Meta-analysis for selection of feed efficiency in crossbred pigs.

Current progress towards a selection index.

EAAP 2019 - **Michael Aldridge**, Rob Bergsma, Mario Calus

WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018

Feed-a-Gene

twitter @mn_aldridge

Feed efficiency.

$$\text{Feed Efficiency} = \frac{\text{Average daily gain}}{\text{Daily feed intake}}$$

$$\text{Feed Conversion Ratio} = \frac{\text{Daily feed intake}}{\text{Average daily gain}}$$

WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018

Feed-a-Gene

Research question.

Which novel traits should be included in a selection index for crossbred pig feed efficiency?

The problem.

- ✓ Lower FCR
- ✓ Faster growth rates
- ✓ Early maturity

- ✓ Viable litter sizes
- ✓ Fertility and fecundity
- ✓ Lower litter variation

The genetic correlation between purebred and crossbred traits is **not** equal to one.

genetic

New traits and opportunities.

- Digestibility
- Feeding behaviour
- Group records
- Biomarkers
- Welfare indicators
- Indirect genetic effects
- Perturbations
- Microbiota

Parameter estimates in literature

Trait	σ_G	Genetic correlation with FCR
Feed conversion ratio	0.18 (4)	1.00
Average daily gain	0.07 (5)	-0.27 (12)
Daily feed intake	0.68 (4)	0.32 (11)
Dry matter digestibility	0.41 (1)	-0.65 (1)
Eating time per day	5.01 (2)	0.18 (3)
Group daily feed intake	0.17 (2)	0.12 (1)
Growth rate with social effect	27.94 (2)	0.10 (1)
Nitrogen excreted	0.23 (1)	0.16 (1)
Joint lesions	0.16 (1)	-0.09 (1)
Total lesion count	0.34 (1)	-0.08 (1)

(Literature used in meta analysis)

Which traits are likely to improve FCR?

$$\sigma_{I,R}/\sigma_I = r_{I,R} * \sigma_R$$

Which traits are likely to improve FCR?

Trait	FCR (kg/kg) with one σ_G change in selected trait	Relative phenotypic change in FCR with one σ_G change in selected trait
Feed conversion ratio	2.380 (Originally 2.520)	-5.56%
Average daily gain	2.447	-2.90%
Daily feed intake	2.511	-0.37%
Dry matter digestibility	2.490	-1.20%
Eating time per day	2.519	-0.04%
Group daily feed intake	2.511	-0.35%
Growth rate with social effect	2.520	-0.01%
Nitrogen excreted	2.510	-0.40%
Joint lesions	2.525	0.20%
Total lesion count	2.522	0.06%

Selection index theory.

- Selection indexes
- Breeding programs
- SelAction

Hazel, LN (1943) The genetic basis for constructing selection indexes. *Genetics* **28**, 476-490.

$\mathbf{a}$ (economic weights)

$\mathbf{b} = \mathbf{P}^{-1}\mathbf{G}\mathbf{a}$ (Index weights)

$\mathbf{R} = \mathbf{b}'\mathbf{G}(\mathbf{b}'\mathbf{P}\mathbf{b})^{-0.5}$ (Response to selection)

WAGENINGEN UNIVERSITY & RESEARCH

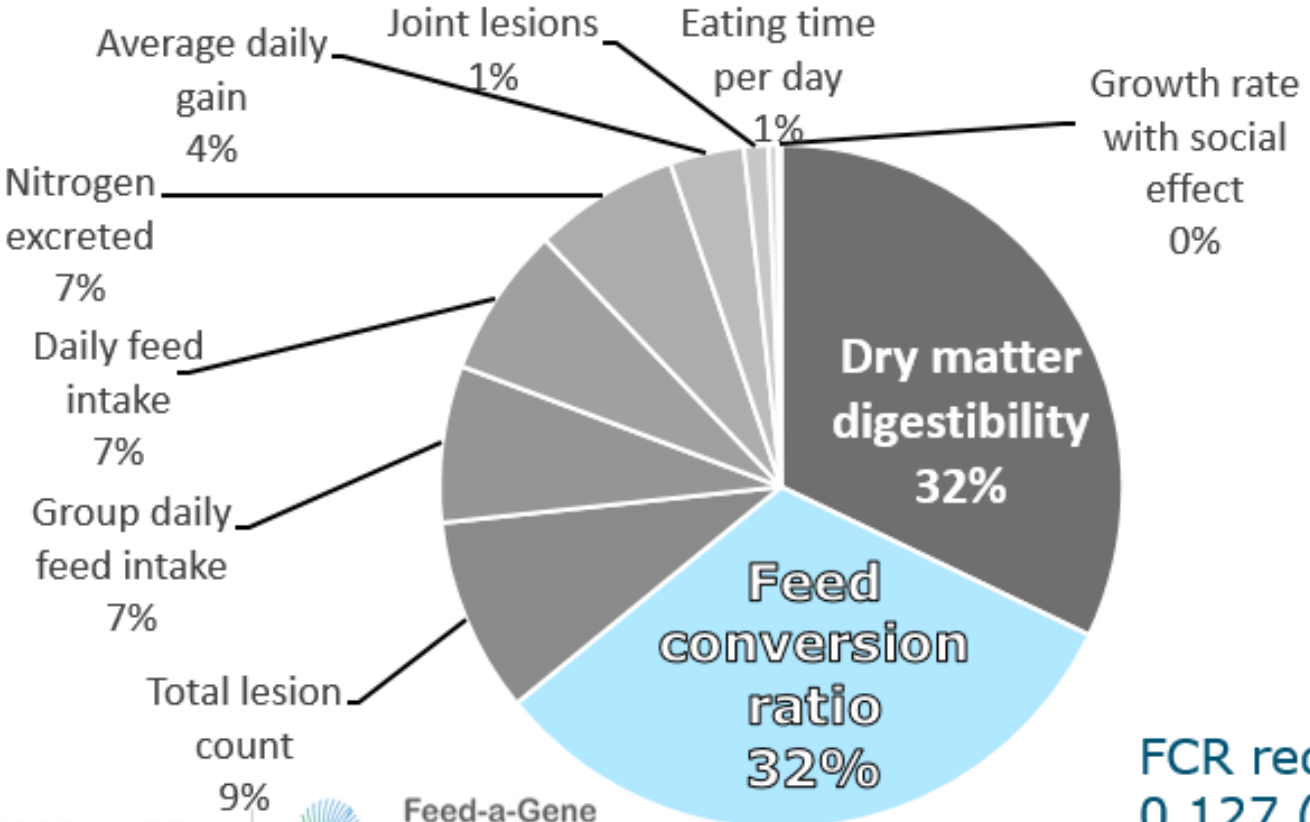
100years 1918 — 2018

Feed-a-Gene

Economic values.

- Economic values for production traits are relatively simple.
- Weightings for novel traits were based on surveys.

SelAction.

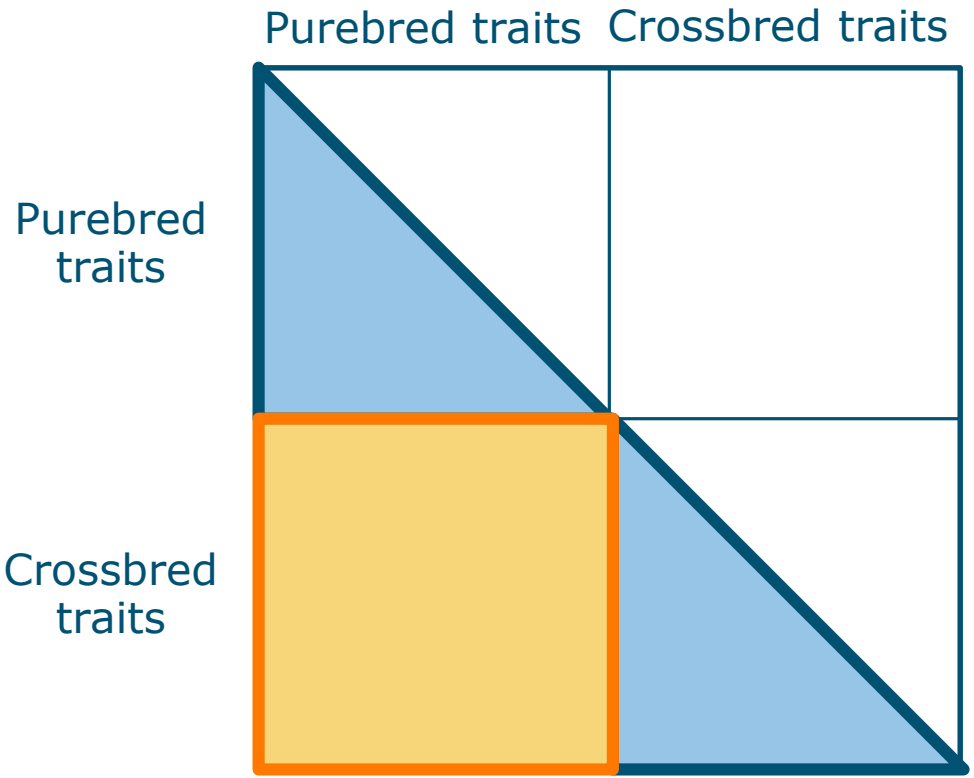


FCR reduced by 0.127 (kg/kg)

WAGENINGEN UNIVERSITY & RESEARCH

Feed-a-Gene

Genetic covariance matrix.



Topigs Norsvin

WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018

Feed-a-Gene

Conclusion.

Selection for FCR:

- Production traits will contribute the most
- Novel traits have benefits
- Pure and crossbreds correlations are needed
- Alternative breeding programs need to be simulated.

Meta-analysis for selection of feed efficiency in crossbred pigs.

Current progress towards a selection index.

EAAP 2019 - **Michael Aldridge**, Rob Bergsma, Mario Calus

WAGENINGEN UNIVERSITY & RESEARCH

100years 1918 — 2018

Feed-a-Gene

twitter @mn_aldridge