



SWINE NUTRITION

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Although swine nutrition has been extensively studied throughout the world, by no means do we have all the answers. The challenge to the swine nutritionist is to help swine and producers provide consumers with a high quality product at a reasonable price and profit.

Swine feeds make up about 70% of the total costs of pork production, therefore the producer should have a basic working knowledge of swine nutrition if he is to maximize profits.

Pigs require a well-balanced diet if they are to efficiently fulfill their basic function of reproduction and meat production. The basic nutrient needs of hogs are *protein, energy, minerals, vitamins* and *water*. Each nutrient has particular functions to perform in the body. If not present at proper levels, any nutrient can limit maximum performance. The pig is more sensitive to a poorly-balanced ration than are cattle and sheep because:

1. He grows extremely fast considering his body weight.
2. The highly concentrated ration he requires does not always provide sufficient amounts of essential nutrients.
3. He is a single stomached animal, so he does not have the ability to synthesize all the essential nutrients.

Protein Requirements

Protein is a very important nutrient in a ration because it supplies the building units (amino acids) which are necessary for building body tissue. There

are 23 known amino acids of which 10 are considered essential or must be supplied in the diet at a particular level if optimal performance is to be expected.

The pig has a specific need for each of the 10 amino acids and needs vary with age and size. Therefore, the pig must be fed sufficient amounts of protein, but the protein he consumes must be of high enough quality that it supplies the proper amount of each of the 10 essential amino acids.

Because most commonly used cereal grains are deficient in both

amount of protein and quality of protein, higher quality protein feeds must be included in the ration. Table 2 lists some of the more commonly used protein feeds, their percent protein and limiting factors.

Some larger producers can make significant savings in feed cost by buying and mixing their own supplements. However, most farmers purchase supplements containing 30 to 40% protein and the necessary minerals, vitamins and feed additives, which supplement grains completely.

Table 1. Protein and limiting amino acids requirements for pigs of various ages expressed as a percentage of the total ration.¹

Protein and amino acids	Live weight and class				
	Starter 10 - 40	Grower 40-125	Finisher 120-mkt. wt.	Bred sows, gilts	Lactating sows, gilts
% Crude Protein ²	20	13-15 ³	14	12	16
Amino Acids ⁴					
Lysine	0.86	0.74	0.60	0.42	0.74
Methionine + cystine ⁵	0.73	0.50	0.30	0.28	0.36
Tryptophan	0.18	0.12	0.07	0.07	0.13
Threonine	0.66	0.51	0.45	0.39	0.37

¹Taken from "Nutrient Requirements of Swine." Dr. A. J. Jensen. 1972. Feedlot Management. Yearbook Issue.

²Approximate protein levels required to meet the essential amino acid needs.

³If barrows and gilts are fed separately, 13 and 15% respectively will more efficiently meet requirements since gilts produce leaner carcasses than do barrows.

⁴Recent research indicates that lysine, methionine, tryptophane and threonine are the most limiting amino acids and the remaining 6 amino acids are supplied in sufficient amounts in normally used feedstuffs.

⁵Cystine can supply approximately 52% of the need for methionine. Thus, the values represent a methionine, plus cystine allowance.

Energy Needs

The greatest nutritional requirement in swine rations is for energy, which is supplied primarily by cereal grains. Every movement and function of the body involves the expenditure of energy.

Energy is the most expensive nutrient in swine rations since 70 to 80% of the feed ingredients are used as energy. Most recent feed tables express energy values as digestible energy (DE) and metabolizable energy (ME).

Feed sources used to supply energy

should be low in fiber and highly digestible. They are usually low in protein.

Most cereal grains are suitable in swine feeding because they are high in energy and low in fiber. However, they are deficient in quality and quantity of protein, very low in calcium and only fair in phosphorus content.

Tables 3 and 4 list the energy requirements for varying weights and classes of swine and some of the commonly used energy feeds for swine.

Minerals

The pig requires at least 15 mineral elements which are essential for many vital metabolic processes and skeletal development.

Calcium, phosphorus, sodium, potassium, magnesium and sulfur — referred to as major or macro minerals — are all required in relatively large amounts. Manganese, zinc, iron, iodine, copper, cobalt, fluorine and selenium — called minor, micro and trace minerals — are required in small amounts.

Table 2. Commonly used protein feeds.

Feed	% Protein	Quality ¹	Limiting factors
Soybean meal, SBOM	40-50	Good	Marginal in methionine
Fish meal	60	Excellent	Cost
Meat scraps, tankage, meat and bone meal	50	Good	Excellent amino acid balance when used with SBOM
Linseed meal	35	Fair	Should be used with other protein supplements
Cottonseed meal ²	41	Poor	Don't use more than 5% in diet
Cull peas	23-26	Good	Marginal to low in methionine
Dried skim milk	33	Excellent	Cost

¹As related to quality of amino acids

²Unless properly processed, contains a toxic factor called gossypol, which restricts its use in swine feeds.

Table 3. Energy

Energy KCAL/lb of diet ¹	Live weight and class				
	Starter 10 - 40	Grower 40-125	Finisher 120-mkt. wt. Requirements	Bred sows, gilts	Lactating sows, gilts
Digestible (DE)	1591	1512	1502	1490	1512
Metabolizable (ME)	1495	1422	1423	1420	1422

¹Diets are assumed to contain 90% dry matter.

Table 4. Energy needs

Grain	Relative ¹ value (%)	Preferred % of grain	Evaluation as feed
Corn	100	100	Excellent
Barley	85-90	50-80	Good (higher fiber)
Wheat	100	50-80	High % pasty powdery
Oats	75-85	40	Best for breeding animals
Milo	95	100	Similar to corn

¹Corn is the number one livestock feed in the U.S. and is often used as the yardstick against which all other energy feeds are measured.

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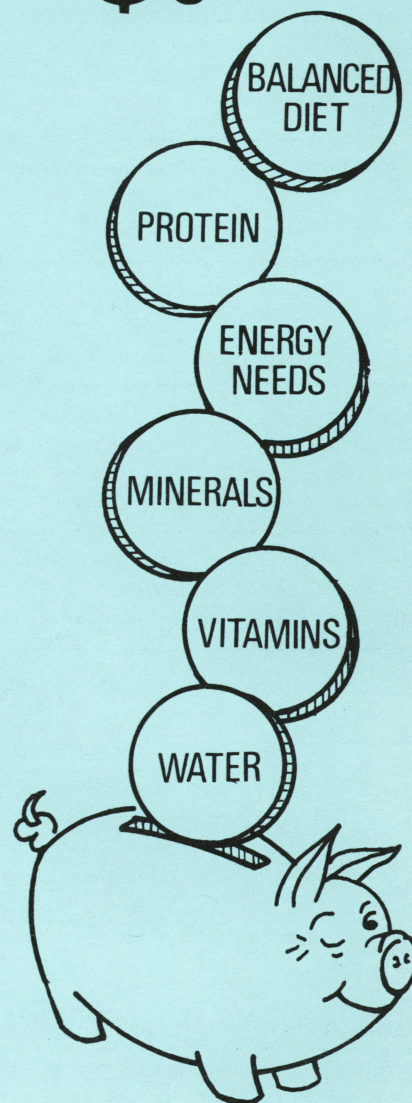


Table 5. Sources of minerals for swine.¹

Mineral	Source	Mineral %	Remarks
Calcium and phosphorus	Ground limestone (calcium carbonate)	38% Ca, 0% P	Good availability, usually cheapest source
	Dicalcium phosphate	26% Ca, 18.5% P	Good availability
	Steamed bone meal	24% Ca, 12% P	Could be limited availability
	Deflourinated rock phosphate	34% Ca, 14.5% P	Availability varies
	Deflourinated treble phosphate	32% Ca, 18% P	Availability varies
	Monocalcium phosphate	25% Ca, 21% P	Good availability
	Sodium tripolyphosphate	0%, 25% P	Good availability usually a higher cost source of P
	Soft phosphates	varies	Limited availability
Iron	Ferrous sulfate	20.1% Fe	Good availability
	Ferric ammonium citrate	16.5-18.5% Fe	Good availability
	Ferrous fumerate	32.9% Fe	Good availability
	Ferric chloride	20.7% Fe	Mediocre availability, picks up moisture
	Ferrous carbonate	48.2% Fe	Availability varies depending on solubility
	Ferric oxide	69.9% Fe	Limited availability, used for red color
	Ferrous oxide	77.8% Fe	Limited availability
Copper	Cupric carbonate	50-55% Cu	All are good sources of copper
	Cupric chloride	37.3% Cu	
	Cupric oxide	79.7% Cu	
	Cupric sulfate	25.4% Cu	
Manganese	Manganese carbonate	47.8% Mn	All are good sources of manganese
	Manganese chloride	27.8% Mn	
	Manganese oxide	77.4% Mn	
	Manganese sulfate	22.8% Mn	
Zinc	Zinc carbonate	56% Zn	All are good sources of zinc
	Zinc chloride	48.0% Zn	
	Zinc oxide	80.3% Zn	
	Zinc sulfate	22.7% Zn	
Iodine	Calcium iodate	65.1% I	All are good sources of iodine
	Potassium iodide	76.4% I	
	Cuprous iodide	66.6% I	
	Ethylene diamine dihydriodide	80.0% I	

¹Taken from "Live Cycle Swine Nutrition." Iowa State University, Ames, Iowa, August, 1970. Provided by Dr. Dean Howes, Caldwell Research and Extension Center.

Table 6. Animal weight or production¹

	Starter 10 to 30 lb.	Grower 30 to 120 lb.	Finisher 120 to mkt. wt.	Breeder	
				Gestation	Lactation
Calcium, %, diet	0.90	0.75	0.50	0.75	0.75
Phosphorus, %, diet	0.60	0.50	0.50	0.50	0.50
NaCl (salt)	0.50	0.50	0.35	0.50	0.50
Trace minerals (for all ages)					
	mg/lb of diet or ppm				
Iron	80	32			
Copper	6	2.7			
Manganese	20	9			
Zinc	50	23			
Iodine	0.22	0.1			

¹Taken from "Nutrient Requirements of Swine." 1972. Feedlot Management. Yearbook Issue.

The amount of each mineral to be added to a ration depends on:

1. Requirements for each pig.
2. Feed ingredients used in the ration.
3. Method of feeding.

Of the major minerals, calcium and phosphorus are the only ones which must be provided in a supplement. Natural feeds contain enough of the macro elements and they do not need to be included in formulation of supplements. The trace mineral needs of the pig can be met with the addition of a good trace mineralized salt (T.M. Salt).

Table 5 lists several compounds and gives remarks about their availability. Table 6 gives the mineral allowances for swine.

Vitamins

Vitamin A, vitamin D, riboflavin, niacin, pantothenic acid, vitamin B₁₂ and sometimes choline and vitamin E are vitamins of concern in swine rations and should be added to the swine diet.

Vitamins are required in very small amounts by the pig but are extremely essential for proper feed utilization and reproduction. Litter size is dependent on a well balanced nutritional program when there is an increase in competition for nutrients by fetal or unborn pigs. Deficiencies may cause *slow growth, higher feed costs, poor breeding efficiency and the birth of weak pigs.*

Many of the 14 vitamins, that have been found to have specific functions in the body, are found in sufficient amounts in normal feed ingredients and, therefore, are not of concern when formulating swine rations.

All swine rations should be fortified with a good commercial vitamin premix particularly if pigs are fed in total confinement.

Table 7 gives 2 vitamin premixes that may be prepared using ground feed as a carrier for supplementing the ration.

Water

Pigs should receive plenty of clean water at all times. Inadquate and dirty water will usually cause a decrease in feed utilization. Growing and finishing pigs require up to 6 quarts of water per day while lactating sows will consume as much as 4 to 5 gallons each day.

General Considerations

Idaho has a variety of feeds available that will provide adequate energy in all classes of swine rations.

Barley and corn are the major energy feeds used and when possible should be used as the basis for swine rations. Other energy feeds such as potatoes, oats and wheat may be used in limited quantity when supply and economic conditions permit. Table 8 lists some typical balanced diets for swine feed in Idaho.

Table 7. Composition of vitamin premix to be added per ton of complete feed.¹

	<u>1</u>	<u>2</u>
Vitamin A, million I. U.	3.0	...
(325,000 I.U./gm)-grams	...	15.4
Vitamin D, million I.U.	0.4	...
(4,000,000 I.U./lb)-grams	...	113.5
Vitamin E
(125,000 I.U./lb)-grams	...	19.0
Vitamin B ₁₂ milligrams	10	...
(60 mg/lb)-grams	...	136.0
Niacin, grams	15	...
(50%)-grams	...	48.0
Pantothenic acid, grams	8.0	...
(160 gm/lb)-grams	...	34.0
Choline Chloride (50%)-grams	...	800.0
Riboflavin, grams	2.0	...
(60 mmg/lb)-grams	...	22.6
Ethoxquin or BHT, grams	...	114.0
CARRIER - Made up to 10 lb.	?	?

¹Provided by Dr. Dean Howes, Caldwell Research and Extension Center.

Table 8. Typical balanced diets for swine.

Ingredient	% Protein	Growing and Finishing									Sow Reproduction				Boars
		Starter 10 - 40			Grower 40-125			Finisher 120-230			Gestation		Lactation		
		1 lb.	2 lb.	3 lb.	1 lb.	2 lb.	3 lb.	1 lb.	2 lb.	3 lb.	1 lb.	2 lb.	1 lb.	2 lb.	
Corn, ground	9	1,112	489		1,485			1,713			1,684			1,477	1,606
Barley, ground	12		718	718		1,664	824		1,760	1,000		1,731	1,664		
Wheat, ground	11			595			600			410					
Soybean meal	44	500	450	450	442	162		225	180		221	105	162	442	320
Meat meal	55		112	112		100	100					100	100		
Alfalfa meal	17														
Dried whey	12	300													
Cull peas	23						400			500					
Animal fat			150	50		50	50			50			50		
Limestone	38 Ca	10	6		20	6		15	30	22	21	18	6	22	22
DiCalcium phosphate 24% Ca, 18.5% P		25			17			25	10		33	25		28	21
Sugar (sucrose)		25	50	50											
Salt		5	10	10	10	10	10	10	10	10	10	10	10	10	10
D.L. methionine	98		.50			.50	6		3						
Trace mineral mix ¹															
Feed additives ²															
Vitamin premix ¹															
Analysis:															
Crude protein %		18.87	20.00	20.90	16.0	15.83	15.59	13.08	14.47	14.00	12.0	14.5	15.83	16.0	14.0
Calcium %		0.71	0.80	0.74	0.65	0.72	--	0.64	0.61	--	0.80	0.75	0.72	0.80	0.70
Phosphorus %		0.64	0.68	0.69	0.50	0.65	--	0.52	0.54	--	0.60	0.62	0.65	0.60	0.50

¹The amount of trace minerals and vitamin mix used will depend on the brand purchased and the manufacturer's recommended levels.

²The amount of feed additives used will depend on individual herd health condition and the manufacturer's recommended levels.

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