Meeting the Protein and Amino Acid Needs of Swine

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All pigs require protein, which consists of amino acids. Amino acids are used for maintenance, growth, gestation, and lactation. Pigs actually do not have a protein requirement, but quality protein provides the amino acids which are required. While some amino acids are synthesized by the animal, the essential ones cannot be synthesized at a rapid enough rate to permit normal growth. These must be provided in the feed. See Table 1 for the essential amino acids and their requirements for growing and finishing pigs.

During digestion, protein breaks down into individual amino acids. The animal then absorbs amino acids from the intestines. Then, the amino acids are recombined within the body tissue into new protein molecules. When you formulate swine diets, keep in mind that most cereal grains are deficient in lysine, tryptophan and threonine. Lysine is commonly the most limiting amino acid. Evaluate protein sources primarily on the ability to correct these deficiencies, particularly that of lysine. See Table 2 for the approximate contents of some of the more important amino acids in common feeds.

**Sources of protein supplement.** Soybean meal does an excellent job of supplementing cereal grains to meet the amino acid requirements of pigs. Other protein sources can be successfully included in the swine ration depending on their cost and quality.

There are limitations to the amounts you should add to the swine rations. These limitations have to do with palatability, levels of amino acids, and price. For example, you should limit meat meal to 40 to 50 percent of the total supplement, and

<table>
<thead>
<tr>
<th>Table 1. Protein and amino acid requirements for growing pigs and sows.</th>
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</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td></td>
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<tr>
<td>Protein</td>
</tr>
<tr>
<td>Arginine</td>
</tr>
<tr>
<td>Histidine</td>
</tr>
<tr>
<td>Isoleucine</td>
</tr>
<tr>
<td>Leucine</td>
</tr>
<tr>
<td>Lysine</td>
</tr>
<tr>
<td>Methionine + cystine&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Phenalalnine + tyrosine&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Threonine</td>
</tr>
<tr>
<td>Tryptophan</td>
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<td>Valine</td>
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<sup>1</sup>NRC, 1979, Nutrient Requirements of Swine.
<sup>2</sup>Methionine can fulfill the total requirement; cystine can meet 50 percent of the total requirements.
<sup>3</sup>Phenalanine can fulfill the total requirement; tyrosine can meet 50 percent of the total requirements.
Table 2. Essential amino acid content of commonly used swine feeds.¹

<table>
<thead>
<tr>
<th>Grains</th>
<th>Arginine</th>
<th>Histidine</th>
<th>Isoleucine</th>
<th>Leucine</th>
<th>Lysine</th>
<th>Methionine</th>
<th>Cystine</th>
<th>Phenylalanine</th>
<th>Tyrosine</th>
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<td>2.65</td>
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<td>1.72</td>
<td>1.13</td>
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<td>.29</td>
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<td>.38</td>
<td>.38</td>
<td>.29</td>
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<td>Wheat midds, standard</td>
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<td>.63</td>
<td>.37</td>
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<td>Whey, dried whole</td>
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<td>.16</td>
<td>.72</td>
<td>1.00</td>
<td>.80</td>
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<td>.24</td>
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<td>.16</td>
<td>1.03</td>
<td>.13</td>
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<td>1.52</td>
<td>2.12</td>
<td>.50</td>
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</table>

¹Pork Industry Fact Sheet, 5.

cottonseed meal to 10 to 15 percent of the total supplement. Although meal is an excellent protein source, it is often limited because of cost.

Calculating grain protein ratios. Use Table 3 as a quick way to determine the approximate ratio of grain and supplement needed to provide a given protein level. For example, if you need a 16 percent ration for 50- to 75-pound pigs, and if you are using a 32 percent commercial supplement, Table 3 shows that 1,392 pounds of corn and 608 pounds of supplement are required to make up a ton of 16 percent total ration. Thus, you need 2.28 pounds of grain for each pound of supplement. If the supplement was 44 percent soybean meal, the ratio would be 4 pounds of grain to 1 pound of the 44 percent supplement.

Buying protein supplement wisely. In general, as the percentage of protein increases in a supplement, price per pound of protein decreases. However, price is not the only factor to consider when buying protein. A quality or balance of amino acids and other factors should also be considered. Also commercial supplements often contain minerals, vitamins, and may contain antibiotics and medicants for use with home-grown grains. These add to the cost of the ration. Consider these costs when comparing the complete supplement price with soybean meal. Have a general idea of the total cost of these nutrients per ton of feed so you can more accurately compare the costs of home-mixed and commercial supplements.

Keep in mind, however, in comparing sources of protein that the major nutrient you’re purchasing is protein. A good method of making a cost comparison is on the basis of cost per pound of protein.

Table 4 allows you to make quick comparisons of two supplements or a comparison with soybean meal.

Use of synthetic amino acids. Researchers have clearly demonstrated that supplemental lysine can significantly reduce the amount of high quality soybean meal needed. Be aware of the price per unit of lysine in the synthetic sources as compared to the natural source. With the use of synthetic lysine, you can decrease the dietary protein level without affecting performance. As a rule, 3 pounds of lysine monohydrochloride plus 97 pounds of grain can
replace 100 pounds of 44 percent soybean meal. If the supplemental lysine plus the grain is cheaper than 44 percent soybean meal, the cost of the diet can be reduced by using supplemental lysine.

**High lysine corn.** Opaque-2 corn is higher in lysine and tryptophan than regular hybrid corn, but its protein level is similar to regular corn. You can balance rations successfully on the actual lysine content of high amino acid grain. Have an analysis taken since there is considerable variation among high lysine varieties. Make decisions concerning the use of Opaque-2 corn in swine rations on the basis of economics, yield characteristics, and lysine content of the particular variety available.

**Table 3. Grain-supplement ratios for different swine rations.**

Shows the amount of supplement needed at different percent levels to formulate 2,000 pounds of ration with different levels of protein.

(Shelled corn figured at 9 percent protein.)

<table>
<thead>
<tr>
<th>Percent protein in total ration</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>22</th>
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<tbody>
<tr>
<td>Percent protein in supplement</td>
<td>grain (lb.)</td>
<td>1,714</td>
<td>1,620</td>
<td>1,524</td>
<td>1,428</td>
<td>1,334</td>
<td>1,144</td>
<td>952</td>
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<tr>
<td>suppl. (lb.)</td>
<td>286</td>
<td>380</td>
<td>476</td>
<td>572</td>
<td>666</td>
<td>856</td>
<td>1,048</td>
<td>1,238</td>
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<tr>
<td>lb. grain/lb. suppl.*</td>
<td>6.00</td>
<td>4.25</td>
<td>3.20</td>
<td>2.50</td>
<td>2.00</td>
<td>1.33</td>
<td>0.91</td>
<td>0.62</td>
</tr>
<tr>
<td>grain (lb.)</td>
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<td>1,636</td>
<td>1,546</td>
<td>1,454</td>
<td>1,364</td>
<td>1,182</td>
<td>1,000</td>
<td>818</td>
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<td>suppl.</td>
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<td>364</td>
<td>454</td>
<td>546</td>
<td>636</td>
<td>818</td>
<td>1,000</td>
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</tr>
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<td>4.30</td>
<td>3.40</td>
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<td>1,416</td>
<td>1,250</td>
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<tr>
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<td>416</td>
<td>500</td>
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<td>750</td>
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<td>846</td>
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<td>600</td>
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<td>866</td>
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<td>5.00</td>
<td>4.00</td>
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<td>788</td>
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Table 3. Continued.

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Table 4. Cost per pound of protein at various percentages and prices.

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