

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

M. Dufrasne<sup>1</sup> – V. Jaspert<sup>2</sup> – J. Wavreille<sup>3</sup> & N. Gengler<sup>1,4</sup>

<sup>1</sup> Animal Science Unit, Gembloux Agro-Bio Tech, University of Liege (GxABT-ULg) – Gembloux, Belgium

<sup>2</sup> Walloon Pig Breeders Association (AWEP) – Ciney, Belgium

<sup>3</sup> Walloon Agricultural Research Centre (CRA-W) – Gembloux, Belgium

<sup>4</sup> National Fund for Scientific Research (FRS-FNRS) – Brussels, Belgium

2011 ADSA-ASAS JAM – July 10-14 New Orleans, Louisiana

## 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

## 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



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**

$$\textcircled{y} = Xb + Za + e$$

**Observation:**

- Estimated feed intake (EFI) (g/d)



## Methods

### ▪ Model 1

$$y = X\mathbf{b} + Z\mathbf{a} + e$$

#### Fixed effects:

- Sex
- Pen where pigs were tested



## Methods

### ▪ Model 1

$$y = X\mathbf{b} + Z\mathbf{a} + e$$

#### Random effects:

- Vector of additive genetic effects



## Methods

- **Model 1**

$$y = Xb + Za + \textcircled{e}$$

**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 covariables
- 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
<b>Index</b>	<b>0.09</b>

- 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)	<b>0.72</b>	<b>0.08</b>	<b>0.43</b>	<b>0.89</b>
ADG (kg/d)	<b>0.71</b>	<b>0.08</b>	<b>0.39</b>	<b>0.86</b>

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
<b>Index</b>	<b>0.35</b>	<b>0.07</b>	<b>0.18</b>	<b>0.55</b>
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)

**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!

### ■ Collaboration:

- Walloon Pig Breeders Association (AWEP)
- Walloon Agricultural Research Centre (CRA-W)
- ULg - Gembloux Agro-Bio Tech (GxABT)



### ■ Study supported by:

- Walloon Region of Belgium
- National Fund for Scientific Research (FRS-FNRS)



- Author's contact: [marie.dufasne@ulg.ac.be](mailto:marie.dufasne@ulg.ac.be)