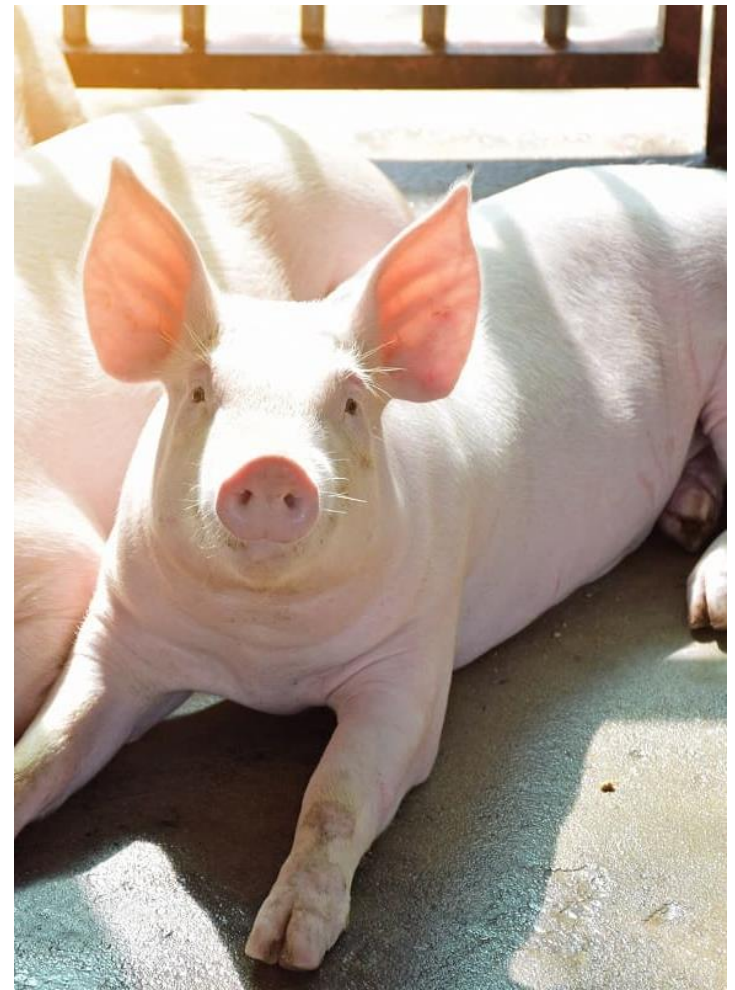
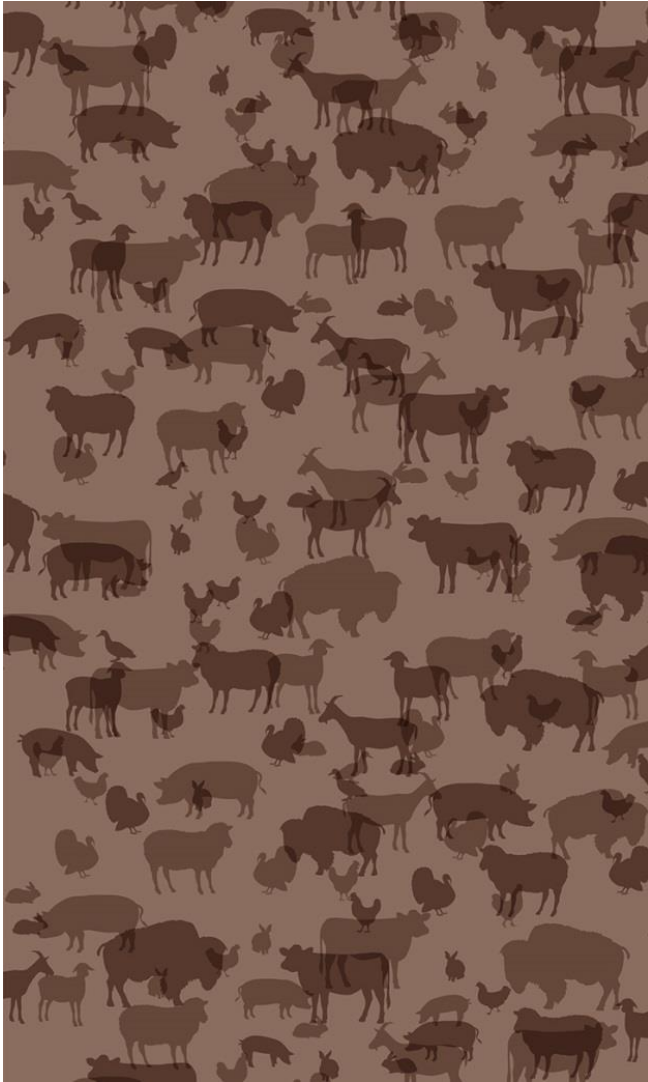


Critical swine production traits improved in offspring finisher pigs by feed efficiency selection of parents

Dr. Argenis Rodas-Gonzalez



**University
of Manitoba**

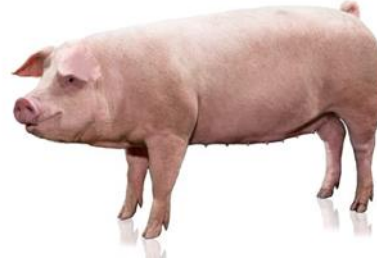
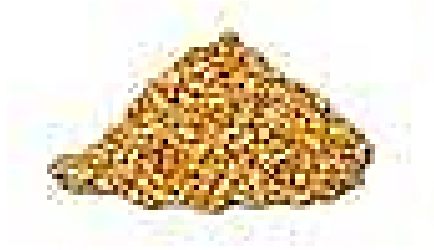


PRAIRIE LIVESTOCK EXPO



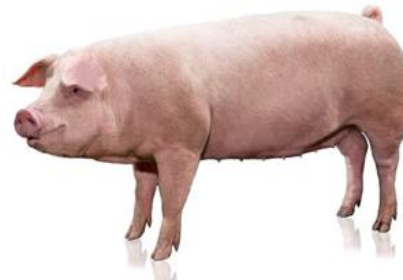
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What is feed efficiency

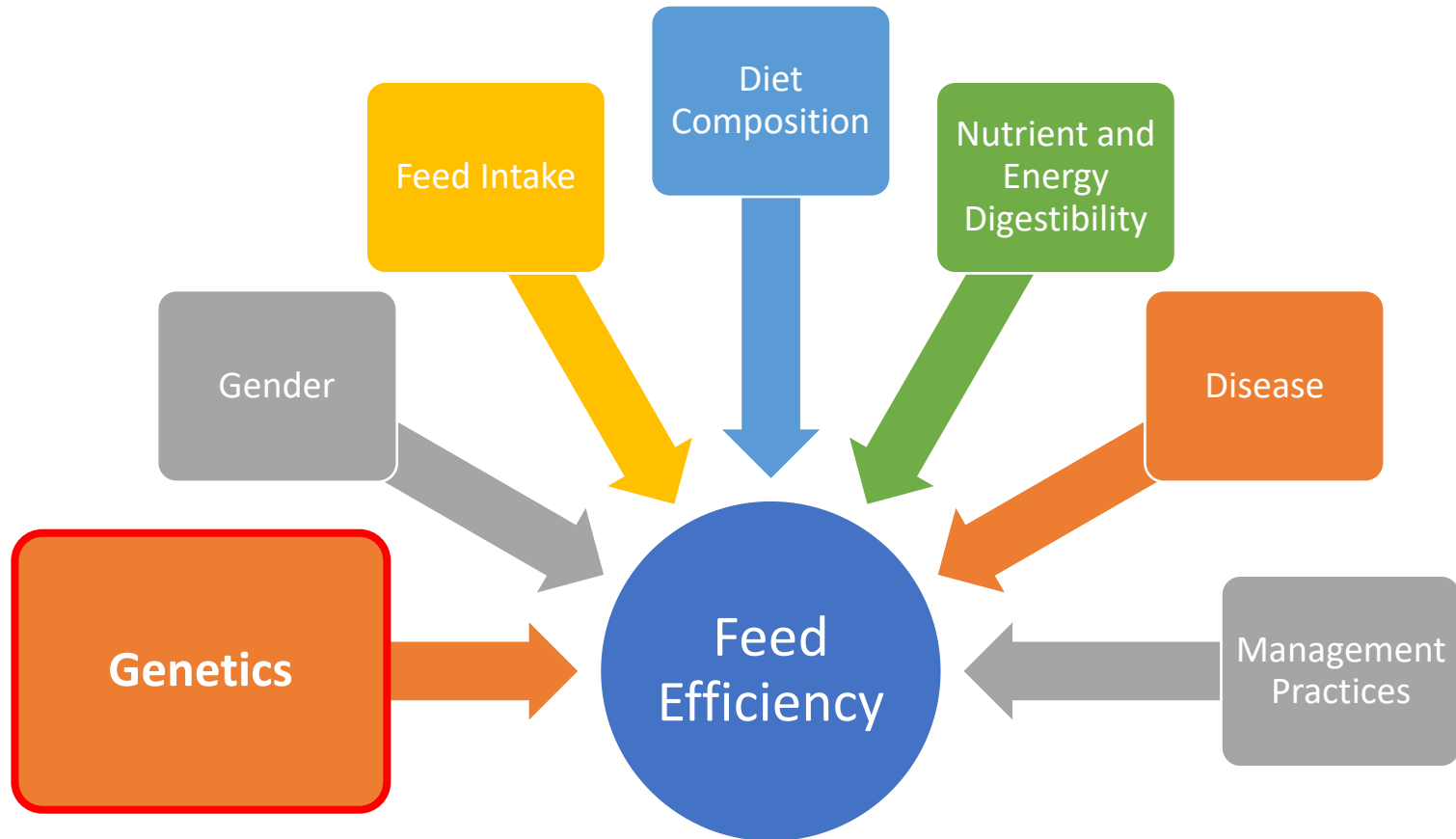


Feed efficiency (FE): pig's ability to turn feed into an edible product, pork

Zijlstra & Beltranena, 2013

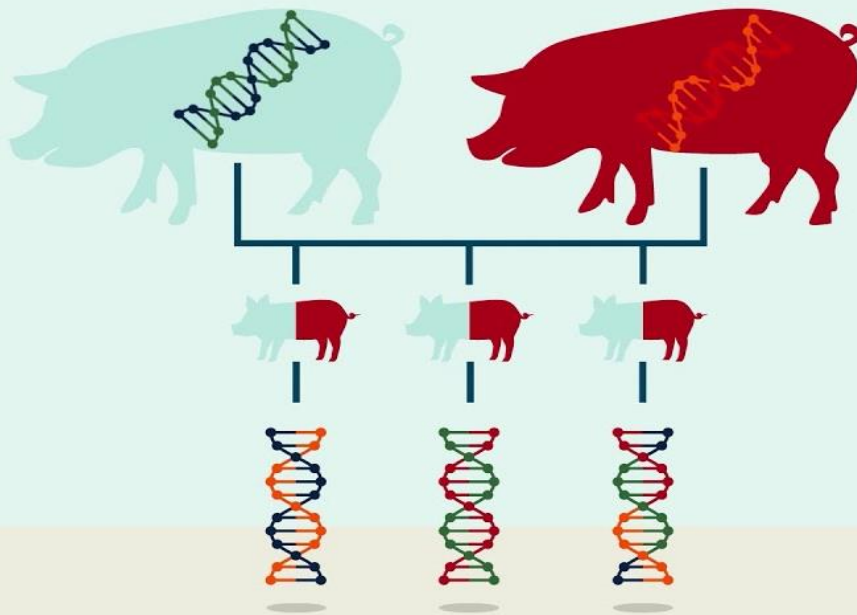


Factors affecting feed efficiency



(Gaillard et al., 2020; Patience et al., 2015; Tokach et al., 2012)

Improving Feed Efficiency through Genetics



- Feed efficiency is heritable trait
- Estimated breeding value (EBV)
- High efficiency pigs present:
 - Lower average daily feed intake
 - Lower feed conversion ratio (FCR)
 - Leaner carcass

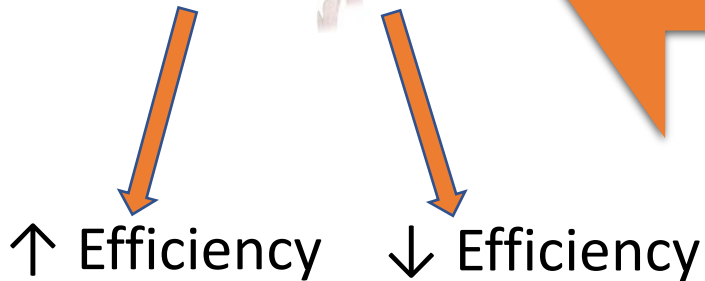
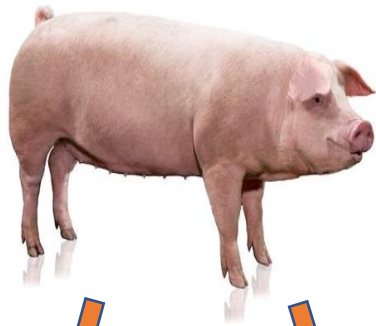
How the selection of pigs based on the EBV-FCR within the Large White breed genetic lines (dam-line vs sire-line) affects

- Growth performance
- Nutrient digestibility
- Carcass traits
- Carcass composition
- Meat and belly qualities

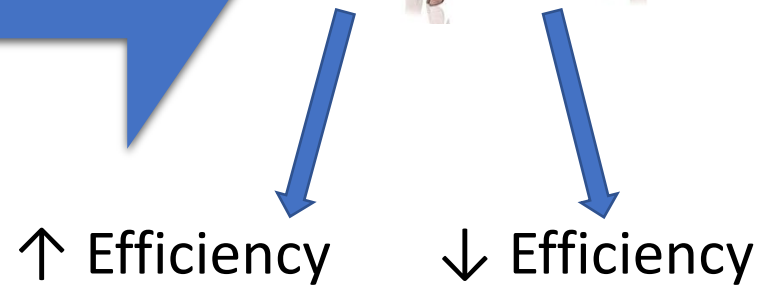
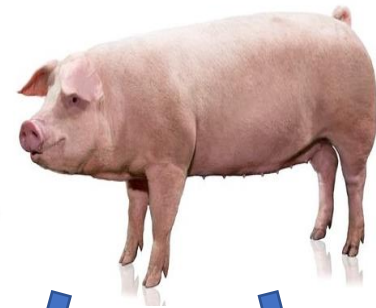
Improving competitiveness and sustainability of pork production project

2000 Large White Boars

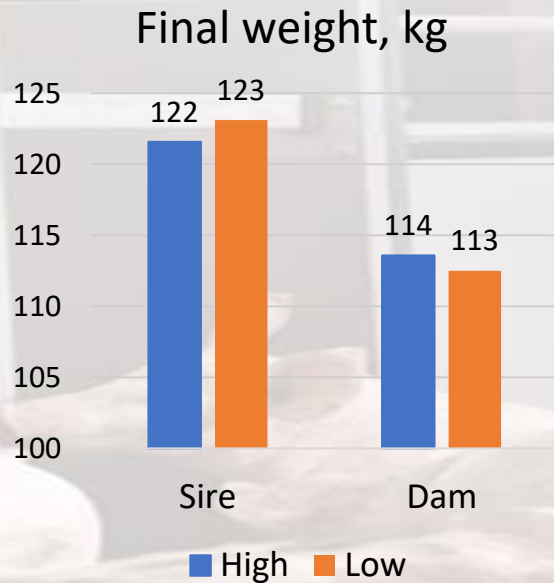
Dam line



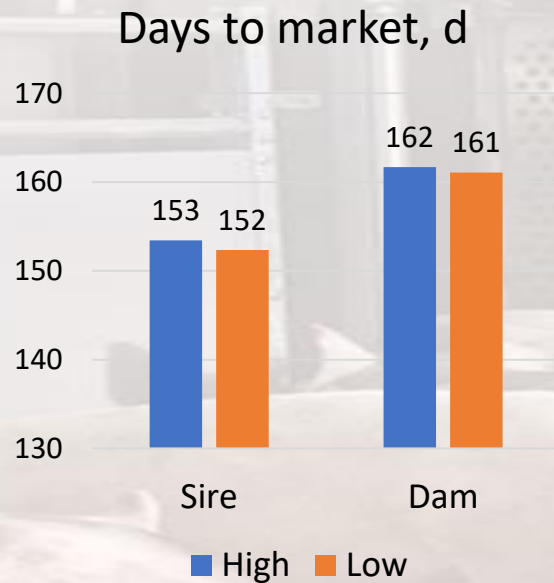
Sire line



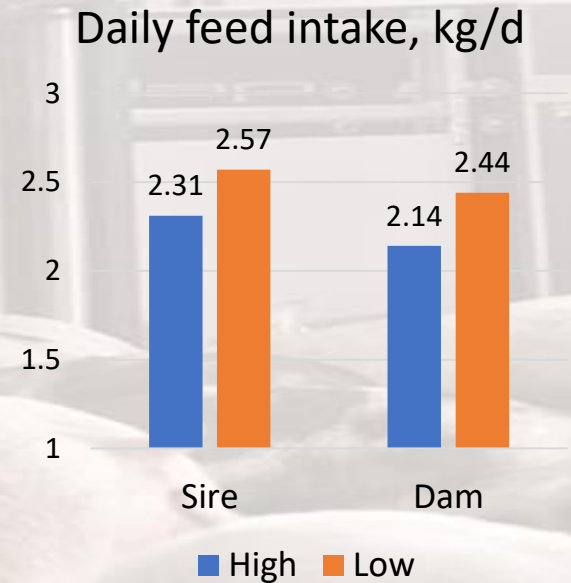
Growth Performance



Line $P < 0.01$
Efficiency $P = 0.80$



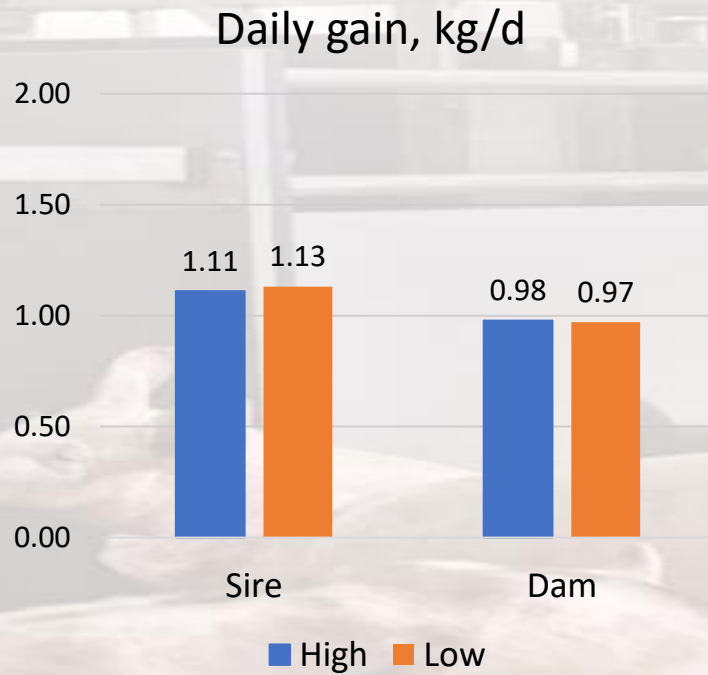
Line $P < 0.01$
Efficiency $P = 0.33$



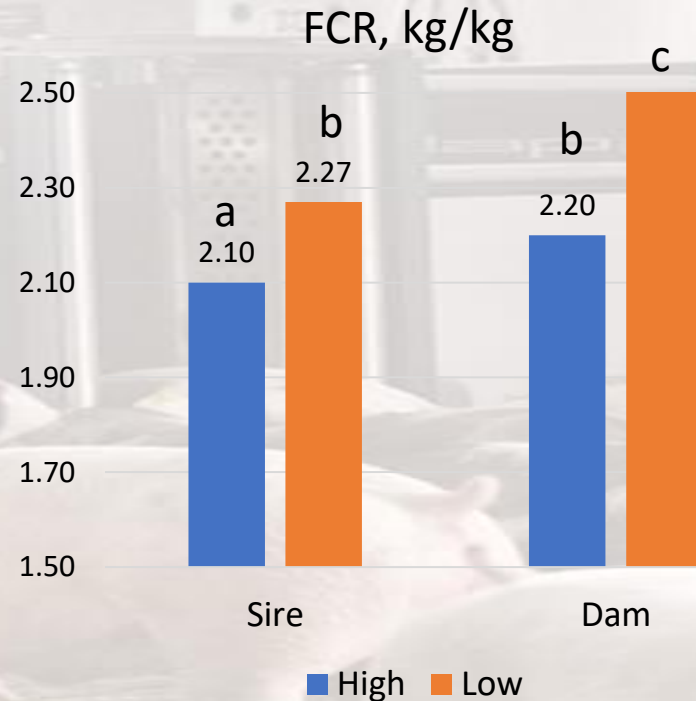
Line $P < 0.01$
Efficiency $P < 0.01$

**Adjusted by co-variance analysis, using initial weight as co-variable

Growth Performance



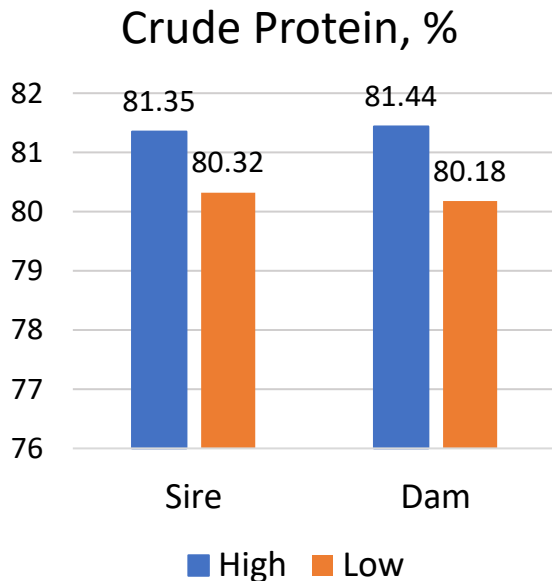
Line $P < 0.01$
Efficiency $P = 0.58$



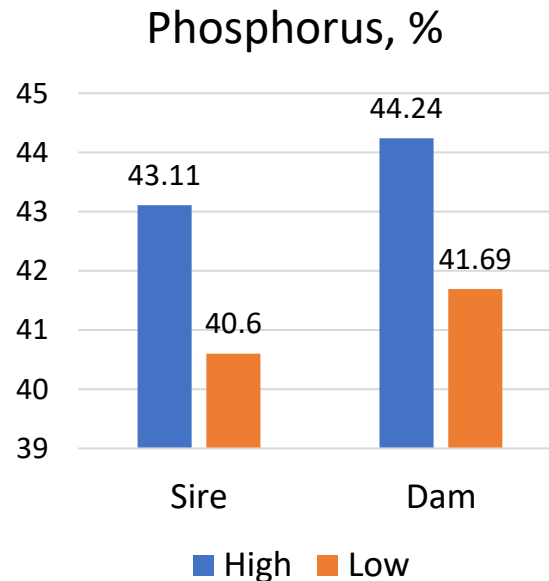
Line x Efficiency $P = 0.03$

**Adjusted by co-variance analysis, using initial weight as co-variable

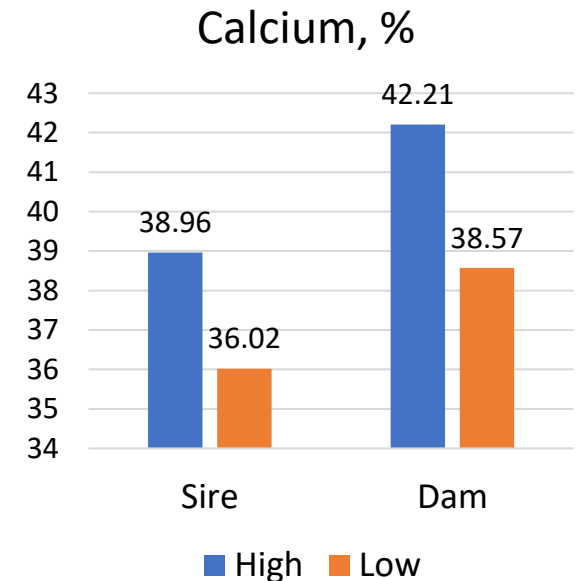
Nutrient digestibility



Line $P = 0.96$
Efficiency $P = 0.06$



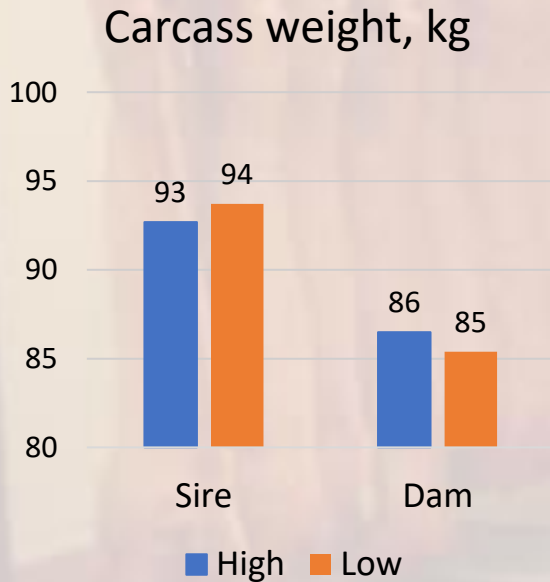
Line $P = 0.47$
Efficiency $P = 0.10$



Line $P = 0.09$
Efficiency $P = 0.05$

**Adjusted by co-variance analysis, using initial weight as co-variable

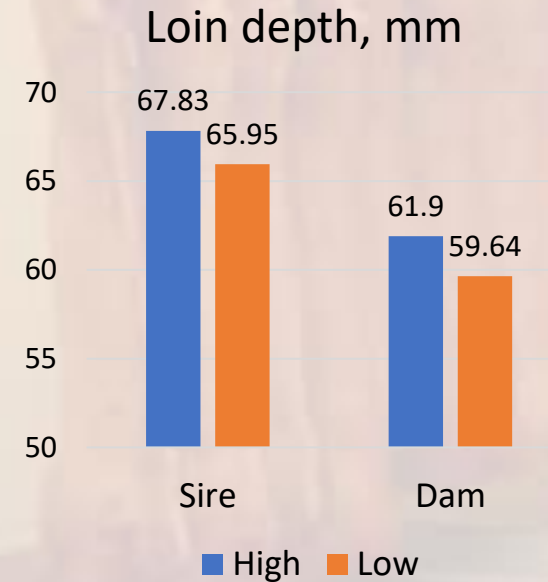
Carcass traits



Line $P < 0.01$
Efficiency $P = 0.95$



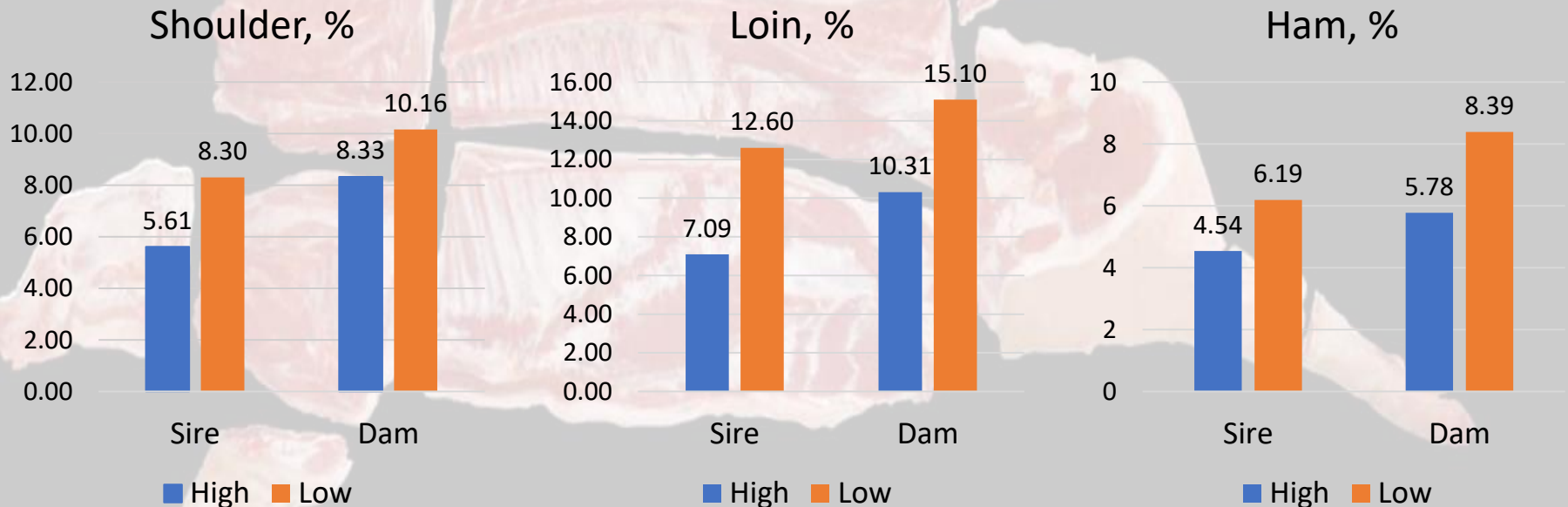
Line $P < 0.01$
Efficiency < 0.01



Line $P < 0.01$
Efficiency $P < 0.01$

**Adjusted by co-variance analysis, using initial weight as co-variable

Carcass composition: Fat



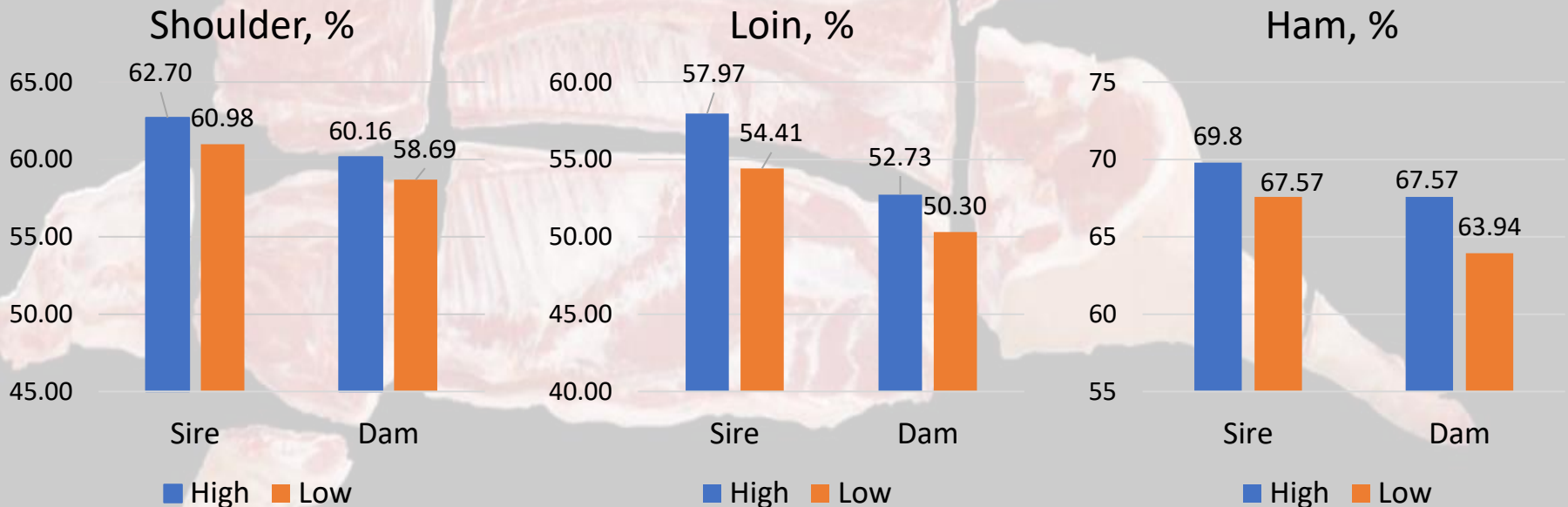
Line $P < 0.01$
Efficiency $P < 0.01$

Line $P < 0.01$
Efficiency $P < 0.01$

Line $P = 0.01$
Efficiency $P < 0.01$

**Adjusted by co-variance analysis, using final weight as co-variable

Carcass composition: Lean



Line $P = 0.15$
Efficiency $P = 0.04$

Line $P < 0.01$
Efficiency < 0.01

Line $P < 0.01$
Efficiency $P < 0.01$

**Adjusted by co-variance analysis, using final weight as co-variable

Pork quality



Pork quality traits affected by Large White genetic lines and estimated breeding value for feed conversion.

Variables	Line (L)		Efficiency (E)		SEM	P-value		
	Sire	Dam	Low	High		L	E	L x E
pH	5.57	5.62	5.64	5.53	0.04	0.21	0.07	0.22
Drip loss ₄₈ , %	6.61	6.16	6.78	6.12	0.87	0.53	0.79	0.41
Lightness	57.49	55.81	56.26	57.18	0.66	<0.01	0.44	0.84
Redness	17.29	18.13	17.62	17.84	0.34	<0.01	0.83	0.54
Yellowness	10.15	9.82	10.07	10.03	0.23	0.14	0.70	0.77
Cooking time, min	8.43	8.48	8.98	8.23	0.55	0.93	0.36	0.72
Cooking loss, %	15.70	16.12	16.78	16.41	0.90	0.60	0.06	0.72
Shear force, kg	3.81	4.33	3.85	4.26	0.36	0.13	0.62	0.46

For quality, genetic lines expressed minimal colour changes



Belly quality

Belly evaluation traits affected by Large White genetic lines and estimated breeding value for feed conversion.

Variables	Line (L)		Efficiency (E)		SEM	P-value		
	Sire	Dam	Low	High		L	E	L x E
Ribbed belly, kg	4.11	3.76	4.13	3.70	0.11	<0.01	<0.01	<0.01
Length, cm	49.24	48.97	50.72	48.11	0.91	0.73	0.03	0.08
Width, cm ^a	24.35	23.86	24.30	24.07	0.49	0.38	0.85	0.83
Thick, cm	2.75	2.45	2.88	2.26	0.17	0.04	<0.01	<0.01
Flop distance, cm	6.87	7.90	8.27	6.73	0.80	0.13	0.23	0.58
Flop score	2.70	2.71	2.68	2.60	0.10	0.89	0.11	0.53

Sire low-efficiency group had the heaviest (4.57 kg and 3.29 cm) and thickest belly, and the sire high-efficiency group had the lightest weight and thinnest belly (3.60 kg and 2.10 cm).

Conclusions and recommendations

Conclusions y recommendations

- ❖ High efficient pigs (based on EBV-FCR) presented high nutrient digestibility such as crude protein, phosphorus and calcium

- ❖ Benefits
 - Increasing nutrient quantity available towards body growth
 - Lowering feed cost
 - Reducing nutrient pollution to the environment.

- ❖ Nutrient digestibility may be a major biological mechanism that makes one pig more efficient.

Conclusions y recommendations

- ❖ Based on the advantageous performance observed in most carcass yield traits, high-efficient animals offer a favourable response in greater loin and leaner carcasses, without compromising meat and belly quality.
- ❖ Low efficient animals could satisfy bacon processors (heavier and thicker bellies, better slice ability), while high efficient animals could satisfy consumers preference for leaner bacon.

Conclusions y recommendations

❖ Further studies:

- Near-infrared spectroscopy to predict digestibility in fecal samples (80% developed)
- Interaction between host genetics and gut microbiome to explain the underlying biological mechanisms differentiating high and low feed efficient animals
- Gut microbiome and digesta metabolome impact on growth performance and pork quality



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PROGRESS IN PIGS

Acknowledgement





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Thanks