Nutrition for Optimal Profitability

• Feeding the Breeding Herd
  • Gestation Feeding Programs
  • Weaning Age

• Lactation
  • Feed Intake
  • Key Nutrients

• Weight and Backfat Procedure

K-State RESEARCH and EXTENSION

Nutrition for Optimal Profitability

• Keys for Nursery & Grow Finish Success
  • Nursery pigs
    • Amino acid requirements
    • Feed management
  • Grow-finish pigs
    • Energy sources – Fat & DDGS
    • Alternative protein sources
    • Paylean
    • Ingredient procurement and processing

K-State RESEARCH and EXTENSION

Gilt Development

Key: Have gilts with correct backfat at first farrowing!!

Ideal: 19 mm of backfat at farrowing!

Overall goal:
  • Gilts should be mated at a moderate body weight and allowed to continue growth through the first gestation period.

Gilt development

Nutrition is secondary to proper management
  • Gilts should enter herd at young age (SEW or 50 lb)
  • Allows time for acclimation
  • Boar exposure at 140 to 150 d of age
  • Direct, daily exposure of at least 15 minutes
  • Record estrus to ensure bred at second or later estrus
  • Provide extra space during development
    • (12 to 15 sq ft after 140 d of age)
  • Move to gestation crates 14 to 21 days before mating
  • Flush feed until mated, then drop immediately to 4 lb/d

K-State RESEARCH and EXTENSION

Gestation Feeding

Goals:
  • Prepare sows to be in proper body condition at farrowing
  • Maximize reproductive performance
    • Farrowing rate and litter size
  • Meet daily nutrient requirements at the lowest cost possible
    • Cost per sow per day
Problems with overfeeding gestating sows:
- Unnecessary expense
- Impaired mammary development
- Reduced feed intake in lactation

Problem with thin sows:
- Poor reproductive performance
- Increased mortality

Feeding Based on Body Condition Score

Body Condition Score is Variable
- The amount of gestation feed is arbitrarily estimated from evaluating body condition score
- Variability among evaluators
- Feed amounts frequently bounce up and down

Relationship between backfat and body condition score

Estimating sows feed requirements from backfat and weight categories
- Use Renco Lean-meater to scan for backfat at last rib
- More accurate than condition scoring

Do we have to weigh sows?
- No, we use a girth tape to estimate weight
- Goal is to put sows into one of 4 weight categories
Do we have to weigh sows?

- Flank-to-Flank procedure is slightly less accurate than heart girth
- Much easier

Why feed on weight and backfat instead of body condition score?

- Why weight?
  - Maintenance accounts for the majority of the sow feed requirements in gestation
- Why backfat instead of body condition score?
  - Condition score is subjective and not accurate

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**Feeding level from day 0 to 101, lb/day**

<table>
<thead>
<tr>
<th>Girth, in</th>
<th>Estimated weight, lb</th>
<th>Backfat at breeding, mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>43 to 46.5</td>
<td>250 to 325</td>
<td>4.7</td>
</tr>
<tr>
<td>46.6 to 50.0</td>
<td>325 to 400</td>
<td>5.2</td>
</tr>
<tr>
<td>50.1 to 53.0</td>
<td>400 to 475</td>
<td>5.6</td>
</tr>
<tr>
<td>53.1 to 65.0</td>
<td>475 to 600</td>
<td>6.1</td>
</tr>
</tbody>
</table>

*Assumes diet with 1.5 Mcal ME/lb
*All sows fed additional 2 lb/d from d 101 to 115
*Sows maintained at or above 68°F

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**Sow Maintenance Requirements in Gestation**

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Procedures during the first week after breeding

- Scan and determine weight category on all sows that were bred in the last week
- Write the backfat on the sow card
- Use the feed chart to adjust the feeding level
- Other issues:
  - must train a person to scan and estimate weight
  - must know the energy level of diet
  - must know volume (lb) dropped at each setting

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Procedures for extra feed adjustment at 7 weeks postmating

- Lines will be walked at 7 weeks post mating
- Visually very thin sows will be marked and scanned to determine if backfat gains are on target.
  - Approximately 10 to 15% of sows may be below target
- If they are not reaching targets, feed intake is increased by 1 lb/day.
Does it Really Work?

- 2,500 sow farrow-to-wean operation
- A total of 689 sows were put on test over six weeks
- Weight and Back fat at weaning and between day 112 and 114 of gestation was recorded on all sows

Young et al., 2003

Experimental Treatments

1) Breeding Barn manager assessed body condition and set feed drops accordingly every 14 days (Control)

2) Sows we scanned for backfat, feed drops set based on modeled calculations to achieve 19 mm backfat at farrowing (Method 1)

3) Identical to Treatment 2, but thin sows (> 15 mm) were fed to achieve 19 mm by day 36 (Method 2)

Young et al., 2003

Average Daily Feed Intake

<table>
<thead>
<tr>
<th>Feeding Method</th>
<th>Control</th>
<th>Method 2</th>
<th>Method 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Intake, lb</td>
<td>5.7 a</td>
<td>5.1 b</td>
<td>5.1 b</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>a, b P &lt; 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>SED = 0.07</td>
</tr>
</tbody>
</table>

Backfat by Percent of Sows at Farrowing

<table>
<thead>
<tr>
<th>Backfat, mm</th>
<th>&lt;11</th>
<th>11-13</th>
<th>13-15</th>
<th>15-17</th>
<th>17-19</th>
<th>19-21</th>
<th>21-23</th>
<th>23-25</th>
<th>&gt;25</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Sows</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Control Method 2 Method 3

Influence of Backfat at Farrowing on Lactation Feed Intake

<table>
<thead>
<tr>
<th>Backfat, mm</th>
<th>&lt;17</th>
<th>17-21</th>
<th>&gt;21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed Intake, lb</td>
<td>13.2 a</td>
<td>13 a</td>
<td>12.9 b</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>a, b P &lt; 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>SED = 0.3</td>
</tr>
</tbody>
</table>

Influence Subsequent Total Born

<table>
<thead>
<tr>
<th>Backfat, mm</th>
<th>&lt;17</th>
<th>17-21</th>
<th>&gt;21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Born</td>
<td>11.8 a b</td>
<td>12.1 b</td>
<td>11.1 b</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>a, b P &lt; 0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>SED = 0.07</td>
</tr>
</tbody>
</table>
Lactation Feeding

Goals:
- Maximize feed intake
- Prepare sow for rebreeding
- Litter size and prompt return to estrus
- Maximize milk production
- Match nutrient levels to feed intake and level of productivity

Average pig weaning weight (d 16) in two systems

People Make the Difference!

Influence of Lysine and Energy Intake on Milk Yield

Influence of Lysine and Energy Intake on LH Secretion

Influence of energy source in lactation on reproductive hormone secretion

Tokach et al., 1993
How to determine feed intake?
- 3,000 sow farm
- 450 farrowing crates
- 3,615 litters in 6 month period
- Weaning weight = 101 lb at 19 days
- 419 tons of lactation feed used in 6 months
- Meticulous lactation sow feed intake records

How is lactation feed intake calculated?
1) Count feed records for individual sows
   - Count feed records for individual sows = 14.4 lb/day
2) Total feed
   - Total feed = \( \frac{419 \text{ tons} \times 2000 \text{ lb}}{450 \text{ crates} \times 182 \text{ d}} = 10.2 \text{ lb/day} \)
3) Total feed
   - Total feed = \( \frac{419 \text{ tons} \times 2000 \text{ lb}}{3,615 \times 19 \text{ d}} = 12.2 \text{ lb/d} \)

The problems with individual sow feed intake cards
- Takes too much time
- Fewer feedings per day
- Not recorded accurately
- False sense of “knowing what is going on”
- Decreases feed intake and weaning weight

Proposed feeding strategy for lactating sows

<table>
<thead>
<tr>
<th>Amount of feed left in feeder</th>
<th>Morning</th>
<th>Noon</th>
<th>Evening</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empty</td>
<td>2*</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>&lt; ½ scoop</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>&gt; ½ scoop</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*Number of scoops of feed assuming 4 lb of feed per scoop.

Sow Feeder Cards
- Laminated card for display in the farrowing house.
- Outlines our sow lactation feed intake procedure and goals
- Simplifies lactation feeding and keeps fresh feed in front of the sow at all times!

Feed sows at least 3 times per day!
Using Nutrition to Increase Milk Production

- Maximize feed intake during lactation
  - Proper body condition at farrowing
  - Maintain sow comfort
  - Correct feeder design
  - Do not limit consumption

- Match the diet to the level of feed intake and milk production

Dietary Lysine Recommendations

<table>
<thead>
<tr>
<th>Wean wt, lb</th>
<th>Lactation Feed Intake, lb/d</th>
<th>g/d lysine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 21</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>100</td>
<td>1.0</td>
<td>.9</td>
</tr>
<tr>
<td>110</td>
<td>1.1</td>
<td>1.0</td>
</tr>
<tr>
<td>120</td>
<td>1.2</td>
<td>1.1</td>
</tr>
<tr>
<td>130</td>
<td>1.2</td>
<td>1.1</td>
</tr>
<tr>
<td>140</td>
<td>1.2</td>
<td>1.1</td>
</tr>
<tr>
<td>150</td>
<td>1.2</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Common sow diet formulation problems

- Selecting gestation dietary energy level by cost per ton instead of cost per sow per day
- Using expensive fat sources
- Using expensive additives without solid data
- Over-formulation of gestation diets and under-formulation of lactation diets
- Using ingredients with variable quality in lactation diets
- Synthetic amino acids in lactation and gestation diets

Lactation Summary

- Feed intake is king!
  - Maximize intake through whatever means possible.
  - Amino acid level should be matched to the level of sow productivity and intake.

No magic bullets to replace excellent sow management (FEED INTAKE).
What is the ideal weaning age for your system?

How do you value a weaned pig?

• All weaned pigs of some minimal weight are usually considered to be of equal value.
• “Pig” is the common denominator
• Weight is not in equation

Trial Design

• Trial 1 = 12, 15, 18, or 21 days
• Trial 2 = 15.5, 18.5, or 21.5 days
• Nursery Feed Budget (More or Less Complex)
  * No effect (P>0.27) on wean-to-finish performance
• All wean age treatments were weaned from 1 sow farm on same day in same AIAO nursery site, and maintained integrity into AIAO finishing site.
  * Each trial completed in 4 blocks

Each Pen: Replicated Treatment Population

• Wean-to-finish population throughout, costs, and revenue
• Trial 1 = 2,272 wean pigs, with 16 nursery & 24 finisher pens / age
• Trial 2 = 3,456 wean pigs, with 32 nursery & 40 finisher pens / age

Wean-to-Finish ADG

\[
\begin{array}{cccccc}
\text{Wean age, d} & 12 & 15 & 18 & 21 & 15.5 & 18.5 & 21.5 \\
\text{ADG} & 1.28 & 1.36 & 1.40 & 1.51 & 1.49 & 1.54 & 1.59 \\
\text{SE} & \pm 0.02 & \pm 0.01 & & & & & \\
\text{Linear, P<0.001} & & & & & & & \\
\end{array}
\]

Wean-to-Finish Mortality

\[
\begin{array}{cccccc}
\text{Wean age, d} & 12 & 15 & 18 & 21 & 15.5 & 18.5 & 21.5 \\
\text{Mortality, %} & 9.4 & 7.9 & 6.8 & 3.6 & 3.9 & 3.4 & 2.5 \\
\text{Linear, P<0.01} & & & & & & & \\
\text{SE} & \pm 0.95 & \pm 0.50 & & & & & \\
\end{array}
\]

Weight sold / pig weaned

\[
\begin{array}{cccccc}
\text{Wean age, d} & 12 & 15 & 18 & 21 & 15.5 & 18.5 & 21.5 \\
\text{Weight, lb} & 208 & 222 & 230 & 249 & 237 & 246 & 256 \\
\text{Linear, P<0.001} & & & & & & & \\
\text{SE} & \pm 2.89 & \pm 2.43 & & & & & \\
\end{array}
\]
Influence of weaning age summary

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Change per 1 day</th>
<th>Change per 3 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wean weight</td>
<td>.565 lb</td>
<td>1.70 lb</td>
</tr>
<tr>
<td>42 d weight</td>
<td>1.96 lb</td>
<td>5.88 lb</td>
</tr>
<tr>
<td>WF ADG, g</td>
<td>0.02 lb/d</td>
<td>0.06 lb/d</td>
</tr>
<tr>
<td>WF Mortality</td>
<td>-0.42%</td>
<td>-1.26%</td>
</tr>
<tr>
<td>Pounds sold per weaned pig</td>
<td>3.71 lb</td>
<td>11.1 lb</td>
</tr>
<tr>
<td>Cost/cwt, $</td>
<td>-$0.30</td>
<td>-$0.90</td>
</tr>
<tr>
<td>Income over costs per weaned pig</td>
<td>$0.94</td>
<td>$2.82</td>
</tr>
</tbody>
</table>

Main et al., 2002

What happens to profitability for the entire system if you increase weaning age

• Depends on the system.
• If farrowing space is constant, number of pigs produced will decrease.
• Decrease is offset by increased born alive with longer lactation period and more valuable pigs.

Net margin

Add crates

Don’t add crates

What happens to profitability for the entire system if you increase weaning age

• Depend on the system.
• If farrowing space can be increased to produce the same number of pigs, net margin will increase.
  • Improved reproductive performance
  • Older, more valuable pigs