



Swine Fact Sheet

Animal and Dairy Sciences

Auburn University



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EVALUATING ALTERNATIVE FEEDSTUFFS FOR SWINE

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Introduction

A properly formulated swine diet will meet the daily requirements for protein and amino acids, energy, minerals and vitamins. In the United States, grain, primarily corn, wheat and grain sorghum, provide 45 to 65 percent of the protein and 80 to 90 percent of the energy. Soybean meal provides the remaining 35 to 55 percent of the protein and 10 to 20 percent of the energy. Fat, typically animal fat or a blend of animal and vegetable fat, are often used to increase the energy density of the diet. Vitamins and minerals are added either as individual ingredients, or in premixes and basemixes. With a relatively inexpensive supply of grain and soybean meal, there is little incentive to consider the use of alternative feed ingredients that may not support the level of performance expected from grain-soybean meal diets.

In areas of the United States outside of the main grain producing areas, the use of alternative feed ingredients is not only considered, but is an integral part of competitive feeding programs. Some alternatives, such as other grains, meat by-products, by-products of the brewing and distilling industries, and plant protein products, are readily available and have been extensively evaluated. Others are not as available and must be evaluated as the material becomes available for feeding. A thorough evaluation of these

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potential ingredients should include availability, nutrient content and quality, handling and cost.

Availability

Before a potential feed ingredient is considered for use, there must be an adequate supply to warrant further evaluation. For example, a full evaluation of citrus pulp may not be necessary when there are only 50 kilograms and 100 pigs to feed. A detailed analysis of an ingredient is costly and time consuming. Without a significant supply of the ingredient, it is difficult to justify the cost and time for evaluation.

Nutrient Content

Once the availability of a potential feed ingredient has been established, the next step is a thorough evaluation of the nutrient content. Initially, a simple analysis consisting of crude protein, moisture and ash is needed to classify the product and determine the next course of action. Products that may provide a significant portion of the protein and amino acids (greater than 30 percent of daily intake) should be subjected to an amino acid analysis. An analysis of calcium, phosphorus and trace minerals is needed for products with 1 percent or more ash.

The energy content of a product is much more difficult to determine directly. It can, however, be estimated from a chemical analysis. A measure of fiber (crude fiber or acid detergent fiber), moisture and ash will eliminate the components with little or no energy content. Protein contains more gross energy than starch, but it must be broken down for use as energy. The metabolizable energy of a product, therefore, may decrease as the crude protein increases. Fat has a gross energy content of 9.6 kilocalories per gram. The metabolizable energy content of fat ranges from 7.28 (vegetable source) to 7.8 (animal source) kilocalories per kilogram. Starch contains 4.2 kilocalories of gross energy and 4 (corn) kilocalories of metabolizable energy per gram. Based on these estimates and the chemical analysis, a crude estimate of metabolizable energy can be

determined. The estimates can be verified by comparing with an ingredient of similar nutrient content and established energy content.

Another method for estimating the energy content of a plant or animal product is density. Density is the ratio of weight per unit of volume: grams per liter. Fiber is bulky, therefore less dense than other nutrients. If a product is high in fiber, the density will be low and the energy content should also be low.

Nutrient Quality

Unlike the nutrient content, nutrient quality is difficult to determine. It is possible to estimate protein quality from the balance of amino acids, but the true measure of quality is the amino acid digestibility. High temperature processing (drying) can reduce the amino acid digestibility significantly. The physical form of the product can affect the digestibility amino acids and starch. Coarse ground grain, for example, has lower starch and amino acid digestibilities than fine ground grains when measured at the terminal ileum. The particle size does not allow for adequate digestion in the small intestine.

The source of the product will also have an effect on nutrient quality. Phosphorus from plant sources has a lower availability than from animal or mineral sources. Many plants contain phytic acid, which binds phosphorus. Meat products are more susceptible to high temperatures: amino acid, especially tryptophan, can be reduced.

Handling

If the availability, nutrient content and quality justify further evaluation, the next question is handling. Ideal handling qualities depend on available facilities for transporting, storing and feeding, as well as the physical form of the final swine diet.

A potential feed ingredient must be delivered to the farm with a minimum of effort. Extremely bulky ingredients are difficult to move in large quantities because of the low density. Ingredients with a high moisture content can also be difficult. For example, stillage is a by-product of ethanol production. In its raw form, it is 96 to 98 percent moisture. Transporting this product requires a water tight vehicle. Wet sugar

beet pulp averages 87 percent moisture, resulting in a very dense product. In both cases, the majority of the weight hauled is water.

Storage qualities of a product also depend on density and moisture content. Bulky ingredients require more space for storage. Products with 16 to 25 percent moisture can spoil, reducing the nutrient quality over time. With high moisture products (over 25 percent moisture), fermentation is possible, with the subsequent production of volatile fatty acids. These can be caustic and will destroy metal or wooden bins over time.

The physical form of the desired final swine diet will determine the usefulness of many potential feed ingredients. Feeding programs vary greatly, but can be divided into two main groups: complete mixed feeds and supplemented individual ingredients. A complete mixed feed contains everything the animal needs for growth, maintenance and production. All ingredients are mixed, and the final feed is either hand-fed or fed free choice. Some ingredients are best fed individually, not mixed with the remainder of the diet. Other required nutrients are provided as a supplement.

Including dry products in a complete swine feed is possible. The addition of products with more than 15 to 20 percent moisture will dilute the nutrient density, increase feed conversion and depress growth if included at high levels. These products can, however, be fed free choice or hand fed as long as other essential nutrients are supplemented.

Summary

An ideal feeding program for swine takes into account the nutrient needs of the animal you are feeding, the available feeding facilities and all available feed ingredients. Diets with a high nutrient density (grain-soybean meal) will support maximum performance for most classes of swine. There are cases, however, when maximum performance is not the goal. It is these cases where the use of many alternative feed ingredients best fits.

Before an ingredient is used in swine feeding, it must be available for use. Next, you must determine the nutrient content and quality. If the ingredient will support the desired level of pig performance, you must have the facilities to transport, store and feed the product. Finally, can you include the product in a feeding program that fits your labor supply, facilities and the product you are trying to produce.