Quantifying the relation between reproduction and finishing traits

Roos Vogelzang, Egbert Knol, Luc Janss
Towards 5 ton of pork per sow per year

• We need:
  – Reduction in cost price of a piglet: increase in litter size
  – Reduction in fixed cost per kg of pork: increase in market weight

• Consequence larger litters
  – Decrease in birth weight, hence
    • Higher mortality risk
    • Lower gain later in life
Litter size and birth weight

Phenotypic trend

**Tempo * Topigs 20**
> 28,500 piglets

Average birth weight 1285 gram

An extra piglet born per litter decreased the average birth weight with 30 gram
Litter size and mortality

Phenotypic trend

**Tempo * Topigs 20**

> 28,500 piglets

Stillborn + preweaning mortality

An extra piglet born per litter increased mortality until weaning with 1.68%
Birth weight and daily gain

- Individual weight curves of 2174 finishing pigs
- Using the Gompertz curve function in a joint Bayesian analysis
- Average birth weight was 1391 gram and average litter size was 15.2
- The weights during start, middle and end of the finishing period were used (23.2, 70.2, and 123.8 kg, respectively)
Birth weight and daily gain

Gompertz curve (Fitzhugh Jr. 1976)

\[ Y = A \exp(-be^{-ct}) \]

- \( Y \rightarrow \) Body weight on time = \( t \)
- \( A \rightarrow \) Mature weight
- \( b \rightarrow \) scaling parameter (established by initial \( Y_0 \))
- \( c \rightarrow \) growth rate parameter
- \( t \rightarrow \) time in days after birth

- Growth curve is the first derivate of weight curve
## Birth weight and daily gain

<table>
<thead>
<tr>
<th>Birth weight</th>
<th>&lt;1000g</th>
<th>1000g-2000g</th>
<th>&gt;2000g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gompertz parameter A</td>
<td>233.6</td>
<td>245.4</td>
<td>260.3</td>
</tr>
<tr>
<td>Gompertz parameter B</td>
<td>-4.944</td>
<td>-4.859</td>
<td>-4.737</td>
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<tr>
<td>Gompertz parameter C</td>
<td>-0.0116</td>
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<tr>
<td>Average age 120 kg</td>
<td>173</td>
<td>165</td>
<td>156</td>
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<tr>
<td>Average weight 170 days</td>
<td>118</td>
<td>126</td>
<td>136</td>
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</table>
Birth weight and daily gain

- Birthweight <1000g
- Birthweight 1000g-2000g
- Birthweight >2000g
Growth curve 25-120 kg

- Birthweight >2000g
- Birthweight 1000g-2000g
- Birthweight <1000g

Birth weight and daily gain
Combining results

Sow output per litter
- Increasing litter size
- Increasing mortality
- Decreasing birth weight
- Decreasing daily gain

Slaughter age 170 days

<table>
<thead>
<tr>
<th>Total number born</th>
<th>Birth weight</th>
<th>Number weaned</th>
<th>Weight 170 days</th>
<th>Kg per litter</th>
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<tr>
<td>10</td>
<td>1545</td>
<td>9.3</td>
<td>129</td>
<td>1176</td>
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25 total born = 17.2 weaned = 2072 kg / litter * 2.43 litters = > 5000 kg / sow / year
Combining results

**Biological limit**
± 18 piglets weaned per litter

**Vision Topigs Norsvin**
Every extra piglet born should be weaned

If farrowing + lactation survival = 85%
⇒ 15 piglets born = 1579 kg /litter
⇒ 20 piglets born = 2073 kg /litter

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Combining results

Finite finishing space
15 → 25 piglets
+ 4.5 weaned per litter

We will need to

Create space
 or
Reduce sow population
 or
Decrease slaughter age to 125 days
 → ±1250 kg/litter
Combining results

Sow output per litter

2015
15.6 piglets / litter
1600 kg / litter

Phenotypic trend
+0.25 piglets/litter

Prediction 2025
18.1 piglets / litter?
1760 kg / litter
Take home message

• The effect of birth weight proves that not only the genes of the finisher pig, but also the reproduction potential of the sow is very important for the total weight output per sow at slaughter.

• Increasing birth weight is highly relevant.

• The total carcass weight output per sow continues to increase with increase in litter size and there is no evidence that breeding for a further increase in litter size will restrict sow output at slaughter in the near future.
Thank you for your attention!

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