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EC81-210 Swine Diet Suggestions

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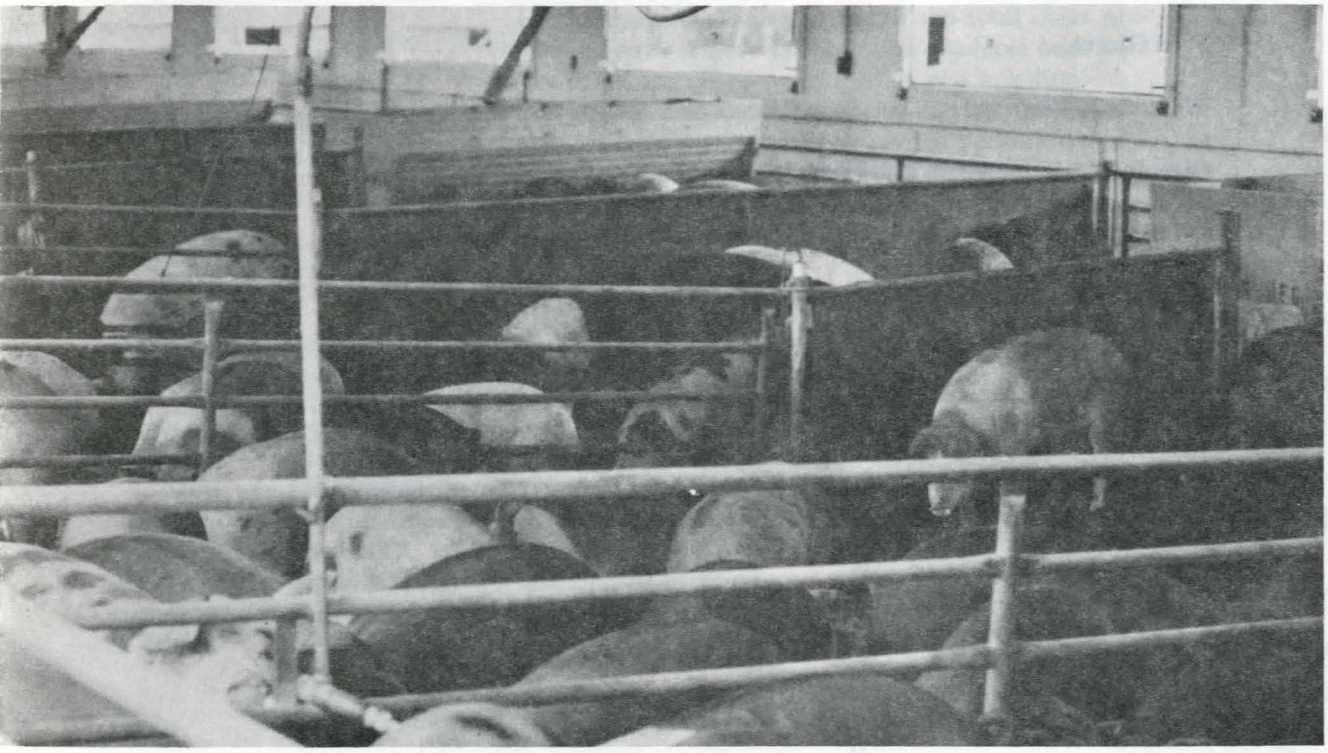
swine diet suggestions



EXTENSION WORK IN "AGRICULTURE, HOME ECONOMICS AND SUBJECTS RELATING THERETO,"
THE COOPERATIVE EXTENSION SERVICE, INSTITUTE OF AGRICULTURE AND NATURAL RESOURCES,
UNIVERSITY OF NEBRASKA-LINCOLN, COOPERATING WITH THE COUNTIES AND THE U.S. DEPARTMENT OF AGRICULTURE
LEO E. LUCAS, DIRECTOR

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University of Nebraska Swine Diet Suggestions

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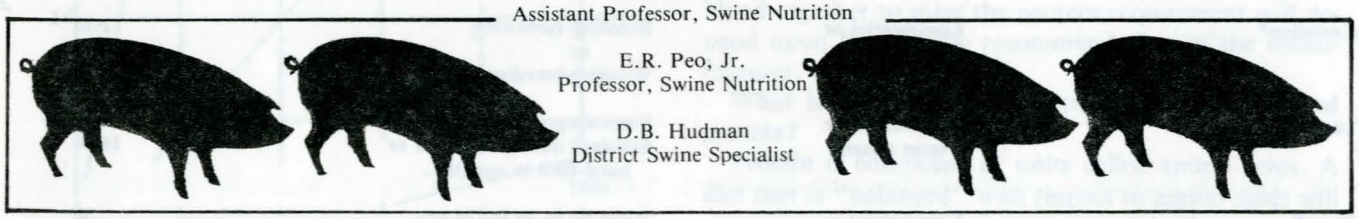

Feed represents 50-60 percent of the total costs of producing pork (Figure 1). Thus, the producer must be aware of all aspects of swine feeding and nutrition.

Since diets and methods of feeding are changing rapidly, this publication will be revised periodically to provide the latest recommendations. In addition, it is the objective of this publication to give answers to some of the more frequently asked questions.

PROTEIN

How can I determine the most economical protein level to feed growing-finishing pigs when corn and soybean meal prices vary?

General recommendations for the level of protein in the diet for the major classes of swine are found in Table 1.

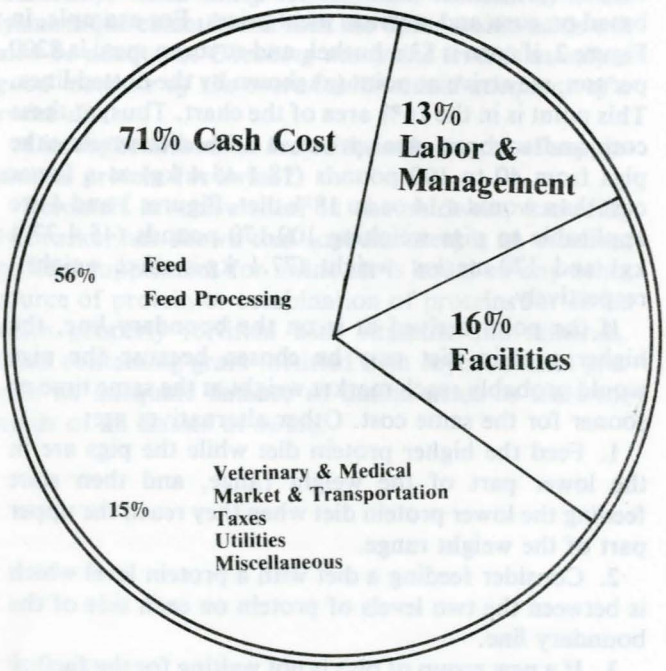

Figure 1. Total Production Cost

Table 1. General feeding program for swine.

Diet	Source	Age or size of pig	Level of protein %
Pre-starter	Commercial	Early weaned or orphan pigs	22
Starter	Commercial or farm mixed	Two weeks of age to 40 lb body weight (18.1 kg)	18-20
Starter-grower or growing-finishing	Commercial or farm mixed	40-100 lb body weight (18.1-45.4 kg)	16
Growing-finishing	Commercial or farm mixed	100-170 lb or market weight (45.4-77.1 kg)	14
Growing-finishing	Commercial or farm mixed	170 lb to market weight (77.1 kg)	12
Developing gilts and gestation[a]	Commercial or farm mixed	180 lb-breeding (81.6 kg)	14
Gestation[a]	Commercial or farm mixed	Breeding-farrowing	12-16[b]
		or	
		Weaning-breeding	12-16
Lactation[a]	Commercial or farm mixed	Farrowing-weaning	14-16
		Self-feed during lactation or hand-feed to appetite.	14-16
Boars[a]	Commercial or farm mixed	Weaning to 75 lb (34 kg)	18
		75 lb to 240 lb (34-108.9 kg)	16
		240 lb (109 kg) to 1 year-Limit feed 5 to 5.5 lb (1.8-2.3 kg) per day	14
		Adult-Limit feed 4 to 5 lb (1.8-2.3 kg) per day)	14

[a] For more information on Breeding Herd Management, see EC 80-212.

[b] Level selected depends upon daily feed intake; see Table 10.

Figures 2, 3, and 4[1] can be used to determine the most economical protein levels to feed growing-finishing pigs based on corn and soybean meal prices. For example, in Figure 2, if corn is $3 a bushel, and soybean meal is $200 per ton, we arrive at point (a) shown by the dotted lines. This point is in the 16% area of the chart. Thus, at these corn and soybean meal prices, a 16% diet would take pigs from 40 to 100 pounds (18.1-45.4 kg) at a lower cost than would a 14 or an 18% diet. Figures 3 and 4 are applicable to pigs weighing 100-170 pounds (45.4-77.1 kg) and 170-market weight (77.1 kg-market weight), respectively.

If the point arrived at is on the boundary line, the higher protein diet may be chosen because the pigs would probably reach market weight at the same time or sooner for the same cost. Other alternatives are:

1. Feed the higher protein diet while the pigs are in the lower part of the weight range, and then start feeding the lower protein diet when they reach the upper part of the weight range.

2. Consider feeding a diet with a protein level which is between the two levels of protein on each side of the boundary line.

3. If a new group of pigs is not waiting for the facility and if the producer has extra time to care for the pigs,

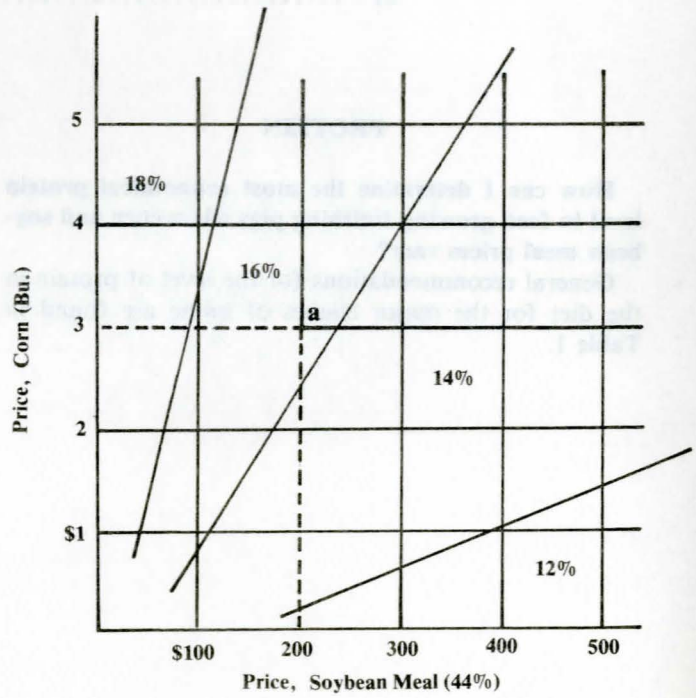

Figure 2. Suggested protein levels for growing-finishing diets, based on corn and soybean meal prices, for pigs from 40-100 pounds (18.1-45.4 kg).

[1] Bitney, Larry L. and Bobby D. Moser. 1974. Feed prices and protein levels for pigs. Nebraska Swine Report, pp. 3-4.

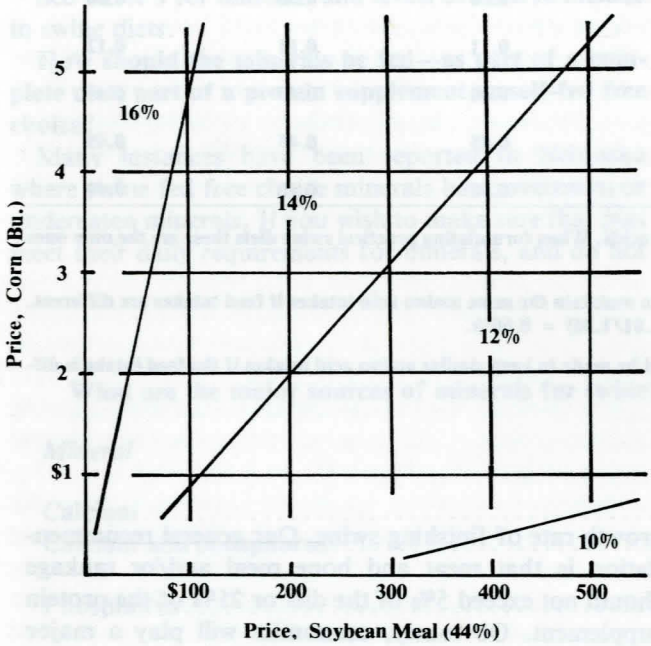

Figure 3. Suggested protein levels for growing-finishing diets, based on corn and soybean meal prices, for pigs from 100-170 pounds (45.4-77.1 kg).

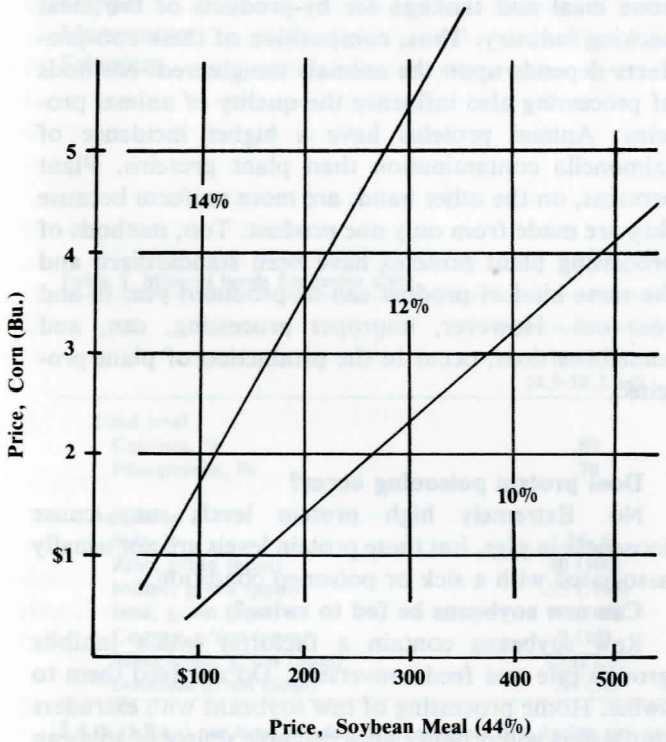

Figure 4. Suggested protein levels for growing-finishing diets, based on corn and soybean meal prices, for pigs from 170 pound-market weight (77.1 kg-market wt.).

the lower protein level could be chosen. *The figures consider the added costs of slower gaining pigs resulting from the lower protein diets.*

The amount of grain and commercial supplement to blend together to meet the protein requirement will depend upon the specific recommendation of the manufacturer.

What is the relationship between amino acids and protein?

Protein is composed of units called amino acids. A diet that is "balanced" with respect to amino acids will contain the proper level and ratio of the 8-10 essential amino acids required by the pig for maintenance, growth, and reproduction. The protein of corn and other cereal grains is deficient in certain of the essential amino acids. Protein supplements are used to correct amino acid deficiencies in grains. For example, soybean meal and grain combinations have a good balance of amino acids.

The recommended allowances for some of the more critical amino acids are shown in Table 2. Lysine is the first limiting amino acid in a corn-soybean meal diet. Generally, when using conventional feedstuffs, if the lysine requirement is met then the other amino acids will also be adequate. *Checking the lysine level is usually a good measure of the overall amino acid adequacy of a swine diet.*

Can soybean meal be fed as the only source of supplemental protein for swine?

Research at universities in the midwest, including Nebraska, has shown that soybean meal is an excellent protein supplement for swine. It is equal to any other source of protein or combination of proteins for swine when properly fortified with vitamins and minerals. Diets containing grain fortified with soybean meal provide an adequate balance of amino acids to meet the needs of all classes of swine.

Table 2. Recommended amino acid allowances for swine[a] (% as fed).

Amino acid	Growing pig weights				Gestation[b]	Lactation[c]
	10-40 lb (4.5-18.1 kg)	40-100 lb (18.1-45.4 kg)	100-170 lb (45.4-77.1 kg)	170-market wt. (77.1 kg)		
Lysine	1.10	0.75	0.60	0.50	0.50	0.60
Tryptophan	0.20	0.15	0.13	0.11	0.11	0.12
Threonine	0.60	0.50	0.45	0.40	0.40	0.45
Isoleucine	0.65	0.55	0.50	0.45	0.45	0.45
Methionine + Cystine	0.55	0.45	0.40	0.30	0.30	0.40

[a] Suggested allowances are given for 5 of the 10 indispensible (essential) amino acids. When formulating practical swine diets these are the only ones that need to be considered.

[b] Assumes a feed intake of 4 lb (1.81 kg) per day. Values should be adjusted to maintain the same amino acid intakes if feed intakes are different. E.g., if 3 lb (1.36 kg) of feed are fed lysine allowance should be .50 x 4/3 (1.81/1.36) = 0.66%.

[c] Assumes an average feed intake of 12 lb (5.4 kg) per day. Adjustments should be made to keep similar amino acid intakes if the feed intake is different than 12 lb/day (5.4 kg).

If soybean meal alone contains an adequate balance of amino acids, why do most commercial supplements contain a variety of protein sources?

There are three major reasons:

1. When feed manufacturers register feed, they list all feedstuffs that they may want to include. Then, depending on the price and limits of good nutrition, they substitute lower priced protein sources for higher priced ones. Thus, feed manufacturers are able to pass these economic advantages on to consumers.

2. Since soybean meal is highly palatable to swine, the feed manufacturer may need to add less palatable ingredients, such as alfalfa meal, to help control supplement consumption for producers who feed supplement free choice with grain.

3. Habit! Animal proteins were once considered to be superior to plant proteins. This is no longer true.

Is it practical to supplement swine diets with amino acids?

Sometimes yes, sometimes no. Under certain economic conditions, it is practical to supplement lysine directly. We recommend that not over 100 lb (45.4 kg) of 44% soybean meal be replaced per ton of diet. A rule of thumb is that 2.75 lb (1.2 kg) of actual lysine (100% pure) and 97.25 lb (44.2 kg) of corn can replace 100 lb (45.4 kg) of 44% soybean meal per ton of diet. A common source of lysine is L-lysine monohydrochloride which is 78% lysine. At present it is not economically sound to supplement practical swine diets with synthetic sources of tryptophan and threonine. Recent evidence indicates that supplementing practical swine diets with methionine does not improve performance and often depresses performance.

Can meat and bone meal or tankage be fed as the only source of protein?

Research at the University of Nebraska indicates that high levels of meat and bone scraps in the diet reduce growth rate of finishing swine. Our general recommendation is that meat and bone meal and/or tankage should not exceed 5% of the diet or 25% of the protein supplement. Obviously, economics will play a major role in the level of these protein sources to be fed.

Is there a difference in uniformity of product between protein sources?

Animal protein products vary more in composition and quality than do plant protein sources. Meat and bone meal and tankage are by-products of the meat packing industry. Thus, composition of these two products depends upon the animals slaughtered. Methods of processing also influence the quality of animal proteins. Animal proteins have a higher incidence of salmonella contamination than plant proteins. Plant proteins, on the other hand, are more uniform because they are made from only one product. Too, methods of processing plant proteins have been standardized and the same kind of product can be produced year in and year out. However, improper processing, can, and sometimes does, occur in the production of plant proteins.

Does protein poisoning occur?

No. Extremely high protein levels may cause looseness in pigs, but these protein levels are not usually associated with a sick or poisoned condition.

Can raw soybeans be fed to swine?

Raw soybeans contain a factor(s) which inhibits growth rate and feed conversion. Do not feed them to swine. Home processing of raw soybeans with extruders or roasters will produce an acceptable source of soybean protein for swine. Processing of soybeans on the farm will depend primarily on economics (see the 1970 and 1971 Nebraska Swine Reports).

MINERALS

What minerals and what level of each should be included in diets for swine?

See Table 3 for minerals and levels of each to include in swine diets.

How should the minerals be fed—as part of a complete diet, part of a protein supplement or self-fed free choice?

Many instances have been reported in Nebraska where swine fed free choice minerals have overeaten or undereaten minerals. If you wish to make sure that pigs meet their daily requirements for minerals, and do not exceed them, feed minerals in a completely mixed diet.

What occurs if high levels of minerals are fed?

Most commercial protein supplements are balanced in minerals to meet the pig's needs when the supplement is combined with grain according to the manufacturer's recommendations. Minerals should not be added haphazardly. If problems develop such as leg abnormalities, or when there is a reduction in performance, all management components including diets, genetic defects, disease, type of floor and floor surface should be analyzed before changes or additions in the mineral content are made. Warning! *Adding minerals without reason may cause more harm than good.*

What are the major sources of minerals for swine?

Mineral	*Source*
Calcium	Ground limestone
Calcium and phosphorus	Dicalcium phosphate, defluorinated phosphate, monocalcium phosphate, steamed bone meal
Phosphorus	Monosodium and disodium phosphate, sodium tri-poly phosphate
Sodium and Chlorine	Salt
Iron (baby pigs)	Iron injections, oral iron, clean soil
Iron (growing and mature pigs)	Iron sulfate, trace mineral mixes, trace mineralized salt
Zinc	Zinc sulfate, zinc oxide, zinc carbonate, trace mineral mixes, trace mineralized salt
Cobalt, potassium, magnesium, sulfur	Usually adequate in natural feedstuffs
Copper	Copper sulfate, Copper oxide
Manganese	Manganese oxide, Manganese sulfate
Selenium	Sodium selenite

Table 3. Mineral levels for swine diets.

	Pig weight		
	10-40 lb (4.5-18.2 kg)	40 lb (18.2 kg)-market weight	Breeding[a,b] Swine
Total level			
Calcium, %	.80	.65	.90
Phosphorus, %	.70	.50	.80
Additions			
Salt, %	.25-.5	.25-.5	.25-.5
Zinc, g/ton (ppm)	90 (100)	90 (100)	90 (100)
Iodine, g/ton (ppm)	.15 (.165)	.15 (.165)	.2 (.22)
Iron, g/ton (ppm)	90 (100)	90 (100)	90 (100)
Copper, g/ton (ppm)	9 (10)	9 (10)	9 (10)
Manganese, g/ton (ppm)	25 (27.5)	25 (27.5)	25 (27.5)
Selenium g/ton (ppm)[c]	.09 (.1)	.09 (.1)	.09 (.1)

[a] 4 lb (1.8 kg) per head per day of a complete diet during pre-gestation and gestation; full feeding of a complete diet during lactation.

[b] Developing and mature boars.

[c] Maximum allowable legal addition.

What levels of calcium and phosphorus should be fed?

The optimum levels of calcium and phosphorus to feed are shown in Table 3. Regardless of level, the prefered ratio of calcium to phosphorus should not exceed 1.3 parts calcium to 1 part phosphorus.

What is parakeratosis and what relation has it to zinc?

A deficiency in zinc in the diet will cause a nutritional disease called parakeratosis. Also, the combination of a high level of calcium (over 0.9%) and zinc level below 50 ppm may result in parakeratosis. The condition can be identified by the mangy appearance of the animal. The skin becomes dry and scaly, particularly behind the ears, on the hind legs, tail, and under region of the body. The condition can be prevented by keeping the level of calcium below 0.9% and by adding 100 ppm of zinc per ton of complete diet.

Should selenium be supplemented in Nebraska swine diets?

Selenium deficiency and/or toxicity is a regional problem within the United States. Grains grown in Nebraska are generally considered adequate in this element. Some areas of northeast Nebraska have a history of too high selenium content. Therefore, swine diets containing Nebraska grown feed grains should be adequate in selenium. If selenium supplementation is needed, it can be legally added up to .1 ppm of a complete feed. Because symptoms of selenium deficiency such as mulberry heart and white muscle disease have been diagnosed recently in Nebraska, as a safety factor we recommend that 0.1 ppm selenium (.09 gm/ton, legal addition amount allowable) be added to all swine diets.

Is iron carbonate an available source of iron for pigs?

Recent research indicates that iron from iron carbonate is often poorly utilized by pigs. Iron sulfate is an excellent source of iron and is preferred over the carbonate form.

How about the use of electrolytes?

Electrolytes appear to have a beneficial role in pigs dehydrated as a result of diarrhea or dysentery. Other than a disease or stress (movement of feeder pigs) situation, electrolytes have no particular value over elements present in a balanced swine diet.

VITAMINS

Certain vitamins need to be added routinely to swine diets. The recommended vitamin additions per ton of complete diet are shown in Table 4.

How much carotene should be considered in grains when determining the amount of supplemental vitamin A to add in the diet?

Vitamin A (or its precursor carotene) is easily destroyed by heat and light. This results in varying levels of vitamin A activity between grain samples. Thus, in diet formulation, we consider that corn, milo, and other cereals have no vitamin A activity.

Are there any differences in stabilized vitamin A between commercial feeds?

Generally not. Most commercial companies fortify their feed with a stabilized form of vitamin A. The stabilized form of vitamin A is active over an extended period of time.

Table 4. Recommended vitamin additions per ton of complete diet.

	Pig weight			
	10-40 lb (4.5-18.1 kg)	40-100 lb (18.1-45.4 kg)	100 lb-Mkt. (45.4 kg)	Breeding[a] swine
Vitamin A, (million IU)	4.0	3.0	2.0	5.0
Vitamin D_2 or D_3 (million IU)	.5	.5	.5	.5
Riboflavin (g)	3.0	2.0	2.0	5.0
Niacin (g)	20.0	16.0	16.0	30.0
Pantothenic acid (g)	9.0	9.0	6.0	18.0
Choline (g)	200.0	200.0	200.0	500.0
Vitamin E (g)	10.0	10.0	10.0	20.0
Vitamin K (g)[b]	2.0	2.0	2.0	2.0
Vitamin B_{12} (mg)	20.0	20.0	10.0	15.0

[a] Based on 4 lb (1.8 kg)/head/day of a complete diet during pre-gestation and gestation; and full feeding of a complete diet during lactation.

[b] MSB (menadione sodium bisulfite or equivalent).

Should vitamin E be added to Nebraska swine diets?

Vitamin E and selenium are interrelated and are usually present in adequate amounts in Nebraska grown feestuffs. Vitamin E and selenium are both antioxidants. Vitamin E spares selenium. Since feedstuffs vary in their vitamin E content, it may be desirable to add vitamin E to swine diets as a safety factor. Leafy alfalfa hay is an excellent source of vitamin E.

Should choline be supplemented in swine diets?

Yes. Research indictes that supplementing choline at a level of 500 grams per ton of complete diet during gestation increases number of live pigs born and weaned. Choline supplementation is recommended at a 200 gram level per ton of a complete growing-finishing swine diet. Although the requirement for this vitamin has not been defined, this 200 gram level is our suggestion to prevent a possible choline deficiency in the growing-finishing pig. Choline has not corrected the condition of "shakers" or "spraddlers" at birth in both university and field tests. Evidence would indicate that these conditions may be caused by a virus or combination of viruses. Genetic causes are not implicated.

Should swine diets be supplemented with biotin?

Biotin, sometimes called vitamin H, would rarely be deficient in swine diets used in the corn belt.

When buying vitamins and minerals, should they be bought as separate premixes or together in the same mix?

Some vitamins are destroyed when in contact with minerals over a prolonged period of time. Therefore, we recommend that vitamins and minerals be purchased in separate premixes. If the vitamins and minerals are purchased in one premix, they should be used within 30 days of purchase. Vitamin and mineral premixes should be stored in a cool, dry, and dark place. Stabilizing agents have increased the shelf-life of vitamin-mineral premix combinations.

What is the approximate cost of adding premixes to corn-soybean meal diets?

As a guide, a premix containing only vitamins will cost up to $6 to fortify a ton of complete feed. A premix containing both vitamins and minerals may cost $10-$12 to fortify a ton of complete feed.

FEED ADDITIVES

What antibiotics should be fed and at what levels?

The response to specific antibiotics varies considerably due to disease level, kind and level of antibiotic, season of year, and other environmental factors. Rotation of antibiotics and use of mixtures seem to be more effective than antibiotics used singly and/or continually. Rotation may be yearly or with changes in protein levels.

Antibiotics should not be used to replace good management.

What are the recommended levels of antibiotics per ton of complete diet?

Level of usage depends upon the type of antibiotic selected. Thus, when mixing comply with the manufacturer's direction.

How about feeding antibiotics to the breeding herd?

Herds that have experienced problems with conception rates and litter size have often been helped by the addition of antibiotics to brood sow diets.

The routine feeding of antibiotics to the breeding herd is discouraged unless there is a history of reproductive problems.

When should arsenicals be used in diets?

Besides their growth-promoting effect, arsenicals may also help where scours is a problem. Arsenicals can be added in the form of arsanilic acid, 100 ppm per ton of complete feed, or 3-nitro-4 hydroxy phenylarsonic acid (3-nitro) at 75 ppm per ton of complete diet.

What are the withdrawal periods for feed additives?

Certain feed additives must be withdrawn from the feed prior to slaughter at varying intervals to insure residue-free carcasses. Some withdrawal periods for commonly used feed additives are listed in Table 5. The availability and/or withdrawal time of feed additives can change. The law requires the withdrawal time to be placed on all feed tags.

What are probiotics?

Probiotics, which means in favor of life, play an opposite role to antibiotics on the microorganisms of the digestive tract. It has been theorized that probiotics increase the population of desirable microorganisms instead of killing or inhibiting undesirable organisms. The most common microorganism included in probiotic products is lactobacillus, a normal bacterial inhabitant of the digestive tract of healthy animals. These bacteria remove waste products and inhibit the growth of certain undesirable bacteria.

Research has shown that stress conditions such as weaning, diet, or environmental changes, or poor sanitation can alter the microflora of the digestive tract. Probiotics may be advantageous, especially for early weaned pigs, to combat these stresses.

FEED GRAINS

What is the feeding value of grains other than corn when fed to swine?

Feeding values of grains compared to corn are given in Table 6.

Although some feed grains may produce the same weight gain as corn, the amount of feed required to produce a unit of gain may be greater, as in the case of milo (5% more). Thus, the overall value of milo is reduced when compared to corn.

What rule should you follow when replacing corn with milo in a corn-soybean diet?

A good procedure is to substitute milo or corn pound for pound, if the protein content of the milo is greater than 9%. If the protein content of milo falls below 9%,

recalculate your diets on a protein basis. It is usually profitable to have your milo analyzed for protein content. Milo should be ground finely for swine for best utilization.

Table 5. Withdrawal time for additives in swine feeds[a/]

Feed additive	Time before slaughter
Arsanilic acid	5 days
ASP 250 (sulfamethazine)	15 days
CSP 250 (sulfathiazole)	7 days
CSP 250 (sulfamethazine)	15 days
Atgard (Dichlorvos)	none
Aureomycin (Chlortetracycline)	none
Bacitracin	none
Banminth	1 day
Erythromycin	none
Flavomycin (Bambermycins)	none
Hygromycin	2 days
Lincomycin	6 days
Mecadox (Carbadox)	10 weeks
NF 180 or Furox (Furazolidone)	6 days
Neomycin Sulfate	20 days
Oleandomycin	none
Penicillin	none
Piperazine	none
Roxarsone (3 Nitro)	5 days
Spectinomycin (baby pig)	21 days
Terramycin (Oxytetracycline)	none
Tramisol	72 hours
Tylan (Tylosin)	none
Tylan - Sulfa	15 days
Virginiamycin	none

[a] Effective as of printing date.

Table 6. Feeding values of grains.

Grain	Feeding value as compared to corn
Corn	100%
Milo	97%
Wheat	100%
Barley	90%
Rye	85%
Oats[a]	80%
Millet	93%

[a] New varieties may increase value.

What limits the use of oats in growing-finishing diets?

The high fiber content of oats (11.5%) reduces the energy content of diets and consequently results in reduced growth rate and feed efficiency of growing-finishing pigs when oats exceeds 20% of the diet. Adding oats to the diet of newly weaned pigs may help in the prevention of edema disease and reduce the incidence of nutritional scours. Oats is an excellent feed grain, particularly for brood sows. New varieties of oats such as Spear and Dahl show good promise as the only feed grain for swine.

Can wheat be fed to swine?

Wheat is an excellent feed grain for swine. It can replace part or all of the corn pound for pound in a swine diet without affecting performance. Since wheat tends to flour, it should be coarsely ground. If ground too fine, the palatability may decrease and result in lowered performance.

What is high lysine corn?

Opaque-2 (high lysine) corn is higher than regular corn in all the essential amino acids except leucine. High lysine corn is especially higher in lysine and tryptophan. Since the lysine content may vary, it is suggested that the high lysine corn be analyzed for lysine content. High lysine corn drys more rapidly than normal corn. Therefore, if high lysine corn is being mechanically dried for storage, corn moisture should be watched carefully. High lysine corn should be ground more coarsely than normal corn. A 1/2" (12.7 mm) screen is suggested. Some producers prefer a roller mill for processing high lysine corn.

If high lysine corn contains .38% lysine or higher on an 86% dry matter basis or .44% lysine or higher on a 100% dry matter basis, the protein level of the diet can be reduced by 2%. That is, if the requirement is 16% with normal corn, a 14% diet will give the same performance if high lysine corn is used.

If swine producers consider growing high lysine corn, they must evaluate such economic factors as the yield of high lysine corn and the price of normal corn and supplemental protein (see the 1972 and 1973 Nebraska Swine Reports for economic considerations).

Should fat be added to swine diets?

Research indicates that the addition of 3-5% fat to growing-finishing swine diets will improve average daily gain and feed conversion with little effect on carcass backfat. Addition of fat above 5% will further improve feed conversion. However, physical handling problems may limit the use of these higher levels.

Research with sows suggests that fat addition to the diet before farrowing and during lactation has the potential to improve pig survivability. It appears that a diet containing 8% fat must be fed for about one week before and one week following farrowing to have an effect upon pig survival.

Adding fat to swine diets is an economic question. Fat additions will increase the cost of diet, which must be offset by an increase in pig performance. The physical handling problems associated with adding fat to the diet in the liquid form may limit its usefulness for home mixing. Commercial supplements and complete diets containing added fat are available. Fat that is added to a swine diet must be stabilized and of high quality.

METHODS OF FEEDING

The most common method of feeding swine is to use a complete diet. Another method is grain and supplement free choice.

We recommend the use of complete diets because the producer can be sure of better control of protein,

mineral, and vitamin intake. Over-consumption of protein supplement is eliminated. Each pig gets a balanced diet with every unit of feed. Although complete diets are preferred, grain and protein supplement, self-fed free choice, is still an economical practice, particularly if mixing and grinding equipment are not readily available.

Will it pay to mix and formulate diets on the farm?

One method of mixing a complete diet is by mixing ground corn with a commercial supplement in proportions suggested by the manufacturer. The mixing can be done either commercially or with a grinder-mixer. A self-unloading wagon is not a mixer and therefore does a poor job of mixing corn and supplement.

A second method is to use the feeding program suggested in this circular. This requires the producer to buy all ingredients indicated in the diets used in Tables 7, 8 and 9 and to do a thorough job of mixing. Horizontal feed mixers are preferred but vertical mixers are capable of providing adequate blending.

Many factors are involved in the success of home mixing. Some of these include the efficiency of grinding, mixing, size of operation, quality of feed, availability of the diet ingredients, and qualified labor.

When considering home mixing, don't overlook the role that the feed manufacturer plays in providing invaluable services to the swine industry.

Should feed be limited to growing-finishing swine, and if so, at what weight should you start?

The question must be answered on an individual farm basis. There are several reasons for limiting feed for finishing hogs. These include (1) the amount of feed required to produce a pound of gain may be reduced by 5% to 15%, (2) the backfat thickness can be reduced 0.1 inch (.25 cm) at 200 pounds (91 kg), (3) facilitates the feeding of high moisture grain, and (4) experience has shown that limit feeding may help prevent diarrhea and edema disease when starting newly weaned pigs and recently purchased feeder pigs.

The economic advantages of limit feeding will depend upon the extra time required for pigs to reach market weight. Thus, reduced feed costs may be offset by increased investment and a longer feeding time.

If limited feeding is planned, pigs should weigh about 125 pounds (56.5 kg) before feed intake is reduced. Feed intake may be reduced by feeding 80% of full feed or feeding a constant amount of 5 pounds (2.3 kg) per pig daily to market weight. Limited feeding is not widely practiced in the U.S. for finishing swine.

Table 7. Sample diets for young pigs (% of diet).

	Percent protein			
Ingredients	22 Pre-starter	20 Simple starter	18 Starter-grower	16 Starter-grower
	%	%	%	%
Sugar (beet or cane)	10.00	-----	-----	-----
Ground yellow corn	21.3	41.3	46.7	68.8
Ground oats	5.0	10.0	15.0	-----
Ground wheat	5.0	-----	-----	-----
44% soybean meal	6.4	27.7	22.1	17.8
Dried skimmilk	40.0	-----	-----	-----
Dried whey	-----	10.0	5.0	2.5
Dried fish solubles	5.0	2.5	2.5	2.5
Dried brewer's yeast	1.0	1.0	1.0	1.0
Animal fat (stabilized)	3.0	3.0	3.0	3.0
Dicalcium phosphate (24% Ca, 18.5% P)	0.3	1.2	1.4	1.2
Ground limestone	0.5	0.9	0.9	1.2
Salt	0.3	0.3	0.3	0.3
Trace mineral mix[a]	0.1	0.1	0.1	0.1
Vitamin-antibiotic[b] mix	2.0	2.0	2.0	2.0
TOTAL (%)	100.0	100.0	100.0	100.0

[a] See Table 3 for levels.

[b] See Table 4 for levels.

Table 8. Sample diets for growing-finishing swine (% of diet).

	% Protein				
	18	16	14	12	10
	%	%	%	%	%
Ground corn or milo	67.7	73.7	79.3	85.0	90.7
44% soybean meal	26.2	20.5	14.8	9.0	3.3
17% dehydrated alfalfa meal	2.5	2.5	2.5	2.5	2.5
Ground limestone	.7	.9	.8	.8	.7
Dicalcium phosphate (24% Ca, 18.5% P)	1.5	1.0	1.2	1.3	1.4
Salt	.3	.3	.3	.3	.3
Trace mineral mix[a]	.1	.1	.1	.1	.1
Vitamin-antibiotic premix[b]	1.0	1.0	1.0	1.0	1.0
TOTAL (%)	100	100	100	100	100

[a] See Table 3 for levels.

[b] See Table 4 for levels.

Table 9. Sample diets for the breeding herd (% of diet).

	Summer		Pregestation & gestation					Winter		Lactation			Breeding boars
			Spring/Fall							All season			All season
Pounds/head/day	3-3.5	4-4.5	4-4.5	4-4.5	5-5.5	5-5.5	6-6.5	5-5.5	6-6.5	Full	Full	Full	4-6
Kg/head/day	1.4-1.6	1.8-2.0	1.8-2.0	1.8-2.0	2.3-2.5	2.3-2.5	2.7-2.9	2.3-2.5	2.7-2.9	fed	fed	fed	1.8-2.7
	%	%	%	%	%	%	%	%	%	%	%	%	%
Ingredients:													
Corn or milo	77.1	----	84.0	70.9	27.5	52.4	7.2	84.0	74.9	68.8	66.5	52.4	79.4
Soybean meal (44% protein)	16.4	5.4	10.5	8.4	5.9	1.5	2.4	11.7	8.7	16.1	13.6	12.7	15.7
Oats	----	37.0	----	----	10.0	----	----	----	----	----	----	15.0	----
Alfalfa hay (15% protein)	----	53.5	----	16.2	53.4	----	54.4	----	13.3	----	----	----	----
Dehydrated alfalfa meal	----	----	----	----	----	42.9	----	----	----	----	----	----	----
Beet pulp	----	----	----	----	----	----	----	----	----	10.0	----	----	----
Wheat bran	----	----	----	----	----	----	34.6	----	----	----	15.0	15.0	----
Ground limestone	1.1	----	1.1	.2	----	----	----	1.0	.4	.9	1.5	1.5	.9
Dicalcium phosphate (24% Ca, 18.5% P)	3.9	1.3	3.0	2.9	.6	1.3	----	1.9	1.3	2.8	2.0	2.0	2.6
Monosodium phosphate	----	1.5	----	----	1.2	.8	----	----	----	----	----	----	----
Salt	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3	.3
Trace mineral premix[a]	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1	.1
Vitamin premix[b]	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
TOTAL (%)	100	100	100	100	100	100	100	100	100	100	100	100	100

[a] Amount may vary depending upon commercial source. See Tables 3 and 11 for actual amounts to add.

[b] Amounts may vary depending upon commercial source. See Tables 4 and 12 for actual amounts to add.

What influence does fineness of grind have on pig performance?

All grains should be ground for swine. However, fineness of grind depends on several factors. Varying results have been reported due to (1) age of the pig, (2) method of processing, (3) type of grain, and (4) amount of feed wastage. Generally, the young pig will convert more efficiently when feed is ground fine. A coarser grind is recommended for older pigs (75 lb (34.0 kg) to market weight). From a practical standpoint it appears that a medium grind 3/8" to 1/2" (9.5 mm-12.7 mm) screen will give the best total results. Grinding finer than this tends to increase feed wastage and may increase the incidence of gastric ulcers.

What is the feed value of high moisture grain?

High moisture grain is similar in feed value to regular grain on a dry matter basis. High moisture grain is usually fed free choice but automated systems are available today for feeding complete diets with high moisture grain. Protein, vitamins, and minerals can be supplemented by either hand feeding daily or feeding free choice in separate feeders. If high moisture grain is fed in a complete diet, diets should be prepared frequently (every 1 or 2 days) to prevent spoilage. Complete diets can be fed daily on the floor or in a feeder. Diets should be prevented from bridging in the feeders. The major factor to consider in deciding to feed high moisture grain is how the producer desires to harvest and store his grain.

DIETS FOR SWINE

Baby Pig Diets

Orphan Pig Diets. There is no replacement for the sow's colostrum. If the newborn pig does not receive colostrum, it has little chance for survival. However, the pig can obtain colostrum by being placed with another sow that has just farrowed (foster sow). The orphan pig should remain with a foster sow after receiving colostrum. If this is not possible, a milk replacer can be tried. Commercial milk replacers are available. An example of a homemade milk replacer is the following mixture:

1 quart milk
1 pint half-and-half
1 raw egg

Portions of this mixture can be fed every three hours. If possible the orphan pig should be fed a dry 22% prestarter (see Table 7 for composition) from 5-7 days of age until 2-3 weeks of age. At this time the pig can be switched to a 20 or 18% pig starter.

Creep or Starter Diets. Creep feed should be introduced at about 2 weeks of age. The complexity of good starter diets plus the small amount consumed are primary factors responsible for recommending commercial pig starters. If you wish to mix your creep feed, diets in Table 7 are suggested.

The 16% starter-grower diet may be more acceptable to a pig when changing from a complex starter to a simpler corn-soy diet. Also, it can be used for slow growing pigs which are beyond the starter stage.

Growing-Finishing Diets

Diets for the growing-finishing pig are found in Table 8.

Some possible substitutions when using these diets are:

1. Milo, wheat, or millet can be substituted for corn pound for pound. If milo contains less than 9% protein, substitute on a protein basis.
2. Forty-eight percent soybean meal can replace 44% soybean meal by substituting 90 pounds (40.8 kg) of 48% soybean meal and 10 pounds (4.5 kg) of corn or milo for each 100 pounds (45.4 kg) of 44% soybean meal.
3. Dehydrated alfalfa meal is included as a nutrient safety factor in these diets. Therefore, if excellent mixing is available, dehydrated alfalfa can be replaced with corn pound for pound provided adequate vitamin and mineral supplements are available.
4. Ground leafy alfalfa hay can replace dehydrated alfalfa meal.
5. Iodized salt and trace minerals can be replaced by trace mineralized salt.

Pre-gestation, Gestation, Lactation Diets

Pre-gestation, gestation, and lactation diets are found in Table 9.

Should sows be limit-fed or full-fed?

A "limit feeding" program is recommended for gilts and sows during pre-breeding and gestation. However, it should be emphasized that a "limit feeding" program is limiting only the energy intake and not limiting the other nutrients such as protein, minerals, and vitamins. The energy is limited in order to keep sows from becoming too fat. Excessive feeding of gilts and sows leads to increased feed cost and interferes with the potential to maximize reproductive efficiency. Sows that are over fed immediately after breeding or throughout gestation often suffer high embryonic mortality, thus producing smaller litters than sows fed the proper amounts. Sows that become too fat have a tendency to have more farrowing difficulties and crush more pigs. This is especially true during the summer, when sows are subject to heat stress.

Diets for the pregnant female must meet her daily requirements for all essential nutrients. During normal (spring/fall) weather conditions about 6,000 kcal of metabolizable energy per head per day will keep sows in "good" condition. However, this energy intake may need to be adjusted up or down depending upon the condition of the sow and as the weather changes. This is

Table 10. Daily energy and protein needs of brood sows.

Season	Feed intake lb/hd/day (kg)	Metabolizable energy intake kcal/hd/day	Protein[b] g/hd/day	Lysine g/hd/day
Summer[a]	3-3.5 (1.4-1.6)	4500	227	9
Summer	4-4.5 (1.8-2.0)	4500	227	9
Spring/Fall[a]	4-4.5 (1.8-2.0)	6000	227	9
Spring/Fall[a]	5-5.5 (2.3-2.5)	6000	227	9
Spring/Fall	6-6.5 (2.7-2.9)	6000	227	9
Winter[a]	5-5.5 (2.3-2.5)	7500	227	9
Winter	6-6.5 (2.7-2.9)	9000	227	9

[a] Diets most commonly used.

[b] Gestating sows need a minimum of 1/2 pound (.23 kg) of protein/head/day regardless of daily feed intake.

usually accomplished by increasing or decreasing the amount of feed given to the sows daily.

The daily allowance for protein is 0.5 pounds (.2 kg). This allowance can be met by feeding 4 pounds (1.8 kg) of a 12.5% protein diet per day. During the summer feed intake may be reduced to about 3-3.5 pounds (1.4-1.6 kg) per head per day. In this case the protein level of the diet must be increased to about 16%, to meet the 1/2 pound (.2 kg) per head per day requirement. Feeding levels lower than 4 pounds (1.8 kg) will also require an increase in the level of minerals and vitamins to maintain the proper amounts on a daily basis. Daily nutrient requirement for brood sows during gestation are given in Tables 10, 11 and 12.

Table 11. Daily mineral allowances for bred gilts and sows.

Mineral	Nebraska's allowances
Total level:	
Calcium, g/day	16.0
Phosphorus, g/day	14.5
Additions:	
Salt, g/day	5.0-10.0
Zinc, mg/day	180.0
Iodine, mcg/day	400.0
Copper, mg/day	18.0
Iron, mg/day	180.0
Manganese, mg/day	50.0
Selenium, mcg/day[a]	180.0

[a] Legal addition.

Table 12. Daily vitamin additions from premix for bred gilts and sows.

Vitamin	Nebraska's allowances
Vit. A, IU/day	10,000.0
Vit. D, IU/day	1,000.0
Riboflavin, mg/day	10.0
Niacin, mg/day	60.0
Pantothenic Acid, mg/day	36.0
Choline, mg/day	1,000.0
Vit.E, mg/day	40.0
Vit. K, (menadione sodium bisulfite mg/day)	4.0
Vit. B_{12}, mcg/day	30.0

The success of limited-fed sows and gilts depends upon controlling the intake of each female. Care must be taken to see that each gets her share. Individual sow feeding stalls are effective devices for controlling boss sows. Interval feeding during gestation has had good success. Interval feeding means, for example, feeding every other day or every three days. Of course, the amount fed is adjusted accordingly. For example, instead of feeding 4 pounds (1.8 kg) each day during gestation, 8 pounds (3.6 kg) is fed every two days.

Sows should be full-fed during lactation in order to obtain maximum milk production. Hand feeding sows to appetite the first two to three days after farrowing may aid in the detection of milking problems. Sows going off feed and constipation are two of the symptoms of the MMA complex.

Can sow constipation be controlled by supplemental feeding of a specific feed ingredient?

Feed ingredients with a high fiber content and a high water binding capacity, such as dried beet pulp and beet

pulp with molasses can be used as a top dress on sow feed to alleviate constipation. Caution should be taken to avoid feeding a beet pulp that has been ammoniated or mixed with urea. Diets containing beet pulp or wheat bran are shown in Table 9.

Boar Diets

Boars can be fed a corn-soybean meal diet fortified similarly to the gestation diets. The daily feeding rate recommended in Table 1 may have to be changed to reflect differences due to season, condition, and work load of the boar. Boars under heavy use should be fed 6 lb (2.7 kg)/head/day of that diet.

ALFALFA IN SWINE DIETS

Should alfalfa be considered in formulation of swine diets?

Yes. Gestation diets containing from 25 to 66% alfalfa hay have supported good reproductive performance. High levels of alfalfa hay can be fed most accurately when mixed with other components in a pelleted diet. However, the cost may not justify feeding a pelleted diet. Therefore, if diets contain more than 66% alfalfa hay, feed the daily level of ground alfalfa hay plus 1 pound of a corn-vitamin-mineral mixture per head per day. In this case, the proper levels of supplemental vitamins and minerals will be mixed with ground corn, which serves as a carrier. The alfalfa hay is fed separately from the corn-vitamin-mineral mixture. If diets contain 66% alfalfa hay or less, alfalfa hay can be fed as a ground mixture with other needed diet constituents. Alfalfa is often added in growing-finishing swine diets at the rate of 2.5% of the total diet. This level serves as a safety factor to help insure the presence of certain vitamins and minerals. Higher levels of alfalfa in the growing-finishing diet depend on the price of the supplemental protein source, energy source, such as corn, and the performance desired.

CONVERSION FACTORS

With the metric system being adopted, the following lists commonly used conversion factors:

1 pound = *454 grams*

1 ounce = 28.4 grams

1 milligram = 1,000 micrograms

.6 micrograms of B carotene = 1 IU of Vitamin A

To convert milligrams per gram to milligrams per pound, multiply by 454.

To convert micrograms per gram or per pound to milligrams per gram or per pound, divide by 1,000.

To convert milligrams per pound to micrograms per gram or parts per million, divide by .454 or multiply by 2.2. These conversion factors are particularly useful in mineral and vitamin formulation.

Table 13. Feed analysis (as fed moisture level).

Feedstuffs	Protein %	Metabolizable energy Kcal/lb	Fiber %	Calcium %	Phosphorus %	Riboflavin	Niacin	Pantothenic acid	Choline	Lysine %
						----------mg/lb----------				
Alfalfa meal (dehydrated)	17	900.0	24.3	1.30	.24	6.5	20.0	13.6	680	.80
Alfalfa hay (early bloom)	16	850.0	27.0	1.20	.28	5.4	19.0	9.0	550	.60
Barley	11.5	1350.0	8.0	.08	.42	.5	26.0	3.0	460	.40
Beet pulp	9	1200.0	19.0	.68	.10	.3	7.0	.7	370	.60
Corn (yellow)	8.9	1550.0	2.5	.02	.28	.5	10.0	2.2	240	.25
Corn & cob meal (yellow)	8	1330.0	9.0	.04	.27	.4	9.0	2.0	160	.18
Dried brewer's yeast	45	1205.0	2.7	2.0	1.50	17.0	210.0	45.0	1750	3.40
Dried fish solubles	54	1270.0	3.5	1.50	1.00	7.0	135.0	20.0	2200	3.00
Fish meal, medhaden	65	1170.0	1.0	4.50	2.40	2.5	28.0	3.0	1300	4.80
Meat & bone scraps	50	1106.0	2.5	10.00	5.00	1.9	21.0	2.0	900	3.00
Millet	12	1225.0	8.0	.05	.28	.7	24.0	3.4	360	.25
Milo (sorghum)	9	1470.0	2.7	.03	.30	.5	18.0	5.0	310	.22
Molasses, beet	6	1060.0	0.0	.16	.02	1.0	18.0	2.0	400	----
Molasses, cane	3	1060.0	0.0	.50	.08	1.5	16.0	17.0	350	----
Oats	12	1210.0	11.5	.10	.33	.7	7.0	5.8	420	.40
Oats, feed rolled, oat groats	16	1550.0	3.5	.07	.43	.6	3.7	6.5	500	.6
Rye	12.2	1300.0	2.2	.08	.34	.8	.5	3.3	----	.45
Skim milk, dried	33	1530.0	0.0	1.25	1.00	9.0	5.0	1.5	500	2.80
Soybean meal (solvent)	44	1400.0	6.5	.25	.60	1.3	12.0	6.5	1200	2.90
Soybean meal (solvent dehulled)	47.5	1550.0	3.0	.20	.62	1.3	9.6	6.2	1225	3.20
Sugar	----	1690.0	----	----	----	----	----	----	----	----
Tallow, Feed Grade	----	3500.0	----	----	----	----	----	----	----	----
Tankage	60	1200.0	2.2	5.50	3.00	1.0	17.0	1.2	1000	4.00
Wheat, hard	13	1509.0	2.5	.05	.40	.45	24.0	5.0	400	.40
Wheat, bran	15	1055.0	10.5	.12	1.15	1.4	95.0	12.5	500	.60
Wheat, middlings	16	1340.0	7.0	.08	.70	1.0	22.0	8.0	500	.65
Whey, dried whole	12	1450.0	0.0	.90	.75	13.3	5.09	21.0	900	1.00
Dicalcium phosphate	----	----	----	24.00	18.50	----	----	----	----	----
Monocalcium phosphate	----	----	----	20.00	21.00	----	----	----	----	----
Steamed bone meal	----	----	----	28.00	14.00	----	----	----	----	----
Defluorinated rock phosphate	----	----	----	32.00	18.00	----	----	----	----	----
Disodium phosphate	----	----	----	----	21.00	----	----	----	----	----
Monosodium phosphate	----	----	----	----	25.50	----	----	----	----	----
Ground limestone	----	----	----	38.00	----	----	----	----	----	----
Sodium (Tri-Poly) phosphate	----	----	----	----	25.00	----	----	----	----	----

The Cooperative Extension Service provides information and educational programs to all people without regard to race, color or national origin.