

Genetic correlations between piglet production, stayability and feed efficiency traits in Norwegian Landrace

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Background

- High competition for the feed resources in the world
 - Human population growth
 - Climate changes
 - Bioenergy production
- Economy in pork production



Background

- Selection for feed efficiency- effect on the sow
 - Reduced appetite
 - Reduced body reserves
 - Prolonged weaning-oestrus interval
 - Culling

- New goal



New feed efficiency measure

- Developed a new measure for feed efficiency (Martinsen et al., 2015)
 - Fat efficiency, feed/kg fat
 - Lean meat efficiency, feed/kg lean meat
- Genetic variation existed
- AIM: Genetic relationships between the new feed efficiency measures and sow traits





Material

	Feed intake	BCS	STAY	TLW	TNB
Feed intake	8,161				
BCS	-	30,661			
STAY	-	29,077	61,653		
TLW	-	30,661	61,653	63,330	
TNB	-	30,661	61,653	63,330	63,330

Total 72,168 animals in the analyses and 117,524 animals in the pedigree

BCS - Body condition score at weaning

STAY- Culled after first litter or inseminated with a second litter

TLW – Total litter weight at 3 weeks

TNB – Total number of piglets born

Data editing

- Data set- Feed intake measured on boars
 - 4 SD from the mean was outliers
 - Animals with missing values was deleted
- Data set- Stayability and piglet production
 - Only 1. litter sows
 - Age of the sow at farrowing between 250-730 days
 - Age of litter at weaning < 70 days
 - TNB ≥ 2
 - Weaned piglets \leq TNB

***Both data sets
were merged
into one data
set, before
analysed***

Descriptive statistics

	Mean	s.d.
Feed intake (kg)	152.0	29.4
Lean meat (kg)	52.3	3.6
Fat (kg)	15.9	4.3
BCS (1-5)	2.6	0.5
STAY (0/1)	0.7	0.5
TLW (kg)	67.3	19.2
TNB (number)	13.8	2.9



Statistical model- Feed intake

- Total feed intake in the test period (FI)

$$FI = HY_i + BM_j + ST_k + SEC_n + \beta_{lm} \times LMEAT_o + \beta_{fat} \times FAT_q + \beta_{amw} \times AMW_r \\ + animal_s + pen_t + \alpha_{p_s} \times lmeat_s + \alpha_{f_s} \times fat_s + e_{ijklmnopqrst}$$

Fixed effects: Herd-year, birth month, scanning time
and section

Fixed regression: lean meat, fat and accumulated metabolic body weight.

Random effects: Animal and pen

Random regressions: lean meat and fat



Statistical models- Sow traits

Trait	M_LITT	BY	HYS	BRYR	WEAN	WEIGHT	AGEm	AGEa	Litter	animal
STAY	✓	✓	✓	✓			✓		✓	✓
BCS	✓		✓	✓	✓		✓	✓	✓	✓
TLW	✓		✓	✓		✓	✓		✓	✓
TNB	✓		✓	✓			✓		✓	✓

M_LITT- Mother's litter number

BY-Birth year

HYS- Herd-year-season

BRYR-Breed-year

WEAN – Number of weaned piglets

WEIGHT- Number of piglets weighted

AGEm – Age of sow at farrowing

AGEa- Age of litter at weaning

Results – Variance components and heritability



Trait	Genetic variance (σ_a^2)	Residual variance (σ_e^2)	Heritabilities (h^2)
Feed intake in the test period	25.58	17.46 (0.95)	0.59
Residual feed intake (RFI)	18.18 (1.47)	-	-
Lean meat efficiency (LME)	0.22 (0.04)	-	-
Fat efficiency (FE)	0.27 (0.03)	-	-

$$h^2 = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_e^2}$$

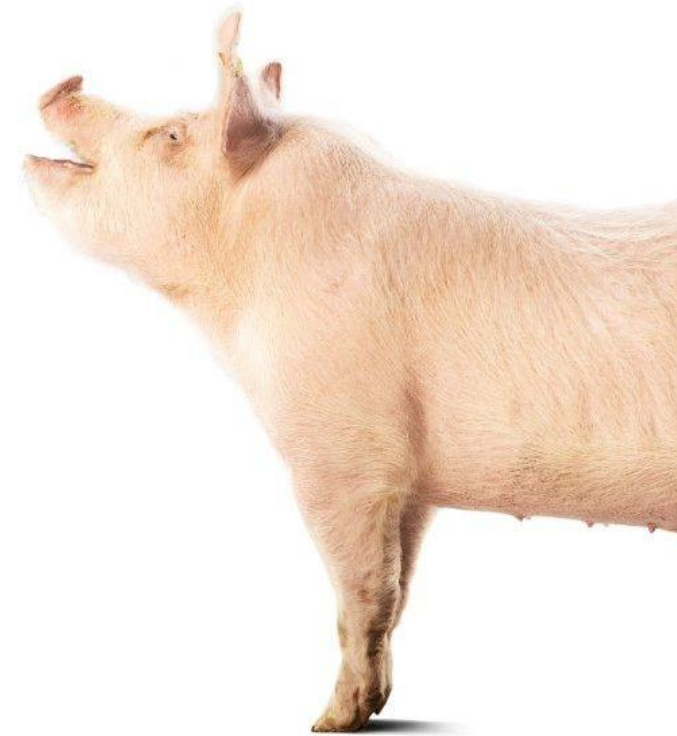
Results - Heritabilities

Trait	Heritability (h^2)
BCS	0.13
STAY	0.12
TLW	0.15
TNB	0.09

$$h^2 = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_e^2}$$

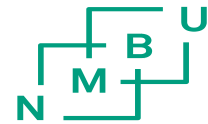


Results – Genetic correlations



Trait	RFI*						
LME	-0.25	LME					
FE	-0.71	-0.19	FE				
BCS	0.14	0.02	-0.10	BCS			
STAY	0.11	0.11	-0.23	0.04	STAY		
TLW	0.08	0.13	-0.18	-0.42	0.12	TLW	
TNB	0.09	-0.07	-0.07	-0.25	0.32	-0.26	

RFI - Residual feed intake
 LME- Lean meat efficiency
 FE- Fat efficiency



Conclusions

- The genetic analysis showed almost non-existing genetic relationships between lean meat efficiency and the sow traits, while fat efficiency had small but unfavorable genetic relationships with the sow traits.
- Selection for the new lean meat efficiency trait is possible without affecting the sow traits.
- If selection of fat efficiency is carried out, it is important to supervise the piglet production and stayability traits in the sow.

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