

## Nutrients for Pigs

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Like all animals, pigs need nutrients for life. Pigs are typically provided nutrients as a mixed and balanced diet. Diets that are insufficient or excessive cause unsatisfactory performance. Because 60-70 percent of production cost is feed costs, understanding the basic nutritional needs of the pig and how to meet them is important. To determine the appropriate diet for a given pig, body size, productivity, genetic potential, and environmental conditions must be considered. This leaflet discusses the nutritional requirements of pigs in terms of four broad categories: water, energy, amino acids, and vitamins and minerals.

### Water

Drinking water, offered free choice, is usually the major source of water for pigs. Important considerations for drinking water are quality, delivery rate, and drinking spaces needed.

Waterers should be checked daily. Damaged and dirty waterers should be repaired or cleaned immediately. Trough waterers commonly are used by niche producers and may become clogged with bedding or feed if not cleaned regularly. Water quality assessments should be performed as part of site selection for pig production (Table 1). Corrective measures such as filters or additives may be effective in some cases of poor quality water.

If water pressure is not sufficient in nipple waterers (Table 2), pigs will compensate by spending more time drinking. However, if there are not enough drinking spaces in a particular pen, some pigs will be deprived of water. It is recommended that at least two sources of water be provided to pens of pigs. This way

even if one waterer becomes clogged or dominated by a few animals, the other still will be available for use.

**Table 1. Water quality assessment factors for pig drinking water<sup>1</sup>.**

Measure	Safe Level (ppm)
Total dissolved solids	3000
Nitrates	100
Nitrites	10
Sulfate	1000
Calcium	1000

<sup>1</sup>Adapted from Swine Nutrition 2<sup>nd</sup> edition, 2001.

**Table 2. Flow rate and pigs per drinking space<sup>1</sup>.**

Size of Pig	Flow rate (pints/min)	Pigs per 12 inch trough
15-50 lb	2-3	40
50-150 lb	3-4	25-35
>150 lb	4	25
Lactating sow	5	12

<sup>1</sup>Adapted from Garth Pig Stockmanship Standards, 1998.

### Symptoms of water deprivation in pigs<sup>1</sup>.

- ◆ Reduced feed intake.
- ◆ Crowding around waterer.
- ◆ Pigs agitated and irritable.
- ◆ Tail biting.
- ◆ Diarrhea in piglets.
- ◆ Increased heart rate and body temperature.

<sup>1</sup>Adapted from Swine Nutrition 2<sup>nd</sup> edition, 2001.

As temperatures increase, water consumption increases. While it is of little practical use to precisely calculate water

requirement for pigs with a goal of minimizing water consumption, Table 3 provides guidelines that might be beneficial when sizing well pumps or planning water use.

**Table 3. Predicted water intake by pigs<sup>1</sup>.**

Type of Pig	Gallons per day
Lactating sow	6.5 – 11
Gestating sow	2.5 – 5.3
Growing pigs < 40 lb	Dry feed intake x 1.3 <sup>2</sup>
Growing pigs > 40 lb	Dry feed intake x 1.6 <sup>2</sup>

<sup>1</sup> Adapted from Whittemore's Science and Practice of Pig Production. 3<sup>rd</sup> edition, 2006.

<sup>2</sup> See IPIC NPP330 2007: Feed and Growth.

### Energy

Pigs need energy to grow. Energy in pig diets usually is supplied by carbohydrate sources such as corn or small grains. Corn and other feed grains provide energy as starch.

Fats and oils (or lipids) provide dense sources of energy that also are readily utilized as energy by pigs. Pound for pound fats provide 2.25 times more energy than carbohydrates. Factors such as cost and meat quality implications should be considered when using fats and oils.

The energy concentration of a diet determines feed intake. Pigs eat feed until they have consumed adequate energy to meet their daily needs. If pigs are fed low energy diets, their gut capacity may limit growth. This typically is not a concern for producers feeding corn-soybean meal diets, but might become an issue when feeding forages to growing pigs.

### Amino Acids

Amino acids are necessary for pigs to build muscle tissue. Amino acids are obtained from proteins in feed. There are 20 different amino acids that are required to make muscle. The pig cannot manufacture 10 of these amino acids. Pigs must gain

these amino acids by eating feeds that contain them. Amino acids that must be eaten are called essential amino acids. Amino acids are required in proportion relative to each other. Supplying 19 amino acids in excess but not enough of the remaining one will limit growth and production. The amino acid found in least abundance relative to the pig's requirement is called the first limiting amino acid. In typical pig diets, lysine is usually the first limiting amino acid, followed by tryptophan, threonine, and methionine.

Crude protein is not a true measure of amino acid content of a feed. Rather it is a measure of the amount of nitrogen present in a particular sample. Crude protein can be used as a preliminary estimate of the amino acid content of a feed.

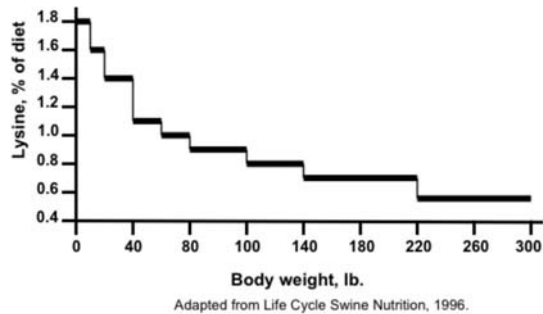
Not all amino acids present in a feed are available to the pig. If subjected to high heat, protein and starch will become indigestible by pigs. Heat damaged corn or soybean meal should be avoided for this reason.

Feed intake is determined by the energy concentration of the diet. Sufficient amino acids must be present in the diet to support muscle growth at the level of feed consumed. For pigs less than 110 pounds, the pig's ability to deposit muscle generally exceeds its ability to consume sufficient feed to meet those needs. Thus pigs less than 110 pounds should be fed diets with more concentrated levels of amino acids than older pigs. The lysine requirement of pigs as a percentage of the diet is shown in Figure 1.

Protein fed in excess of the needs of the pig is excreted as urea. Once excreted, urea is broken down by microbes into ammonia and other forms of nitrogen. Feeding excess protein to pigs is an inefficient way to increase delivery of nitrogen to crop land. While energy feeds (corn) are typically the main component of diets, protein feeds (soybean meal) also are a major part of the

diet. Matching amino acids supplied with muscle growth allows for less costly diets to be formulated.

**Figure 1. Lysine requirements of pigs, % of diet.**



### Vitamins and Minerals

Vitamins and minerals also are required by pigs. Most feed suppliers offer vitamin and trace mineral mixes that have been formulated to meet the requirements of pigs at different stages of growth. Careful attention must be paid to storing vitamin and mineral premixes because their effectiveness may decrease if not stored in accordance with manufacturers' instructions.

Macro-minerals important to pig producers are calcium, phosphorus, and sodium. Calcium and phosphorus are linked. Both are major components of bone. Calcium and phosphorus are deposited in bone at a ratio of 2.2:1. Availability of these minerals depends on the feed source as well as mineral status of the body. In general, the ratio of dietary calcium to available phosphorus should not exceed 2.5:1.

Phosphorus is found in many feeds. Unfortunately plants typically store phosphorus in an inaccessible form -- phytate. Pigs do not make the enzyme phytase and therefore cannot use much of the phosphorus found in grain. Inorganic

sources of phosphorus such as dicalcium phosphate are readily available to the pig, however they can be costly. Synthetic phytase is available and can be fed in some niche markets. Including synthetic phytase in pig diets allows pigs to utilize the phosphorus naturally found in feeds and in turn reduces the need for including phosphorus supplements and ultimately reduces phosphorus excretion.

Sodium is usually supplied as common salt. Salt is widely used in diets at the level of 0.3%. Although salt is relatively inexpensive, dietary levels of common salt above 1% may cause salt toxicity, especially if water is restricted, and should be avoided.

### Additional Resources

Iowa State University Extension. 1996. Life Cycle Swine Nutrition. PM-489. Iowa State University. Ames.

Jurgens, Marshall H. and Kristjan Bregendahl. 2007. Animal Feeding and Nutrition 10<sup>th</sup> Edition. Kendall/Hunt Publishing Company. Dubuque, IA.

Lewis, Austin J. and L. Lee Southern editors. 2001. Swine Nutrition 2<sup>nd</sup> Edition. CRC Press. Boca Raton, FL.

Morrison, F.B. pre-1950. Feeds and Feeding. The Morrison Publishing Company. Ithaca, NY.

National Research Council. 1998. Nutrient Requirements of Swine 10<sup>th</sup> Edition. National Academy Press. Washington, DC.