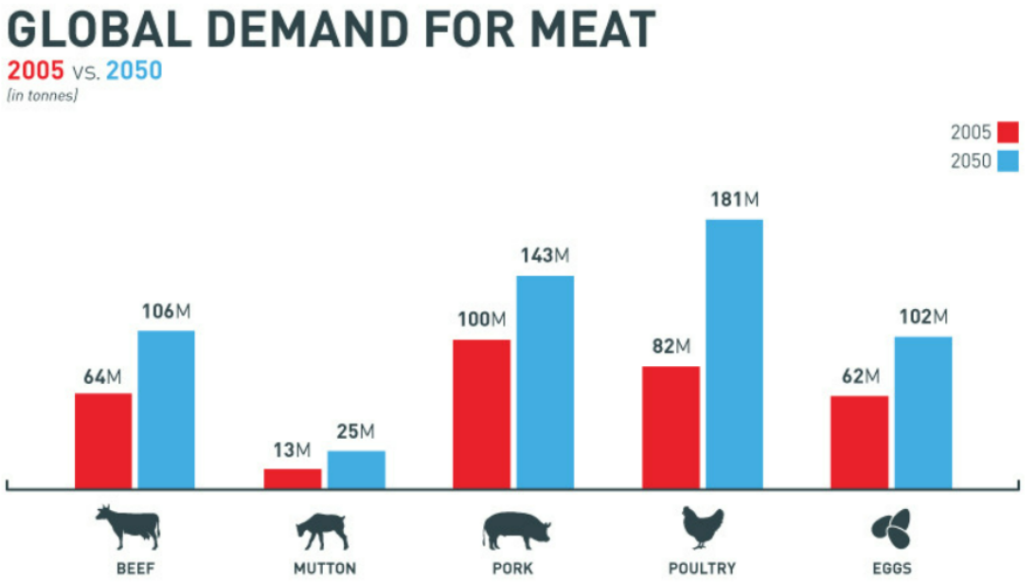
Introduction

- World population is growing → 9.8 billion people in 2050 (source: United Nations, 2017)
- Demand for (pig) meat is increasing (source: FAO, ESA Working Paper, 2012)



- Feed impacts sustainability → 50 - 80 % of CO_2 footprint of pig meat

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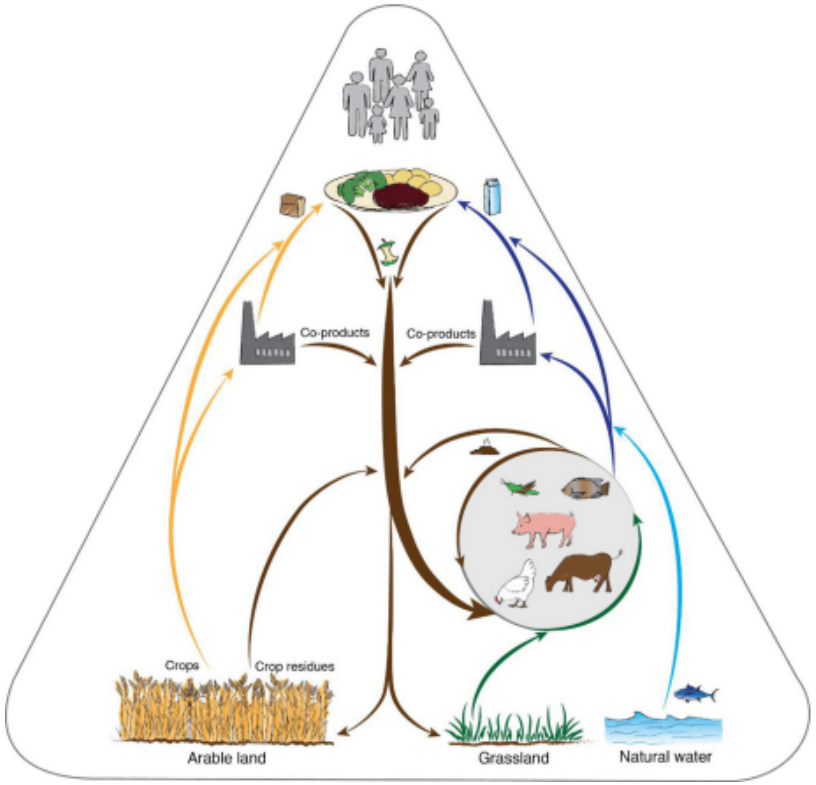
Introduction

Pig production as part of circular food system (see figure)



Source: Van Zanten et al., 2019

Circular feed ingredients are here defined as:

- co-products from human food industry
- non-human edible raw materials
- former food

2 scenarios to replace soybean meal, oil palm products and cereals:

1. Bakery products (BP)
2. Legume seeds (LS)

Objective of experiment:

- Effects on partial of total replacement of cereals, soybean meal and palm kernel meal on performance, carcass characteristics and sustainability parameters.

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Experimental treatments

3 experimental feeds:

I. Control feed with cereals, soybean meal and palm kernel meal

II. bakery products feed (BP): ± 50% bread meal

III. legumes seeds feed (LS): 22.5% feed peas and 25% faba beans

8 dietary treatments:

1. Control: 100% diet I
2. 33% BP: 33% diet II x 67% diet I
3. 67% BP: 67% diet II x 33% diet I
4. 100% BP: 100% diet II
5. 33% LS: 33% diet III x 67% diet I
6. 67% LS: 67% diet III x 33% diet I
7. 100% LS: 100% diet III
8. BP/LS: 50% diet II x 50% diet III

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Material and methods

- Genetics: TN70 x Tempo; gilts and boars
- Growing period from 29 to 123 kg body weight
- 128 pens → 16 replicates per treatment, 8 of each sex
- Pigs grouped per pen on basis of body weight
- Feed and water freely available

Observations:

- Weight and feed intake after 3, 7 and 11 weeks and prior to slaughter
- Carcass characteristics from slaughterhouse
- Grower diets for 0 - 3 weeks, afterwards finisher diets

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Diet compositions, raw materials

	0-3 wks			> 3 wks		
	Control	100% BP	100% LS	Control	100% BP	100% LS
Corn	15.0	-	-	15.0	-	-
Barley	15.0	15.0	15.0	15.0	15.0	15.0
Feed peas	-	-	22.5	-	-	22.5
Wheat	41.9	-	-	40.3	-	-
Faba beans (white)	-	-	25.0	-	-	25.0
Wheat middlings	-	-	17.7	5.2	14.9	22.4
Bread meal	-	49.4	-	-	48.2	-
Fat & oils	0.8	0.3	7.1	0.4	0.3	6.3
Molasses	2.0	2.0	2.0	2.0	2.0	2.0
Soybean meal	17.1	-	-	9.5	-	-
Rapeseed meal 00 34-37% CP	-	10.0	5.0	-	3.0	5.0
Palm kernel meal	5.0	-	-	10.0	-	-
Sunflower meal 35-38% CP	-	20.5	2.8	-	14.4	-
Premix	3.2	2.8	2.9	2.6	2.2	1.8

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Diet compositions, nutrients

		0-3 wks			> 3 wks		
		Control	100% BP	100% LS	Control	100% BP	100% LS
Crude protein	g/kg	173	190	181	153	171	181
Crude fat	g/kg	35	58	92	35	55	85
Crude fibre	g/kg	34	67	73	46	62	74
Starch	g/kg	419	317	280	419	334	289
NE swine	MJ	10.02	10.02	10.02	9.84	9.84	9.84
SID LYS	g/kg	10.2	10.2	10.2	8.7	8.7	8.7
Phosphorus	g/kg	4.6	5.6	5.6	4.1	4.9	5.0
digestible P (STTD)	g/kg	3.3	3.3	3.3	2.7	2.7	2.7
CFP incl. LUC	gr CO_2 eq.	1243	391	833	944	352	775
CFP excl. LUC	gr CO_2 eq.	563	364	729	540	334	681

- Nutrient requirements conform CVB (2020).
- Bakery and legume feeds are higher in crude protein (N) and phosphorus (P)
- CO_2 footprint based on Nevedi (2022) list version 5, LUC = Land Use Change
- Bakery feed lower in CO_2 footprint
- Legume feed lower in CO_2 footprint incl LUC, however higher in CO_2 footprint excl. LUC

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Statistical analysis

- Pen as experimental unit

ANOVA, 8 independent treatments

- Random: batch/room/pen
- Covariate: initial body weight
- Fixed factors: sex + treatment + sex x treatment + ε

- Pairwise differences by using Tukey comparison test
- Graphs marked with indices when significant at $P<0.05$

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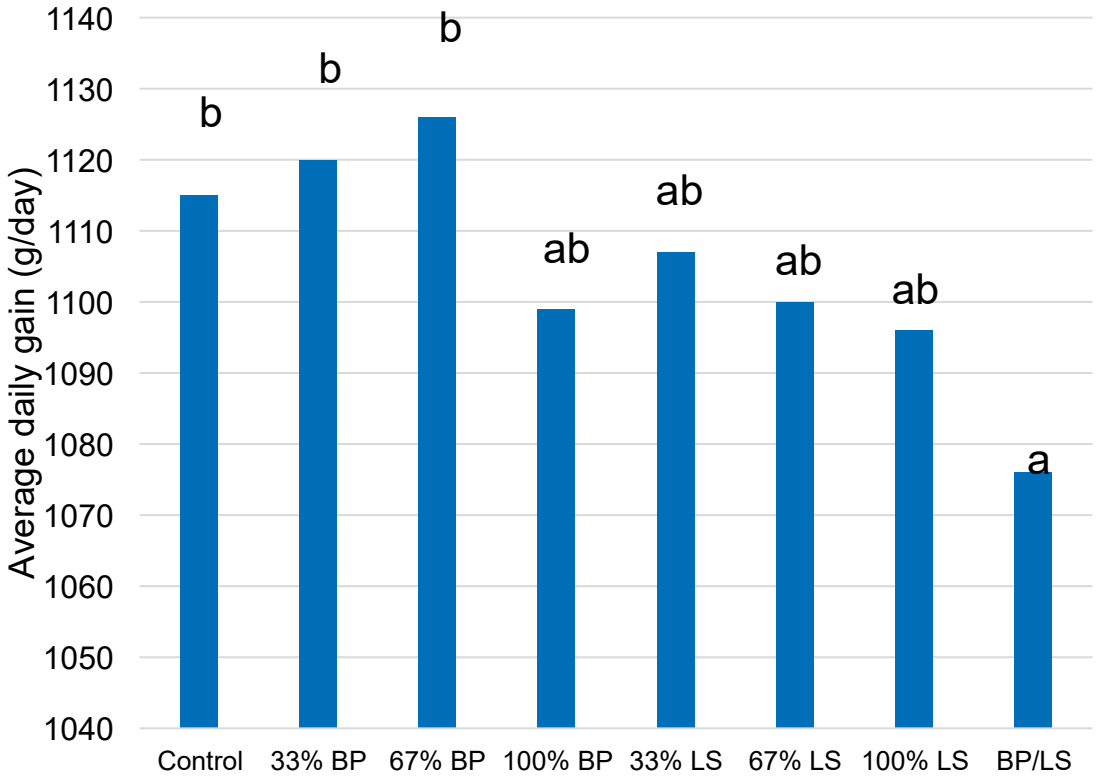
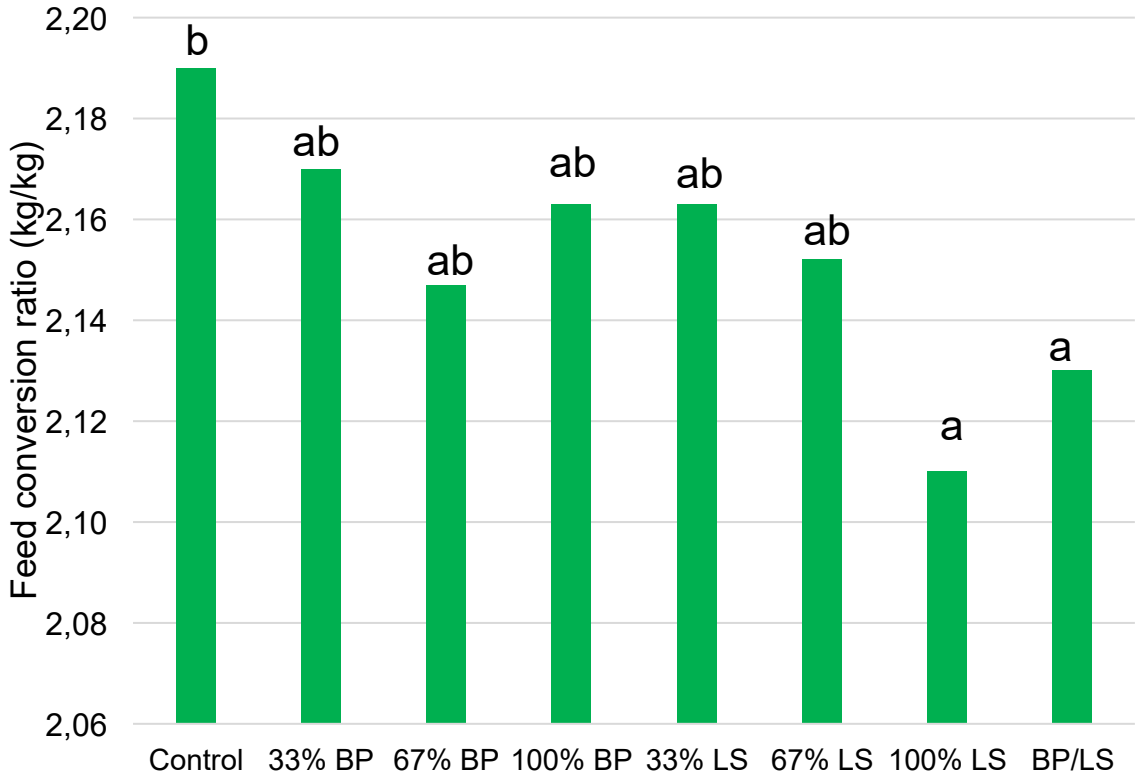
Gain and feed efficiency (29 to 123 kg)





- Limited effects of replacement by bakery products (BP) and legumes seeds (LS) on average daily gain and feed efficiency

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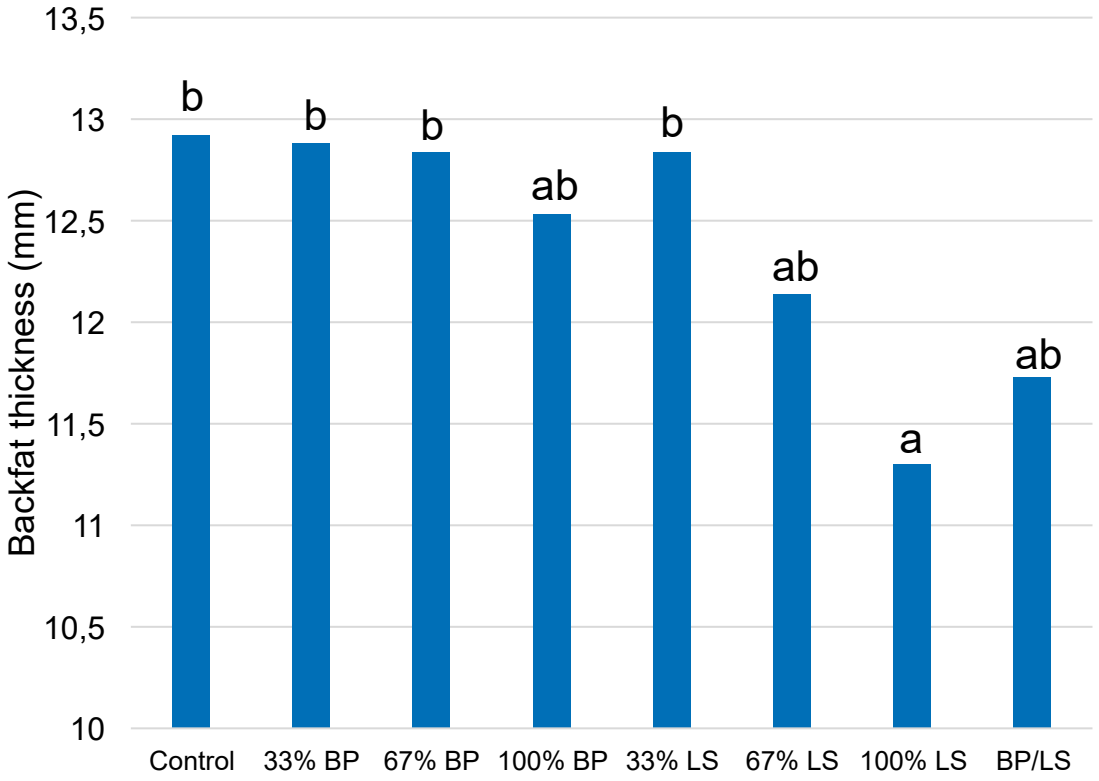
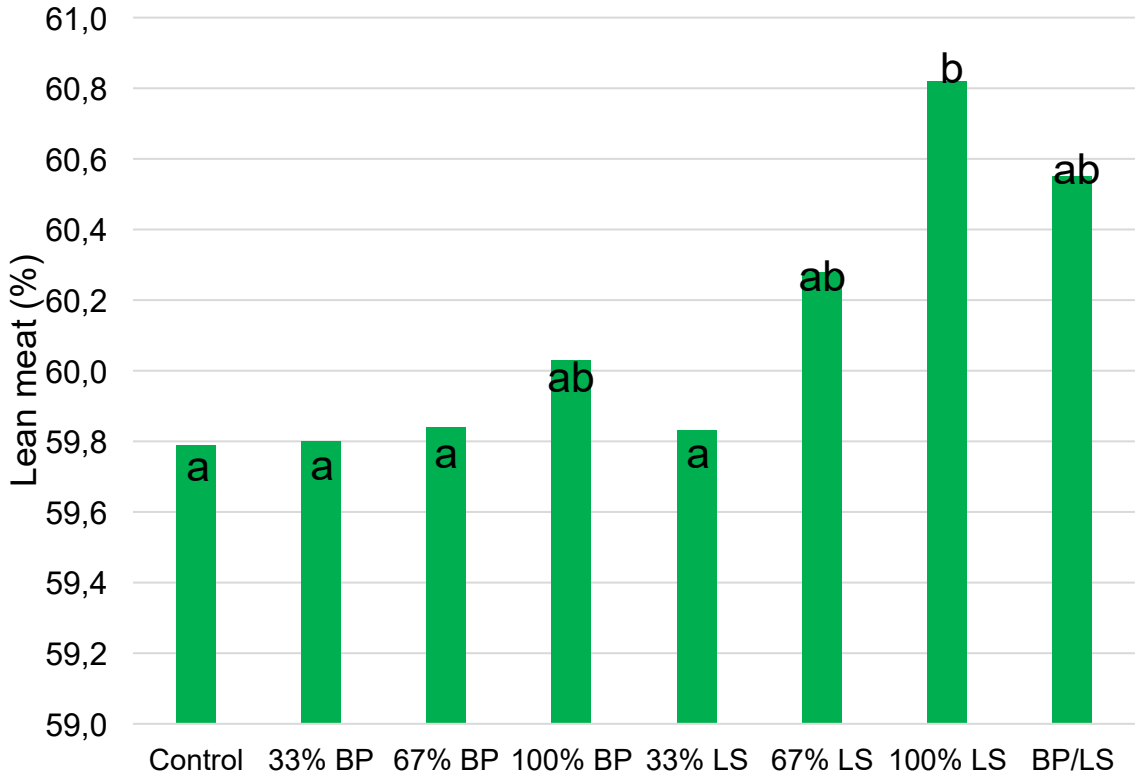
Carcass characteristics (95 kg carcass weight)





- 100% Legumes seeds (LS) resulted in less backfat thickness and higher lean meat%
- No significant effects of replacement on dressing% and muscle thickness

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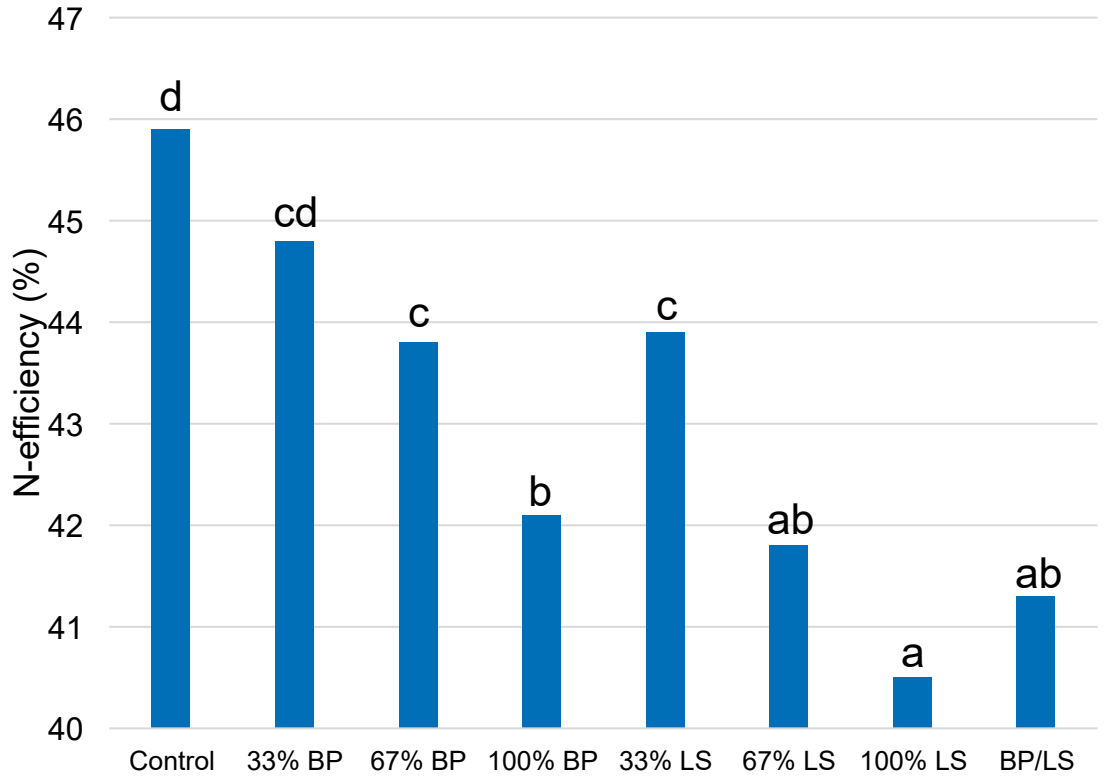
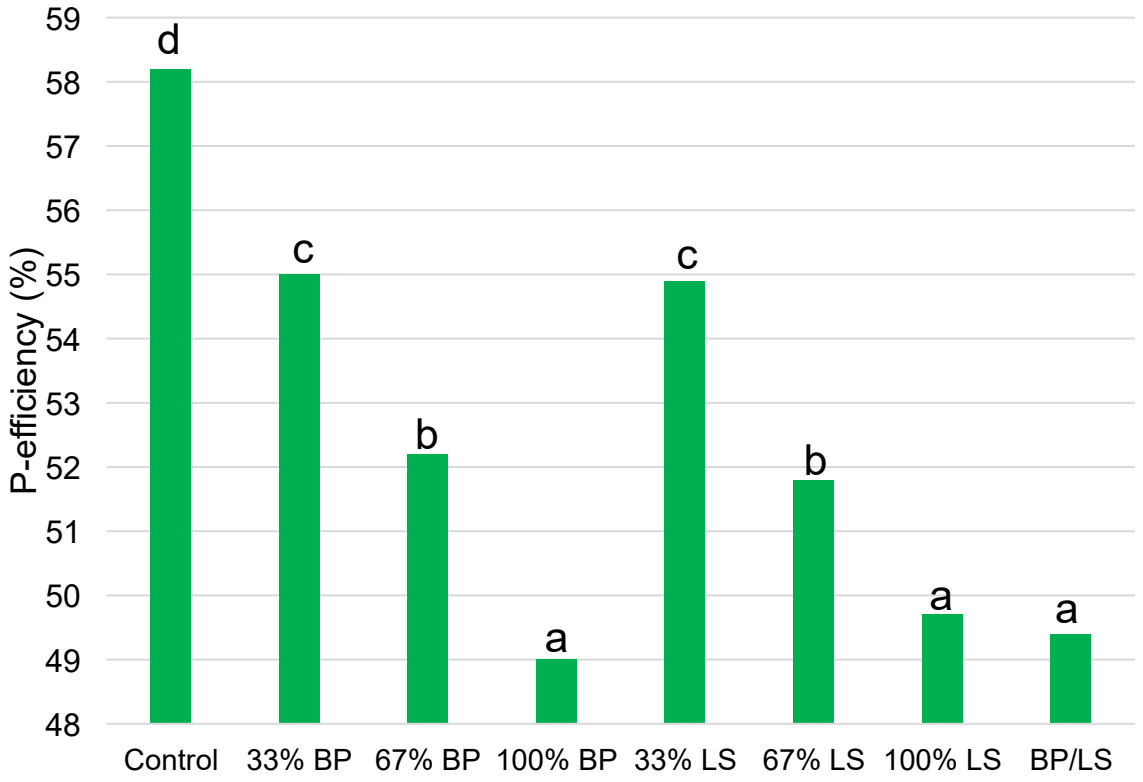
N- and P- efficiency utilisation





- Efficiency of (N) and phosphorus (P) based on N and P content per kg body weight (source RVO, 2020)
- Replacement by bakery products (BP) and legumes seeds (LS) reduced N- and P-efficiency

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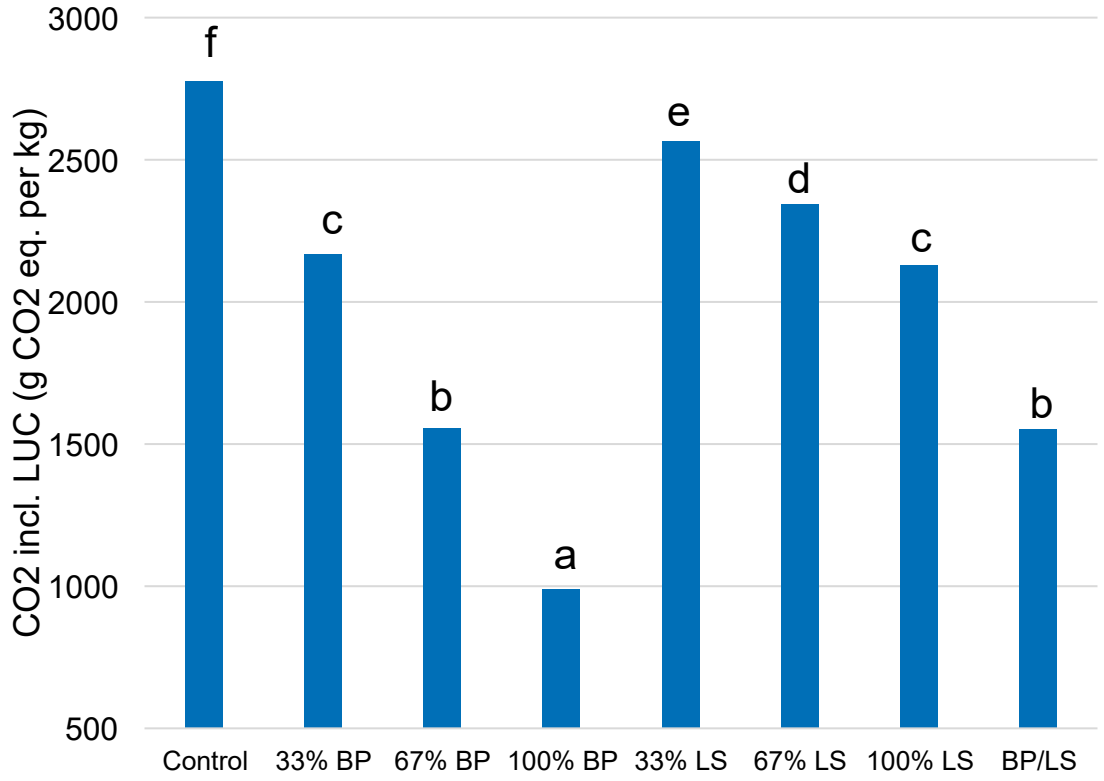
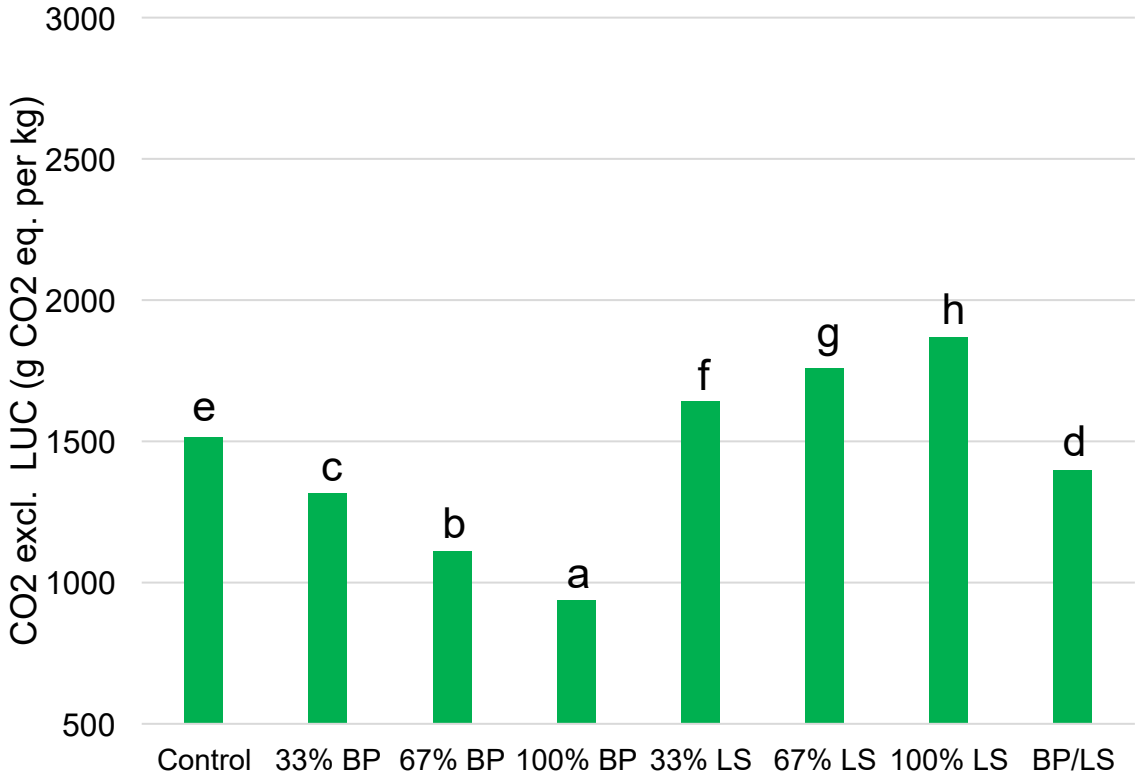
CO_2 footprint per kg carcass





- Replacement by bakery products (BP) reduced CO_2 footprint with and without Land Use Change (LUC)
- Replacement by legumes seeds (LS) reduced CO_2 footprint with LUC but enhanced CO_2 footprint excl LUC

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Summary of findings

	Bakery products (BP)	Legume seeds (LS)
Average daily gain (grams/day)	≈	≈
Feed conversion ratio (kg/kg)	≈	≈
Lean meat percentage (%)	≈	↑ (+2%)
Backfat thickness (mm)	≈	↓ (-12%)
N-efficiency utilisation (%)	↓(-4%)	↓(-5%)
P-efficiency utilisation (%)	↓(-8%)	↓(-9%)
CO_2 footprint including LUC (g CO_2 eq. per kg)	↓(-64%)	↓(-23%)
CO_2 footprint excluding LUC (g CO_2 eq. per kg)	↓(-38%)	↑(+23%)

≈ = approximately equal to, ↓ = lower; ↑ = higher;
() = relative difference between control and diet with 100% BP or LS

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Conclusions

- Cereal grains and soybean meal can be replaced by bakery products and legume seeds with only a minor reduction in daily gain of the pigs at the highest inclusion rate
- The replacement does not compromise feed efficiency (FCR)
- Inclusion of legume seeds may reduce backfat thickness and enhance lean meat%
- The replacement reduces the efficiency of N and P utilisation
- Inclusion of bakery products resulted in a lower CO_2 footprint (incl. and excl. LUC)
- Inclusion of legume seeds resulted in a lower CO_2 footprint incl. LUC, but higher CO_2 footprint excl. LUC

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QUESTIONS?

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