

## Construction of individual breeding values for feed intake of Piétrain boars based on mean pen feed intake, weight and weight gain test station records

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## General context

- Importance of feed efficiency (FE) in livestock production
- Feed intake (FI) is a component of FE
- Selection to reduce FI with growth rate constant
- Individual FI records needed

## Context of the study

- **Progeny-test of Piétrain boars in test station**
- **No facilities to record individual FI**
  - ➔ Total pen FI records
  - ➔ Individual mean pen FI
- **FI different between pigs in same pen**
- **FI genetically related to important traits (e.g. live weight, weight gain...)**

## Objective

To predict **reliable individual genetic merit of Piétrain boars for FI based on mean pen FI, weight and weight gain records of their progeny**

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To compare heritability, estimated breeding values (EBV) and their reliability for FI estimated with different methods

## Material

- Data collected
  - In the Walloon test station
  - On crossbred progeny of Piétrain boars
- Total pen feed intake (kg)
- Number of pigs per pen
- Length of testing for each pig (d)

## Material

- Trait definition:

**Individual Estimated Feed Intake (EFI)**

= Total pen feed intake / Number of pigs per pen

- Daily EFI = EFI / length of testing

➔ 1 397 records of daily EFI (g/d)

## Methods

- Model 1

$$y = Xb + Za + e$$

**Observation:**

➤ Estimated feed intake (EFI) (g/d)

# Methods

- Model 1

$$y = Xb + Za + e$$

Fixed effects:

- Sex
- Pen where pigs were tested



# Methods

- Model 1

$$y = Xb + Za + e$$

Random effects:

- Vector of additive genetic effects



## Methods

- **Model 1**

$$y = Xb + Za + e$$

**Random effects:**

- Vector of additive genetic effects
- Vector of random residual effects

## Methods

- **Model 2 = Model 1**
  - + **Average daily gain (kg/d) between 100 and 210 d (ADG)**
  - + **Live weight (kg) at 100 d (LW100)**  
as linear covariates
- **ADG and LW100 expressed in breeding value**

## Methods

- **Model 2**

- By correcting for ADG and LW100, estimated breeding values = **Residual feed intake (RFI)**
- **RFI** = Observed feed intake – Predicted feed intake based on maintenance and production requirements



## Methods

- **Construction of index combining**

- **RFI** (g/d)
- **LW100** (kg)
- **ADG** (kg/d)

weighted by regression coefficients estimated in Model 2

- ➔ **Index feed intake (IFI)**

- **Heritability and reliability of IFI function of index weighting coefficients**



## Results: descriptive statistics

N = 1 397

Trait	Mean	SD	Min	Max
EFI (g/d)	1 876.8	177.5	1 329	2 444
ADG (kg/d)	0.651	0.035	0.523	0.762
LW100 (kg)	41.7	3.96	29.1	54.4

EFI = Estimated Feed Intake; ADG = Average Daily Gain between 100 and 210 d;  
LW100 = Live weight at 100 d

## Results: Index equation

IFI = Index Feed Intake (g/d)

$$\text{IFI} = \text{RFI} + 2.61 * \text{LW100} + 214.37 * \text{ADG}$$

Regression coefficients from Model 2, used as weighting coefficients to estimate IFI

## Results: Heritability

Method	Heritability
Model 1	0.08
Model 2	0.06
Index	0.09

- Heritability of FI low compared to litterature values (averaging 0.29; ranging from 0.13 to 0.62 )

## Results: Heritability

Method	Heritability
Model 1	0.08
Model 2	0.06
Index	0.09

- Heritability of FI low compared to litterature values (averaging 0.29; ranging from 0.13 to 0.62 )
- Heritability with Index the closest to litterature values

## Results: Reliability of EBV

Method	Mean	SD	Min	Max
Model 1	0.16	0.10	0.00	0.43
Model 2	0.13	0.07	0.00	0.35

N = 56

With Model 1 mean reliability of EBV was too low to base reliable selection decision

## Results: Reliability of EBV

Method	Mean	SD	Min	Max
Model 1	0.16	0.10	0.00	0.43
Model 2	0.13	0.07	0.00	0.35

N = 56

With Model 2 mean reliability of EBV was lower than reliability obtained with Model 1

## Results: Reliability of EBV

Method	Mean	SD	Min	Max
Model 1	0.16	0.10	0.00	0.43
Model 2	0.13	0.07	0.00	0.35
Trait	Mean	SD	Min	Max
LW100 (kg)	0.72	0.08	0.43	0.89
ADG (kg/d)	0.71	0.08	0.39	0.86

N = 56; LW100=Live weight at 100 d; ADG=Average daily gain between 100 and 210 d)

Breeding values for LW100 and ADG were highly reliable

## Results: Reliability of EBV

Method	Mean	SD	Min	Max
Model 1	0.16	0.10	0.00	0.43
Model 2	0.13	0.07	0.00	0.35
Index	0.35	0.07	0.18	0.55
Trait	Mean	SD	Min	Max
LW100 (kg)	0.72	0.08	0.43	0.89
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N = 56; LW100=Live weight at 100 d; ADG=Average daily gain between 100 and 210 d)

By combining RFI with ADG and LW100 reliability of EBV was increased

## Conclusions

- **Heritability of FI is low with the 3 tested methods**
- **Index combining genetic values of**
  - RFI
  - LW100
  - ADG

➔ **Increasing heritability and reliability of EBV for FI**

## Conclusions

**Index combining genetic values of LW100 and ADG with RFI allows to have more reliable prediction of individual genetic merit of Piétrain boars for FI**

## Perspectives

- To include **competitive effect** into the model
  - Feed limitations
  - Competition relationships between pigs in a pen influence FI



## Perspectives

- To include **competitive effect** into the model
  - Feed limitations
  - Competition relationships between pigs in a pen influence FI
- To get **FI records corresponding to weight records**
  - Weights are recorded every 15 days
  - Growth rate and FI are genetically related



## Thank You For Your Attention!

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