

# Genetic parameters for measures of residual feed intake and growth traits in Duroc pigs

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Selection for residual feed intake (RFI), that is, feed consumed above or below the requirements for production and maintenance, may be an alternative measure for feed efficiency. It is, therefore, of interest to determine whether the inclusion of



Body weight : 100 kg  
Daily gain : 0.85 kg/day  
Predicted feed requirement: 2.5 kg/day  
Actual feed intake: 2.6 kg/day

RFI = Actual feed intake - Predicted feed requirement  
= (2.6-2.5) kg/day = 0.10 kg/day

**Animal with lower residual feed intake is always better**

RFI in the selection program would improve efficiency of pig production. Genetic parameters for different measures of RFI and their genetic relationships with its component traits were estimated.

## Materials and Methods

Records on daily feed intake (FI) on 380 boars, and daily gain (DG), backfat thickness (BF), and loin eye area (LEA) on 1642 pigs (380 boar, 868 gilts, and 394 barrows) in seven generations of Duroc population were collected. Four measures of RFI were estimated on boars as the difference between actual and expected feed intake. They were estimated from single trait analyses for FI, with various combinations of production traits included as covariates. These analyses included fixed effect of generation, as well as random animal effect. Models were included initial test age and weight with DG (RFI1); with DG and BF (RFI2); with daily gain and LEA (RFI3); and with DG, BF and LEA (RFI4). Genetic parameters for measures of RFI, and their genetic correlations with FI, DG, and BF were estimated with REML using the variance component estimation (VCE) software.

## Results

Table 1 Estimates of partial regressions of daily feed intake on starting age and weight, and growth traits

Model	Starting Age (d)	Starting Wt. (kg)	DG (kg)	BF (cm)	EMA (cm <sup>2</sup> )	R <sup>2</sup> -value
1	-0.0059	0.0148	1.9927	-	-	0.59
2	-0.0061	0.0120	1.7706	0.2214	-	0.68
3	-0.0066	0.0159	1.9775	-	-0.0070	0.61
4	-0.0064	0.0128	1.7684	0.2152	-0.0039	0.69

- Delayed starting ages reduced daily feed intake.
- Heavier starting weights resulted in higher feed intake.
- Partial regressions of FI on DG were 1.8-2.0 kg.

Table 2 Means, additive genetic variance, and h<sup>2</sup> for measures of RFI

Traits	RFI1	RFI2	RFI3	RFI4
Mean ± S	0.00 ± 0.1	0.00 ± 0.13	-	-0.01 ± 0.13
D	5		0.01 ± 0.1	
σ <sup>2</sup> <sub>A</sub>	0.009	0.004	0.008	0.003
c <sup>2</sup> ± SE	0.16 ± 0.0	0.23 ± 0.02	0.18 ± 0.0	0.23 ± 0.03
h <sup>2</sup> ± SE	0.38 ± 0.0	0.22 ± 0.07	0.33	0.20 ± 0.07
	5		4	
			± 0.04	

- The mean values for all the measures of RFI were zero as expected by definition
- Relatively high common environmental effects were found on these traits.
- All the measures of RFI were moderately heritable.
- However, heritabilities for RFI adjusted with BF were lower than those for RFI not adjusted with BF

Table 3 Estimates of genetic (r<sub>g</sub>) and phenotypic (r<sub>p</sub>) correlations between measures of RFI and growth traits

Traits	FI		DG		BF	
	r <sub>g</sub>	r <sub>p</sub>	r <sub>g</sub>	r <sub>p</sub>	r <sub>g</sub>	r <sub>p</sub>
RFI1	0.78 ± 0.03	0.66	0.22 ± 0.0	0.01	0.77 ± 0.0	0.46
RFI2	0.58 ± 0.04	0.56	0.16 ± 0.0	0.01	0.11 ± 0.0	0.01
RFI3	0.77 ± 0.03	0.64	0.23 ± 0.0	0.00	0.76 ± 0.0	0.42
RFI4	0.56 ± 0.05	0.57	0.17 ± 0.0	0.01	0.07 ± 0.0	0.00

- All the measures of RFI favorably correlated with FI.
- The r<sub>g</sub> between DG and measures of RFI were low but positive, which indicated that genetically fast growing pigs had appetite requirements greater than needs for growth.
- Phenotypic correlation between DG and measures of RFI were closed to zero as expected.
- BF was genetically strongly correlated with RFI, when RFI was not adjusted for BF than those with RFI adjusted with BF.

## Conclusion

Residual feed intake was moderately heritable and should respond to selection. Maternal effects appear to be important for residual feed intake, and need to be included in a genetic evaluation system. It should be possible to select for residual feed intake without adversely affecting daily gain. Feed intake and backfat would also decrease, and the amount of change in backfat would depend on which measure of residual feed intake one uses.