Relative Values of Feedstuffs for Swine - Pork Industry Handbook
Michigan State University Cooperative Extension Service
Emmett J. Stevermer, Iowa State University; C. Ross Hamilton, S. Dakota State University; Nathan T. Moreng, University of Idaho; Matthew J. Parsons, Hadley, Massachusetts; T. D. Tanksley Jr., Texas A&M University
Issued May 1988
2 pages

Extension Bulletin E-2140
May 1988 (New)

pork industry handbook

Cooperative Extension Service • Michigan State University

Determining the Relative Value of Feeds for Swine

Authors
Emmett J. Stevermer, Iowa State University
C. Ross Hamilton, S. Dakota State University
Nathan T. Moreng, University of Idaho
Matthew J. Parsons, Hadley, Massachusetts
T. D. Tanksley Jr., Texas A&M University

Reviewers
Frank Bischoff, Fallon, Nevada
Joe Crenshaw, N. Dakota State University
Louis Malkus, University of Connecticut
Gary Parker, University of Kentucky
Gerald Shurson, Ohio State University

Introduction

Research work conducted during the previous 50 years has defined the nutrient requirements of swine for most stages of production. Nutrient analyses of various feedstuffs indicate that there are a large number of feed ingredients that could be used in swine diets to meet the nutritional requirements of pigs. However, the price relationships among the various ingredients may vary considerably during any given season, year, or locality; and as a result, opportunities to reduce feed costs by substituting one feed ingredient for another often occur. But even so, feed manufacturers and pork producers must evaluate the cost effectiveness and feeding value of various ingredients in order to formulate cost effective and nutritionally adequate swine diets.

Least-Cost Formulations

Linear programs on computers have made it possible to design diets that will meet all minimum nutritional requirements of swine at the least cost. Least-cost formulation techniques are helpful to feed manufacturers and pork producers who maintain inventories of a large number of ingredients or who frequently purchase and sell large quantities of them. Least-cost formulating is of limited value to pork producers who have limited access to many ingredients or have processing systems designed to handle only a small number of ingredients. Least-cost programs usually select the combination of ingredients that give the lowest cost for the diet, not necessarily the ones that result in the lowest cost per unit of gain.

Least-Cost Alternatives

Energy sources, protein, and phosphorus are the three most costly items of the total diet. Ingredients which supply energy make up the major portion of any swine diet and usually account for the majority of the cost of that diet. Feed grains are typically used as the major source of dietary energy for all classes of swine. Each type of grain has certain unique physical and chemical characteristics which affect its value as swine feed. Other publications in the PIH series (provided at the end) deal with limitations and special precautions that need to be recognized when using one or more alternative feeds in swine diets.

The second major cost of diets is incurred from supplemental proteins. Actually, it is the lysine in the protein source that determines the amount of the protein source needed in most swine diets. Lysine is the essential amino acid most likely to be deficient in grain-based diets fed to swine. The percentage of lysine found in grain varies considerably, and it is not directly related to the percentage of protein found in the grain. Because of this, swine diets should be formulated and ingredients evaluated on a lysine rather than protein basis.

The third major contributing factor to the total diet cost is the supplemental phosphorus source. There is considerable variation in the availability of phosphorus in feedstuffs. If the *available* phosphorus values of the ingredients and the requirements, expressed on the same basis, for the pigs are known, they should be used in determining the relative value of potential feedstuffs.

In addition to sources of energy, lysine, and phosphorus, other ingredients contribute to the cost of the diet, but their contribution is relatively small because of the small amounts used and/or the ingredients are not very expensive. Vitamins, trace minerals, salt, and calcium fit into this category. The vitamin content of grains and supplemental protein sources is variable, and their content may decrease rapidly during storage. Therefore, the vitamin content of stored feedstuffs may be of little nutritional value. Feed additives, such as antibiotics and chemotherapeutics, also contribute to the total cost of the diet. The decision of which feed additives to use and when they should be used is dependent upon the cost effectiveness of including feed additives in swine diets.

In the major swine producing regions, there are usually one or two major sources of energy and only two or three ingredients used as sources of supplemental protein. In the corn belt, corn is often the most economical source of energy for swine diets, and soybean meal is usually the most economical source of supplemental protein. Generally, the most economical standard phosphorus source for swine diets is dicalcium phosphate. The producer must decide whether alternative feed ingredients might be used in place of those that are most readily available. For example, is corn a more economical feed ingredient than oats? There are nutrient-compositional differences between the two feedstuffs, but for all practical purposes, it is the energy content, lysine, and phosphorus differences that contribute to their value in swine diets. Therefore it is important to determine and compare the economic value of the energy content, lysine, and phosphorus in order to determine which is the more economical feedstuff.

If the prices of the three reference feedstuffs such as corn, soybean meal, and dicalcium phosphate are known, the value of each nutrient can be calculated. These values can then be applied to the composition of each comparable feedstuff to determine the relative value of that feedstuff. The feedstuff that provides the most nutritive value for the least cost is the ingredient to choose. The levels of protein, amino acids, fiber, vitamins, and minerals—as well as the pigs' age—should all be considered when comparing ingredients for use in swine diets.

Calculations

The calculations used to determine values for energy content, lysine, and phosphorus are based upon prices of three diet ingredients and involve the solving of simultaneous equations. Corn, soybean meal (44% protein), and dicalcium phosphate are used as the reference feedstuffs in the example used in Table 1. The example uses metabolizable energy, total lysine, and total phosphorus values of air-dry ingredients. Other ingredients and other prices and composition of the ingredients can be used if desired.

Solving the simultaneous equations for the economic value of energy content, lysine, and phosphorus allows the determination of the value of any potential feed ingredient.

These calculations can be easily handled by programmable calculators and small micro computers and can then be carried out on a regular basis at a minimal cost.

The values at the bottom of Table 1 should be obtained for the respective formulas when ingredient composition values are the same as those used in Table 1.

Using the Values

Whenever a potential feed ingredient can be added to a swine diet at a lower price than its calculated nutritive value, it is an economical substitute for some of the ingredients that were used in making the comparison. For example, if oats would have a nutritive value of $2.51 per cwt. and could be added to a diet at a cost of $2.30 per cwt. ($0.74 per bushel), then one could formulate a more economical swine diet by using some oats and less corn, soybean meal, and dicalcium phosphate. The resulting diet would be lower in energy content and more diet would be required to produce a unit of weight gain, but the diet cost per unit of gain would be less.

Issued in furtherance of Cooperative Extension work in agriculture and home economics, acts of May 8, and June 30, 1914, in cooperation with the U.S. Department of Agriculture. W.J. Moline, Director, Cooperative Extension Service, Michigan State University, E. Lansing, MI 48824.

Table 1. Spreadsheet program for use with micro computers.

Column: Row	A	B	C	D	E
1.	Ingredient	Price/cwt.	Energy	Lysine	Phosphorus
2.		$	kcal/lb.	%	%
3.					
4.	Corn	$ 2.50	1500	.25	.25
5.	Soybean meal (44%)	$10.00	1475	2.88	.60
6.	Dicalcium phosphate	$15.00	0	0	18.50
7.					
8.			(Formula 1)	(Formula 2)	(Formula 3)
9.			(Formula 4)	(Formula 5)	(Formula 6)
10.					
11.	Value of lysine, $/lb.			(Formula 7)	
12.	Value of phosphorus, $/lb.				(Formula 8)
13.	Value of energy, $/kcal/lb.		(Formula 9)		
14.					
15.	Composition of feed in question:		1220	.34	.33
16.	Relative value of above feed:	(Formula 10)			

Formulas for the above locations

		Values
Formula 1:	@SUM(D4...D6)/@SUM(C4...C6)	0.0011
Formula 2:	@SUM(E4...E6)/@SUM(C4...C6)	0.0065
Formula 3:	@SUM(B4...B6)/@SUM(C4...C6)	0.0092
Formula 4:	((C4*D8)-E4)	9.5063
Formula 5:	((C4*C8)-D4)/C9	0.1397
Formula 6:	((C4*@SUM(B4...B6)/@SUM(C4...C6))-B4)/C9	1.1956
Formula 7:	((C5*E8)-B5-(E9*C5*D8)+(E9*E5))/(((C5*C8)-D5)-(D9*C5*D8)+(D9*E5))	2.7540036
Formula 8:	(B4+(C4*((D11*C8)-E8)-(D11*D4)))/(E4-(C4*D8))	0.8108108
Formula 9:	(@SUM(B4...B6)/@SUM(C4...C6))-(C8*D11)-(D8*E12)	0.0010725
Formula 10:	(C15*C13)+(D15*D11)+(E15*E12)	2.51

5:88-3M-New-SDC/RP-Price: 15¢ - Single copy free to Michigan Residents.