Effect of parity and litter size on milk production of sows

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Factors affecting milk production in sows

- **Litter size**
  - Linear increase of total production with litter size
  - Decrease of amount of milk / piglet

- **Parity**
  - Lower milk production in young and old sows

- **Environment**
  - Decreased milk production in hot climate

- **Nutrition**
  - Energy & amino acid supplies

- **Genotype & selection**
## Evolution of sow performance in French pig farms

<table>
<thead>
<tr>
<th>Year</th>
<th>1990</th>
<th>2000</th>
<th>2011 average</th>
<th>best 33%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litter size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>born alive</td>
<td>10.8</td>
<td>11.9</td>
<td>13.20</td>
<td>13.6</td>
</tr>
<tr>
<td>weaned</td>
<td>9.4</td>
<td>10.4</td>
<td>11.4</td>
<td>11.8</td>
</tr>
<tr>
<td>Litter growth, kg/d</td>
<td>2.020</td>
<td>2.500</td>
<td>2.720</td>
<td>2.850</td>
</tr>
</tbody>
</table>

- => +20% increase in number of piglets weaned/litter
- => +35% increase in litter growth rate (milk)
- => +11% increase in piglets growth rate
Prediction of milk production

✓ Prediction equations from piglets growth
  ✓ Noblet & Etienne (1989)  
    => energy, protein, DM…  
    \[ f(LS, LG, \text{body comp.}) \]

✓ Prediction models
  ✓ Whittemore and Morgan (1990)  \[ f(\text{time}) \]
  ✓ Dourmad et al. (2008) => InraPorc®  \[ f(\text{time}, LS, LG) \]
  ✓ Hansen et al. (2012) => Meta-analyse  \[ f(\text{time}, \text{parity}, LS, LG) \]

⇒ Important for the determination of sow’s nutrient requirements
Objectives of the study

Evaluate the effects on milk production of:

- Litter size
- Parity of sows

In modern high producing sows

Develop prediction equations

- to better take account of the variability among sows
- to improve the determination of nutritional requirements
Material and methods

- **Data from three experimental farms**
  - 3500 litters born between 2006 and 2010
  - Crossbred sows: Large White x Landrace
  - Number of piglets after fostering (1d) and at weaning
  - Individual weight of piglets at birth and at weaning

- **Calculation**
  - Piglets and litter growth rate
  - from Noblet and Etienne (1989)
    - Milk
    - Energy – Protein – Phosphorus

- **Statistical analysis**
  - GLM: Farm – Parity – Litter size - Month of farrowing
## Performance of litters

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>Farm</th>
<th>Parity</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>N° litters</td>
<td>3510</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Parity</td>
<td>3.2</td>
<td>***</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Age at weaning</td>
<td>27.8</td>
<td>***</td>
<td>*</td>
<td>-</td>
</tr>
<tr>
<td>Piglets weaned/litter</td>
<td>11.0</td>
<td>***</td>
<td>***</td>
<td>-</td>
</tr>
<tr>
<td>Weaning weight, kg</td>
<td>8.60</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Piglets gain, g/d</td>
<td>256</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Litter gain, g/d</td>
<td>2800</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
</tbody>
</table>
## Milk production

<table>
<thead>
<tr>
<th></th>
<th>Average</th>
<th>Farm</th>
<th>Parity</th>
<th>LS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk, kg/d</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>per litter</td>
<td>10.7</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>per piglet</td>
<td>1.00</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Energy, MJ/d</td>
<td>53.3</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Protein, g/d</td>
<td>487</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
<tr>
<td>Phosphorus, g/d</td>
<td>15.1</td>
<td>***</td>
<td>***</td>
<td>***</td>
</tr>
</tbody>
</table>
Effect of parity on milk production

Milk per litter, g/d

Milk per piglet, g/d

Parity

Per litter

Per piglet
Effect of litter size on milk production

Milk per litter, g/d

Milk per piglet, g/d

Litter size
Effect of month at farrowing on milk production

- Milk per litter, g/d
- Milk per piglet, g/d

Month of farrowing
Prediction equations of litter weight gain (LG)

\[ LG = LG \times \text{Coeff(Parity, LS, LS)} \]

\[ \text{Coeff} = \text{Const(Parity)} + 5.932 \times (LS - \overline{LS}) - 0.514 \times (LS - \overline{LS})^2 \]

\[ \text{Const(Parity}_{1..8}) = (97.3, 103.7, 104.5, 103.7, 103.6, 101.2, 97.7, 97.5) \]
Effect on nutritional requirements
- example of digestible lysine requirement -

```
<table>
<thead>
<tr>
<th>Parity</th>
<th>Average herd performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>47</td>
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</table>
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Effect on nutritional requirements
- example of digestible lysine requirement -

![Graph showing digestible lysine requirement by parity]

- Average herd performance
- LS per parity & proposed equation

Digestible lysine requirement, g/d

Parity
Conclusion

✓ Increase of milk production
  ✓ 3000 g/d average litter growth rate (in the best 2 farms)
  ✓ 12.0 Liters of milk per day

✓ Milk production
  ✓ Litter size (linear between 6 and 12 piglets)
  ✓ Parity (highest in parity 2 to 5)
  ✓ Season (lower in summer)

✓ 50% of variability in milk production explained by sow parity and LS

▷ Improvement of sow’s nutrient requirements
  • On short term: InraPorc®
  • On medium term: precision feeding of lactating sows
Thank you for your attention