Nutritional strategies during key stages
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GILT Management Meetings: Unlocking Lifetime Potential
Winter 2017
Agenda

• Key stages
  – First gestation
    • Udder development
  – First lactation
  – Weaning to oestrus interval
  – Second gestation
    • 2nd litter syndrome
    • Growth targets per parity
“It’s a Circle”

GILT REARING

FLUSH

GESTATION

LACTATION

TRANSITION
Production objectives during gilt rearing:

- Good body condition
- Good udder line and 14 teats or more
- Good leg strength
- 145 – 160 kg bodyweight
- 240 - 260 days of age
- 16 – 18 mm P2 (3-layer)
Process of mammary development

Nutritional effects:
- 34% feed restriction from d 28 to d 90 had no impact on mammary development
- 20% feed restriction from d 90 until puberty reduced milk producing mass by 26.3%
- 26% feed restriction from d 90 until puberty reduced milk producing mass by 34.2%

(Sørensen et al., 2002; Sørensen et al., 2006; Farmers et al., 2006)
Growing-finishing diets vs. rearing diets

• Minerals
  – Calcium
  – Digestible phosphorus
• Minerals and trace elements
  – Zinc
  – Manganese
• Vitamins
  – Choline
  – Biotin
  – Folic acid
  – Vitamin D
• Amino acids

Using grower-finisher diets results into an undersupply of minerals, trace elements and vitamins that are necessary to prepare the gilts for a long productive life.
Feed programme - Moderate breeds

<table>
<thead>
<tr>
<th>Phase and Diet</th>
<th>Day</th>
<th>KG</th>
<th>Feed kg/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1 (Gilt 1)</td>
<td>63</td>
<td>25</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>119</td>
<td>60</td>
<td>2.4</td>
</tr>
<tr>
<td>Phase 2 (Gilt 2)</td>
<td>126</td>
<td>65</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>168</td>
<td>100</td>
<td>2.7</td>
</tr>
<tr>
<td>Phase 3 (Gilt 3)</td>
<td>175</td>
<td>105</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>238</td>
<td>145</td>
<td>2.9</td>
</tr>
</tbody>
</table>
“It’s a Circle”
Flushing - Production objectives

- Improved oocyte quality and strength of heat
- Increased number of viable embryos and bigger litter size
Flushing – Technical Background

- Carbohydrate-rich diets
- Blood glucose & insulin ↑
- LH, FSH and IGF ↑
- Number of ovulations ↑
- Quality of the oocytes ↑
- Number of embryos ↑
“It’s a Circle”
Early / Mid Gestation

Energy and nutrients for:

• Early Gestation
  – Reconditioning
  – Embryonic development shown to be closely linked with placental area.

• Mid Gestation
  – Maintenance
  – Satiety / Behaviour

• Special gestation diet for gilts to cover ongoing maternal growth
Late gestation

• Energy and nutrients for:
  – Development of the mammary glands
  – Prevention of obesity
  – Growth of the foetuses
  – Maximise glycogen reserves in the piglets
  – Optimise sow body condition
How to feed gilts during gestation

Feeding schedule gilts kg/d

With the exception of PIC and other UK Breeds for most of the genetics used in Europe the feeding schedule for gestating gilts is defined to increase gradually during the first pregnancy. The recommendation of PIC is to feed the same amount of feed until day 85 to support increase of fetus.
“It’s a Circle”
Transition – Production Objectives

- Prevention of constipation
- Energy reserves for the piglet
- Mammary gland development
- Energy reserves for the mother
- Short, trouble free farrowing, producing highly viable piglets
- Colostrum Production

Transitional objectives for production.
Transition – Technical Background

• Energy Supply – Extra Dextrose during transition improved piglet vitality and improved neonatal survival.

<table>
<thead>
<tr>
<th>%</th>
<th>control</th>
<th>dextrose</th>
<th>P-value</th>
</tr>
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<tbody>
<tr>
<td>Vitality score</td>
<td>1.69</td>
<td>1.78</td>
<td>0.025</td>
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<tr>
<td>Died 1st day</td>
<td>8.77</td>
<td>3.73</td>
<td>0.003</td>
</tr>
</tbody>
</table>

• Calcium Supply – Additional calcium required for efficient muscle function
Transition – Technical background

- Colostrum Yield
  - Colostral nutrients start to be produced prior to farrowing
    - Proteins – day 80 of gestation
    - Lactose – day 100 of gestation
- Gut activity
  - The sow will naturally become mildly constipated around farrowing as gut activity reduces
  - Through the supply of the correct fibre balance we can maintain a level of gut activity to prevent severe constipation
“It’s a Circle”
Production objectives during Lactation

What are we trying to achieve during Lactation?

1. Milk yield and quality
2. Body weight and back fat development
3. Minimise body condition loss
Nutritional overview

• High in glycogenic energy for milk yield and lipid for milk quality

• Increase in protein with specific amino acid profile for improved milk quality and maintenance of maternal body composition

• Optimised mineral balance to support maximum milk yield
Lactation weight loss: causes and consequences

- Low feed intake capacity
- Restricted body reserves
- High energy need for milk production
- Follicle development
  - Ovulation rate
  - Embryo survival
  - Weaning-Oestrus
  - Litter size
  - Farrowing rate
  - Within litter birth weight variation

Kemp and Soede, 2016
Effects of feed intake during lactation on...

<table>
<thead>
<tr>
<th>Reference</th>
<th>Weaning age</th>
<th>WOI days</th>
<th>Ovulation rate (number of oocytes)</th>
<th>Embryo survival, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Feed intake</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>King &amp; Williams (1984)</td>
<td>d 32</td>
<td>High</td>
<td>7,6</td>
<td>14,4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>19,9</td>
<td>13,5</td>
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<tr>
<td>Kirkwood et al. (1987)</td>
<td>d 35</td>
<td>High</td>
<td>4,3</td>
<td>18,1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>5,8</td>
<td>18,6</td>
</tr>
<tr>
<td>Kirkwood et al. (1990)</td>
<td>d 28</td>
<td>High</td>
<td>6,0</td>
<td>17,6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>8,9</td>
<td>17,7</td>
</tr>
<tr>
<td>Baidoo et al. (1992)</td>
<td>d 28</td>
<td>High</td>
<td>5,9</td>
<td>16,2</td>
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<tr>
<td></td>
<td></td>
<td>Low</td>
<td>7,5</td>
<td>16,7</td>
</tr>
<tr>
<td>Zak et al. (1997)</td>
<td>d 28</td>
<td>High</td>
<td>3,7</td>
<td>19,9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>5,6</td>
<td>15,4</td>
</tr>
<tr>
<td>Zak et al. (1998)</td>
<td>d 28</td>
<td>High</td>
<td>4,2</td>
<td>14,4</td>
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<tr>
<td></td>
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<td>Low</td>
<td>6,3</td>
<td>15,6</td>
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<tr>
<td>Quesnel &amp; Prunier (1998)</td>
<td>d 24</td>
<td>High</td>
<td>5,7</td>
<td>19,2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>5,9</td>
<td>20,7</td>
</tr>
<tr>
<td>Van den Brand et al. (2000)</td>
<td>d 22</td>
<td>High</td>
<td>5,1</td>
<td>18,1</td>
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<tr>
<td></td>
<td></td>
<td>Low</td>
<td>5,7</td>
<td>16,4</td>
</tr>
<tr>
<td>Vinsky et al. (2006)</td>
<td>d 21</td>
<td>High</td>
<td>5,3</td>
<td>18,3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>5,4</td>
<td>18,2</td>
</tr>
<tr>
<td>Patterson et al. (2011)</td>
<td>d 20</td>
<td>High</td>
<td>5,0</td>
<td>19,7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low</td>
<td>5,3</td>
<td>20,2</td>
</tr>
</tbody>
</table>

In modern multiparous sows with short WOI post-weaning feeding has become less relevant!
However, in first litter sows carbohydrate-rich diets have been shown to increase the percentage of sows in oestrus within 9 days after weaning.

Soede & Kemp, 2015
Effects of feed intake during lactation on follicular development

Zak et al., 1997
Effect of dextrose (150 g/d/d) during the weaning-to-oestrus interval

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Dextrose Yes</th>
<th>Dextrose No</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Litters used (n)</td>
<td>91</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>Live born piglets (n)</td>
<td>12.9</td>
<td>12.7</td>
<td>ns</td>
</tr>
<tr>
<td>Piglet birth weight (g)</td>
<td>1608</td>
<td>1591</td>
<td>ns</td>
</tr>
<tr>
<td>CV birth weight (%)</td>
<td>17.5</td>
<td>21.2</td>
<td>0.03</td>
</tr>
<tr>
<td>Pre-weaning mortality (%)</td>
<td>6.9</td>
<td>7.4</td>
<td>ns</td>
</tr>
</tbody>
</table>

vd Brand et al., 2006
“It’s a Circle”

GILT REARING

FLUSH

GESTATION

2nd

LACTATION

TRANSITION
Second Litter Syndrome

• Parity 2 vs. Parity 1
  – More returns to service
  – Smaller litters
• Problem starts with growth and development of the gilt
  – Mostly younger sows (parity 1,2,3)
  – Effect will last for the lifetime of the sow
• Adjustment in feed type or feeding level in early gestation will help the sow to regain body condition and to have a better productivity
Effect of increased feed intake or increased amino acid supply during early pregnancy on reproductive performance

<table>
<thead>
<tr>
<th>Item</th>
<th>Control</th>
<th>Plus feed</th>
<th>Plus protein</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of sows</td>
<td>49</td>
<td>49</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Total number of piglets born</td>
<td>13,2b</td>
<td>15,2a</td>
<td>13,6b</td>
<td>0,006</td>
</tr>
<tr>
<td>Number of piglets born alive</td>
<td>12,6b</td>
<td>14,4a</td>
<td>13,2ab</td>
<td>0,008</td>
</tr>
<tr>
<td>Average birth weight of piglets, kg</td>
<td>1,45</td>
<td>1,42</td>
<td>1,46</td>
<td>0,650</td>
</tr>
<tr>
<td>CV of birth weight,%</td>
<td>16,9b</td>
<td>20,7a</td>
<td>19,9ab</td>
<td>0,009</td>
</tr>
<tr>
<td>Piglet mortality from d 1 to 3</td>
<td>8,7 %</td>
<td>10,3%</td>
<td>8,4%</td>
<td>0,625</td>
</tr>
</tbody>
</table>

*Control 11,8% XP (2,5kg/d), plus feed (3,25kg/d), plus protein 14,7% XP (2,5kg/d plus 30% AID AA) from d 3 until d 35, followed by 2,8 kg for all*

*Hoving et al., 2011*
How to feed gestating sows

Feeding schedule sows kg/d
Recommended Body Weight Development (kg)

1 S=service, F=farrowing
Summary/overview

With regard to the nutritional requirements of a producing sow, minimally 5 phases can be distinguished.

<table>
<thead>
<tr>
<th>Phase</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| High feeding level during early gestation (after first week) | • High embryonic survival rate  
• Higher birth weight and litter uniformity  
• Recovery of sow body condition  
• Prevent second litter dip |
| Moderate feeding level during mid gestation | • Maintain sow body condition  
• Behaviour |
| High feeding level during late gestation (last 4 weeks) | • Increased birth weight?  
• Higher viability (more energy available)  
• Improved udder development  
• Higher nutrient levels in colostrum  
• Optimal back-fat levels at parturition |
| Decrease feeding level during the last days of gestation | • Gradual transition for gestation to lactation diets  
• Prevent problems during farrowing |
| High feeding level/ feed according to requirement during lactation | • Heavier weaning weights  
• Decrease body weight loss of the sow  
• Improve follicle development  
• Shorter weaning – oestrous interval (1st parity) |
| Flushing between weaning and mating          | • Maximise ovulation rate  
• Stronger expression of oestrus |