Life Cycle Nutrition
Part II

Life Cycle Nutrition
Nonruminants

Life Cycle Nutrition...

- An individual animal's nutritional requirements change daily
- Requirements for:
  - Maintenance
  - Growth
  - Reproduction

Feeding Management: Weaning-Market

- Feed accounts for 60-70% of the total cost of production
- Things to consider when formulating swine diets:
  - Nutrient requirements of the pigs
  - Available feedstuffs
  - Cost
  - Environmental concerns

Market Hog

Grow-Finish

Feeder Pig

Gestation

Farrowing

Weaning

Breed

338 days

56

56

49

42

21
Growing-Finishing Pigs...
- Pigs exiting nursery-market weight
- ~25-120 kg BW
- 75-80% of the total feed is consumed during this time period
- Factors that influence the pig's nutrient requirement for growth:
  - genetics, sex, health, environment, stage of development

<table>
<thead>
<tr>
<th>Average Genotype</th>
<th>High Lean Genotype</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gilts</td>
</tr>
<tr>
<td>25-40 kg</td>
<td></td>
</tr>
<tr>
<td>Lys %</td>
<td>95</td>
</tr>
<tr>
<td>Lys g/d</td>
<td>15</td>
</tr>
<tr>
<td>Feed Int, kg</td>
<td>1.4-2.3</td>
</tr>
<tr>
<td>Daily gain, kg</td>
<td>0.7</td>
</tr>
<tr>
<td>40-60 kg</td>
<td></td>
</tr>
<tr>
<td>Lys %</td>
<td>92</td>
</tr>
<tr>
<td>Lys g/d</td>
<td>17</td>
</tr>
<tr>
<td>Feed Int, kg</td>
<td>1.8-2.0</td>
</tr>
<tr>
<td>Daily gain, kg</td>
<td>0.8</td>
</tr>
<tr>
<td>60-90 kg</td>
<td></td>
</tr>
<tr>
<td>Lys %</td>
<td>77</td>
</tr>
<tr>
<td>Lys g/d</td>
<td>17</td>
</tr>
<tr>
<td>Feed Int, kg</td>
<td>1.8-2.2</td>
</tr>
<tr>
<td>Daily gain, kg</td>
<td>0.9</td>
</tr>
<tr>
<td>90 kg-mkt</td>
<td></td>
</tr>
<tr>
<td>Lys %</td>
<td>57</td>
</tr>
<tr>
<td>Lys g/d</td>
<td>17</td>
</tr>
<tr>
<td>Feed Int, kg</td>
<td>2.0-4.0</td>
</tr>
<tr>
<td>Daily gain, kg</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Growing-Finishing Pigs...
- The rate and composition of weight gain affects amino acid and energy needs of the pig
  - Rapid lean gain → increased AA need
  - Lean deposition requires less energy than fat deposition

Growing-Finishing Pigs...
- Lean deposition requires less energy than fat deposition
  - 1 kg of muscle deposited requires ~ 2.23 Mcal of energy
  - 1 kg of body fat deposited requires ~ 10.30 Mcal of energy

Genetics
- Pigs differ in their genetic potential to deposit lean (muscle) and adipose tissue (lipid)
- Some genotypes have the potential to gain both of these body component tissues rapidly throughout the grow-finish period
- Others gain both slowly
- Others may have a more rapid growth of lean or fat

Sex Effects...
- Gilts and barrows differ in their pattern of lean and fat deposition
- Gilts usually have higher daily lean gain and larger loin eye areas
  - Result is that gilts have a higher percent lean in carcass at slaughter
  - Difference in carcass composition between barrows and gilts is affected by genetic line
Sex Effects...
- Barrows tend to consume more feed than gilts
  - Therefore, they consume more energy
  - Extra energy is stored as fat
  - Because of higher feed intake, and slightly lower lean accretion rate, barrows require slightly lower amounts of amino acids in their diet than gilts

Split-Sex Feeding....
- Because of differences in lean and fat accretion rates and feed intake, split-sex feeding is recommended
  - This allows for more precise diet formulation

Stage of Maturity...
- Expressed as daily needs, nutrient requirements increase with age or maturity, but expressed as a percent of the diet, nutrient needs decrease.

Nutritional Requirements for Growth

Phase feeding...
- Because nutrient requirements change with age or maturity, feeding several diets (phase feeding) during the grow-finish period is recommended
  - Lower feed costs
  - Lower nutrient excretion
Environmental Temperature...

- Ambient temperature can affect feed intake and thus nutrient requirements
- The digestion and metabolism of the major nutrient groups (carbohydrates, fats, proteins) provide the animal with both chemical and heat energy.
- The heat produced is used by the pig to maintain body temperature.

Environmental Temperature...

- Cold temperatures → increase feed intake
- Hot temperatures → decrease feed intake

Environmental Temperature...

- Dietary fat has a lower production of metabolic heat than dietary fiber.
  - Therefore, response to added fat is greater during times of high environmental temperature
  - Whereas, fiber can be detrimental during times of high environmental temperature

Response of Pigs to Fat Supplementation as Influenced by Seasonal Conditions

<table>
<thead>
<tr>
<th>Weekly Max Air Temp</th>
<th>Winter 4°C</th>
<th>Summer 29°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Response due to Addition of 5% Fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight Gain</td>
<td>+0.9</td>
<td>+8.3</td>
</tr>
<tr>
<td>Feed Efficiency</td>
<td>+8.5</td>
<td>+11.3</td>
</tr>
<tr>
<td>ME Intake</td>
<td>-1.3</td>
<td>+2.7</td>
</tr>
<tr>
<td>Gain/ME Intake</td>
<td>+2.2</td>
<td>+5.1</td>
</tr>
<tr>
<td>Backfat</td>
<td>-2.1</td>
<td>+2.9</td>
</tr>
</tbody>
</table>

Stahly, 1981

Herd Health...

- High Health → Increased ADG and feed efficiency
- High Health Status pigs are more likely to reach their genetic potential for growth
- High Health Status pigs gain lean more rapidly, but they also deposit fat at a faster rate

Relative Response of Pigs Housed in a Cold, Warm or Hot Environment to Fat Supplementation

<table>
<thead>
<tr>
<th>5% Fat</th>
<th>10°C</th>
<th>23°C</th>
<th>35°C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>%</td>
<td>%</td>
<td>%</td>
</tr>
<tr>
<td>Change</td>
<td>Change</td>
<td>Change</td>
<td>Change</td>
</tr>
<tr>
<td>Weight Gain</td>
<td>99 99 99 99</td>
<td>109 109 109 109</td>
<td>66 75 75 75</td>
</tr>
<tr>
<td>Feed Eff</td>
<td>89 89 89 89</td>
<td>100 100 100 100</td>
<td>88 100 100 100</td>
</tr>
<tr>
<td>ME Intake</td>
<td>114 114 114 114</td>
<td>103 103 103 103</td>
<td>72 77 77 77</td>
</tr>
<tr>
<td>Gain/ME Intake</td>
<td>86 86 86 86</td>
<td>100 100 100 100</td>
<td>88 94 94 94</td>
</tr>
<tr>
<td>Backfat</td>
<td>93 93 93 93</td>
<td>106 106 106 106</td>
<td>85 92 92 92</td>
</tr>
</tbody>
</table>

Herd Health...
- Antibiotics and other “growth promoting” compounds in the diets of grow-finish pigs usually elicit an improvement in gain and feed efficiency.
- Probably due to the control of subclinical disease
- Response usually decreases with age/maturity
- Antibiotics should not be used as a substitute to good management
- Antibiotics may be more stringently regulated in the future

Feed Wastage...
- Hard to measure...
- General rule of thumb:
  - If feed is observed outside of the feeder, at least 10% of the feed is being wasted
- Feeder selection and proper feeder adjustment are crucial
  - ⅛-½ the bottom of the pan should be lightly covered with feed → no more!!!

Feed Wastage...
- Liquid feeding systems have been shown to reduce feed wastage and improve feed efficiency
  - However, increased labor intensity of such a system makes them less attractive
  - Water wastage may also decrease
    - Need to monitor mold build-up in the feeder

Feed Wastage...
- Wet/Dry feeders may provide a more viable alternative to wet systems, that retain some of the benefits of a wet system.

Drinkers and Feeders
- Exp 1
  - Wet/dry    Dry
    - Water, gal/d 1.19 1.60
    - Manure, gal/d 1.31 1.86
      - (Summer)
    - Water:Feed 1.78 2.79

Ca and P...
- Environmental concerns
- Ca and P in the diet can be greatly reduced in the last 4-6 wks of finishing without negatively impacting performance
- However, there are concerns about possible increases in bone breaks in the packing plant if this practice is taken too far to the extreme.
Phytate P

Phytate P

Phytase...

Phytases are phosphatases that specifically cleave phosphate from phytate

Commercially Available Phytases

Benefits of adding phytase...

Increase P retention
Decrease P excretion
Increase ADG
Increase feed intake
Increase energy digestibility?
Increase amino acid digestibility?

Synthetic Amino Acids...

Lysine
Methionine
Threonine
Tryptohan

Specialty Grains...

GMO plants
High oil corn
Contains 2-4% additional oil
Therefore, higher ME value

Grower Pig Diets with High Oil Corn Varieties

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final wt, kg</td>
<td>39</td>
<td>40</td>
<td>39</td>
<td>40</td>
</tr>
<tr>
<td>Av Daily Gn, kg</td>
<td>.68</td>
<td>.74</td>
<td>.70</td>
<td>.72</td>
</tr>
<tr>
<td>Gain/Feed</td>
<td>.39</td>
<td>.43</td>
<td>.42</td>
<td>.42</td>
</tr>
</tbody>
</table>

Initial wt 20 kg, 28 day trial
Adede 1996
Specialty Grains...
- Low Phytic Acid Corn
  - Increased P availability
  - Not yet commercially available

Feed Processing...
- Particle size

Feed Processing...
- Pelleting
  - Improves feed efficiency by ~4-6%

Diet Digestibility

Pelleted vs Meal Diets

Feed/Gain

Pelleted  Meal

Pelleting

Improved feed efficiency is the result of a decrease in feed wastage, and a slight improvement in digestibility.