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Nutrients, Feeds & Example Rations For Swine

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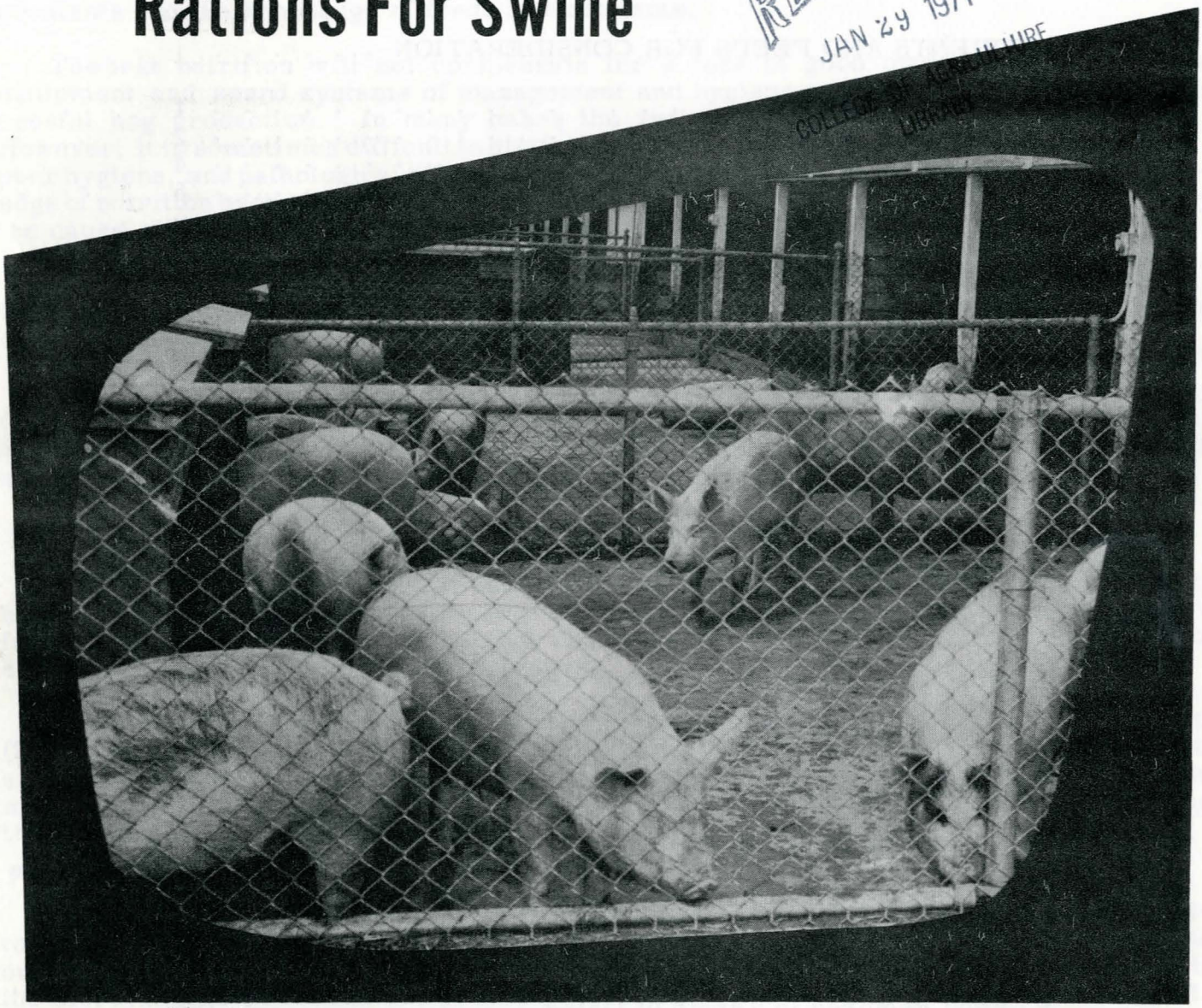

Raising Hogs in Confinement at the University Experiment Station

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NUTRIENTS, FEEDS and EXAMPLE RATIONS for SWINE

* R. J. Meade, Donald R. Warner and M. J. Brinegar

The same principles of nutrition apply to swine feeding whether the producer buys ready-mixed complete rations, mixed supplements to add to home-grown grains, or prefers to mix his own complete rations or supplement. This circular is intended to aid the swine grower in selecting a ready-mixed product suited to his needs and to serve as a guide in mixing rations for swine. The program which should be followed will depend on the extent of the swine enterprise, the availability of equipment for properly mixing ingredients and the knowledge of feeds and nutrients.

The best nutrition will not compensate for a lack of good management. Practical equipment and sound systems of management and hygiene are prime requisites for successful hog production. In many cases the ration is blamed for unthriftiness in pigs. However, it is sometimes difficult to distinguish between poor nutrition, poor management, poor hygiene, and pathological effects. Considering the application of our present knowledge of nutrition by the feed industry, it would appear that faulty nutrition is less frequently the cause of "pig troubles" than it was in the past.

Although little emphasis is placed on water in this discussion, it is the first essential. Maximum utilization of feed nutrients requires a plentiful supply of fresh water located close to the feeding area.

Present economic conditions dictate that the most profitable swine ventures usually follow a pattern of raising the most meat in the least time. Circumstances sometimes warrant deviation from this procedure, but a knowledge of swine nutrition is important in any type of program.

NUTRIENTS and FEEDS for CONSIDERATION

A basic rule of nutrition is that each essential nutrient must be present in an adequate amount for other nutrients to be properly utilized. Energy is the fundamental requirement for growth and maintenance. Many other nutrients are required for efficient utilization of energy and the formation of animal tissues.

Feed ingredients can be grouped into two general classes: (1) protein supplements and (2) the cereal grains. Protein supplements serve not only as sources of protein but, in addition, are often important sources of carotene, vitamin D, the B-vitamins, and essential minerals. A consideration of these nutrients individually will be of value in determining the usefulness of a protein supplement.

Proteins

All proteins consist of compounds called amino acids, which are sometimes referred to as the building stones of protein. There are more than 20 of these amino acids, but only 10 are essential to the pig. An essential amino acid is one that must be supplied in the diet in adequate amounts and proper proportions because the pig cannot synthesize it, or cannot synthesize enough of it. Quality of protein is measured by its ability to furnish the essential amino acids in the proper amounts and proportion. Different protein supplemental feeds contain the same essential amino acids, but they may contain these amino acids in different amounts. Some protein supplemental feeds contain such small amounts of certain essential amino acids that they alone will not supplement the amino acid deficiencies of corn or other cereal grains. Two or more protein supplemental feeds are often used in combination because one feed may supplement the essential amino acid deficiencies of the other, resulting in a much higher quality protein feed. If a protein feed is low in one or more essential amino acids, the protein will not be used efficiently.

*Revision made by staff members, Animal Husbandry Department.

We are primarily interested in two of the amino acids when adding protein supplements to corn. The protein in corn is low in the amino acids lysine and tryptophan. Good protein supplements are designed to correct these deficiencies and to increase the intake of the essential amino acids. Most proteins of plant origin are deficient in lysine. Soybean meal is an exception, being a good source of lysine. The proteins of animal and marine origin are also very good sources of this amino acid. If plant proteins other than soybean meal serve as supplements to corn for swine, another protein that is high in lysine should be used in combination with them. Animal proteins can serve this purpose.

Most supplements containing several proteins furnish enough tryptophan to counteract the deficiency in corn protein. Some samples of meat and bone scraps, if fed alone with corn, will not furnish enough tryptophan for maximum growth. The plant proteins are good sources of tryptophan.

Vitamins

There is nothing magic about the vitamins. Swine received vitamins long before we knew they existed, but as swine feeding methods were improved and faster growth was obtained, certain combinations of feeds were found to be inadequate in growth promoting factors later discovered to be vitamins.

In most cases, the vitamins are parts of enzyme systems which function in the utilization of proteins, fats, carbohydrates and minerals and serve in the maintenance of various body tissues. Animals have specific physiological requirements for these nutrients. Extra amounts over those needed for the definite body processes are of little or no value to the animal because there is little storage of most vitamins in the body. The required vitamins should be supplied in the necessary amounts when needed. The feeding of excess amounts is costly and wasteful.

An impressive list of the vitamins required by swine can be made. Only a few of these are likely to be deficient in the majority of swine rations made from a good combination of natural feedstuffs. Deficiencies of these will seldom occur if correct combinations of ingredients are used.

Vitamin A. Only two classes of swine feed have appreciable vitamin A value. Green leafy forage crops and yellow corn and some of its by-products are good sources of the precursors from which vitamin A is formed in the body. Dehydrated alfalfa meal is an excellent source of carotene. Bleached hay and feeds which have been stored for a long time are unreliable sources of carotene. Fish-liver oil or synthetic sources of vitamin A are available to supplement rations low in vitamin A value. Rations containing yellow corn and good quality alfalfa hay or meal are usually adequate. Some symptoms of a Vitamin A deficiency in swine are slow growth, a lack of coordination and dead, weak or malformed pigs at birth.

Vitamin D is necessary for the absorption of calcium and phosphorus and for proper bone formation. A deficiency causes rickets. If correct levels of calcium and phosphorus are present in the diet, a vitamin D deficiency will not occur under most conditions of swine feeding. Only pigs kept away from direct sunlight are likely to exhibit deficiency symptoms. Since irradiation of the body by the sun produces vitamin D from precursors in the skin, swine kept outside in the summer months will never become deficient in the vitamin. If animals are kept indoors or if exposed to less sunlight during the winter months, good sun-cured alfalfa hay, cod-liver oil, irradiated yeast or irradiated sterols can be used to fortify the rations. Dehydrated alfalfa contains very little vitamin D.

Vitamin E. It has been shown that vitamin E is necessary for successful reproduction in rats. At present, there is no evidence showing any improvement in the reproduction of swine from supplementing natural diets with vitamin E. Green pastures, good quality alfalfa hay or meal, and the cereal grains are good sources of vitamin E.

Vitamin B_{12}. This recently identified vitamin appears to be concerned in some way in the protein metabolism of animals and in the formation of the red blood cells. Feeds of plant origin are deficient in vitamin B_{12}, while feeds of animal and marine origin are good sources of this factor. Diets containing no, or very little, animal protein should be supplemented with a source of vitamin B_{12}. Excellent sources of this vitamin are supplements produced by microbial fermentation. Rations containing 5 to 7 per cent of protein supplemental feed of animal or marine origin will usually be adequate in this vitamin.

Riboflavin. Deficiency symptoms of riboflavin in swine include slow growth, diarrhea, stiffness and a general unthrifty appearance. Litters from riboflavin-deficient sows may be farrowed several days prematurely and show deformities. The cereal grains and most of their by-products are low in riboflavin. The oil meals and most meat by-products are better sources but cannot be relied upon to correct the deficiencies of the grains. Alfalfa, milk products, brewers' yeast and distillers' solubles are rich sources (see table 1). Fermentation solubles and riboflavin from synthetic sources are available for supplementing rations containing inadequate amounts of the above ingredients.

Table 1. Approximate content of some nutrients in feeds. 1/

	Protein	Calcium	Phosphorus	Riboflavin	Niacin	Pantothenic Acid
	per cent (lbs. /100 lbs.)			milligrams/pound		
Corn 2/	8-9	.01-.02	.25-.30	0.4-0.6	8-10	2.1-2.6
Oats	11-13	.08-.10	.35-.40	0.4-0.6	6-8	6.0-7.0
Barley	9-12	.04-.06	.35-.40	0.6-0.9	23-28	3.0-3.8
Grain sorghums	10-12	.02-.03	.30-.35	0.4-0.6	13-18	4.5-5.5
Rye	11-12	.08-.10	.30-.35	0.6-0.8	6.5-7.5	4.0-4.5
Wheat	13-15	.04-.06	.38-.42	0.4-0.6	25-30	5.5-6.5
Wheat middlings	15-17	.05-.10	.70-.90	0.7-1.0	40-45	9-11
Wheat bran	15-17	.10-.14	1.2-1.4	1.2-1.6	60-70	12-14
Soybean meal	41-44	.25-.30	.60-.70	1.3-2.0	15-20	6-7
Cottonseed meal	41-44	.20-.25	1.0-1.3	2.0-2.8	13-15	4.5-6.0
Linseed meal	33-36	.35-.40	.85-.90	1.3-2.0	15-20	7-8
Peanut meal	43-50	.10-.15	.50-.55	2.0-2.5	70-80	20-25
Tankage	60-62	6.0-6.5	3.0-3.5	1.0-1.5	18-22	1.0-1.5
Meat scraps	50-55	8.0-10.0	4.0-5.0	1.5-2.0	18-22	1.5-2.0
Meat and bone scraps	45-50	9.0-11.0	4.5-5.5	1.5-2.0	18-22	1.5-2.0
Fish meal	60-65	4.0-5.5	2.5-3.5	2.5-4.0	25-35	2-4
Alfalfa meal (dehydrated) 2/	15-20	1.3-1.6	.20-.25	6.0-7.5	10-18	10-18
Alfalfa meal (sun cured) 2/	13-17	1.2-1.4	.20-.30	5.5-6.5	10-16	8-12
Distillers' solubles (dried)	25-30	.30-.40	1.2-1.5	5-6	50-55	8-10
Brewers' yeast (dried)	45-50	.10-.15	1.0-1.5	15-20	220-230	50-60
Skim milk (dried) 3/	34-36	1.2-1.4	.90-1.1	8-10	5.5-6.0	15-17
Buttermilk (condensed)	10-12	.40-.50	.20-.30	3-5	1.5-2.0	6-8
Buttermilk (dried)	31-33	1.3-1.4	.80-1.0	10-15	3-5	15-20
Whey (dried)	11-13	.80-.90	.70-.80	10-15	4-6	20-25

1/ There is considerable variation in values for different samples of the same feed. The ranges in values shown should represent most samples of a feed.

2/ Feeds other than yellow corn and green roughages contain very little carotene. Yellow corn usually contains 1.2 to 1.8 milligrams of carotene per pound. Dehydrated alfalfa and sun-cured alfalfa usually contain 40 to 60 milligrams and 20 to 30 milligrams of carotene per pound, respectively.

3/ One gallon of liquid skim milk is equivalent to 0.8 to 0.9 pound of dried skim milk.

Pantothenic acid. Swine fed a ration deficient in this vitamin grow slowly, may have a scurfy skin and diarrhea, and may show a characteristic incoordination (goose stepping). Corn and some by-products are poor sources of this vitamin (see table 1). In general, protein supplements of plant origin contain more pantothenic acid than tankage or fish meal. Alfalfa, milk products, brewers' yeast, peanut meal and wheat bran are good

sources of pantothenic acid. Goose stepping has been noted in pigs (in dry lot) fed rations containing alfalfa meal. Some samples of alfalfa meal at levels normally fed in dry lot may not furnish enough pantothenic acid to compensate for the relatively low levels in corn and several of the protein supplements. Synthetic sources of this vitamin are available for use in rations consisting of feeds low in pantothenic acid.

Niacin. A deficiency of niacin may result in slow growth, vomiting, a rough skin condition and diarrhea. Certain types of diarrhea of nutritional origin respond to niacin therapy. The requirement for niacin will usually be adequately supplied by well formulated rations containing a variety of feedstuffs. Corn, oats, rye and the milk products are among the poorest sources. Numerous other feeds supply considerable niacin (see table 1).

Several other known vitamins are required by swine, but grains and protein supplements supply enough of these under nearly all conditions. Recent research indicates that one or more unidentified growth factors may be required by swine. It is unlikely that correct combinations of ingredients in swine rations and the wise use of good pastures will fail to supply adequate levels of these factors.

Minerals

Calcium and phosphorus are the mineral elements which are most likely to be deficient in swine rations. Where rations are deficient in both calcium and phosphorus, steamed bonemeal or deflourinated phosphates are good supplements. Where only calcium is needed ground limestone can be used. Recommended levels for the various classes of swine are as follows:

Class	Percent in Ration	
	Calcium	Phosphorus
Pre-weaning	.70 - .80	.50 - .60
Weaning to 125 lbs.	.60 - .70	.40 - .50
125 lbs. to market	.55 - .60	.35 - .40
Breeding Stock	.60 - .80	.40 - .50

Salt (sodium chloride) is very important in swine rations. Swine rations should contain about one-half pound salt per 100 pounds. If the salt is included in the protein supplement only, it should be added at the rate of approximately 2 pounds per 100 pounds of supplement.

Additional quantities of some of the "trace minerals" should be supplied to swine under certain conditions of feeding. Supplementary iodine may be necessary where the soil is deficient in this element. The use of stabilized iodized salt is a good practice. A deficiency of iodine will cause goitrous, hairless newborn pigs.

Some rations for growing-finishing pigs may not contain enough zinc and a skin disorder, parakeratosis, may occur. Rations containing excess calcium will aggravate this condition. This emphasizes the importance of proper calcium levels in the ration.

A deficiency of iron and copper will cause anemia in pigs. Since milk is low in these elements, baby pigs kept away from the soil should be supplied with additional iron and copper. Several satisfactory methods of supplying these elements are available:

1. Place clean sod in the pen.
2. Swab the sows udder daily with a copperas solution (one pound per gallon of water).
3. Use commercially prepared treatments (pastes, pills or injections).

The results of some experiments indicate that supplementing certain dry lot rations with cobalt will increase gains. Vitamin B_{12} contains this element. It is possible that such growth stimulation is due to an interrelationship between cobalt and vitamin B_{12} in a diet low in this vitamin.

Trace mineral supplements may be included in the ration at little additional cost even though they may not be needed. The trace mineral mix should be simple (containing iron, copper, zinc and manganese) and concentrated (not mixed in a bulky carrier such as ground limestone or salt.)

Antibiotics

Recent reports have shown that the addition of some of the antibiotics to good swine rations increases gains and feed efficiency. Most of the tests have been made with pigs in dry lot. Some pasture experiments have been reported. Many more experiments are needed before all of the answers are known, but a few general statements can be made.

Antibiotics are drugs and not nutrients. We cannot expect as uniform response in gains of swine fed the antibiotics as we can in the case of nutrients which are required physiologically in definite amounts. There is a proportionately greater increase in gains of young pigs fed antibiotics than in animals near market weights. Although some apparently healthy pigs respond to antibiotic feeding, the benefit is usually greater for unthrifty pigs. The response of pigs on good pasture to antibiotic feeding is less than that of similar pigs in dry lot. Pigs that respond to antibiotic feeding usually consume more feed, leaving a greater proportion of the intake available for growth after the maintenance needs are supplied. In many cases, feeding the antibiotics decreases the incidence of some types of diarrhea. Feeding the antibiotics at economical levels will not, by any means, prevent or cure all types of diarrhea.

Whether feeding the antibiotics has an unfavorable effect on the proportion of lean to fat cuts in a carcass has not been studied adequately. Although present evidence is conflicting, a considerable amount of evidence has been accumulated to indicate that pigs fed properly balanced rations and marketed at proper weights will not yield appreciably less lean cuts because the ration contained an antibiotic.

The effectiveness of several of the antibiotics has been studied. Aureomycin and terramycin have been tested extensively with favorable results. Penicillin, bacitracin, streptomycin and other antibiotics have also been studied. It appears that streptomycin is less effective at similar levels than some of the other antibiotics. In some tests, penicillin has compared favorably with the other antibiotics. It is difficult to make direct comparisons because levels of antibiotics used in some experiments have not been equalized. Limited work with bacitracin does not show it to compare favorably with the other antibiotics. Combinations of antibiotics have also been effective in increasing gains, but at present, few results of such experiments are available.

Experiments show that certain arsonic acid derivatives stimulate the growth of swine under certain conditions, probably in a manner similar to that of the antibiotics. Growth stimulation from these arsenicals has compared favorably with that resulting from use of the more effective antibiotics when added to antibiotic-free rations. In some experiments the arsenicals have produced symptoms of toxicity.

Several theories have been proposed as to how the antibiotics exert their influence. One theory is that they retard the growth of harmful intestinal bacteria. This may either allow beneficial bacteria to multiply and have a favorable effect on the animal or may merely clear up a low grade infection which may or may not be outwardly noticeable. A second theory is that the comparatively low levels of antibiotics required to increase growth actually stimulate the growth of beneficial bacteria. A third theory is that the antibiotics kill bacteria which may compete with the animal for certain nutrients which increase growth. It is probable that a combination of factors is involved.

The question frequently arises as to the advisability of including antibiotics in the gestation or lactation rations of brood sows. Present evidence does not justify the addition of antibiotics to rations of pregnant and lactating sows. Feeding high levels of antibiotics to lactating sows is not an effective means of getting these substances into the suckling pig. Antibiotics in rations for suckling pigs is another problem. Numerous experiments have shown considerable benefit from supplementing creep rations with antibiotics.

Even though many swine producers can expect increased gains from feeding antibiotics (especially in dry lot), it should be emphasized that these compounds cannot take the place of proper nutrition and sanitation. More information is needed before the routine practice of feeding antibiotics can be accurately evaluated.

Supplements are available that contain antibiotics, antibiotics and vitamin B_{12}, antibiotics and several vitamins, or antibiotics, several vitamins and minerals. The swine producer who uses plenty of good pasture, dehydrated alfalfa meal or excellent quality ground alfalfa should be interested primarily in the antibiotic and vitamin B_{12} content of such supplements. If, in addition, considerable protein of animal origin is used, the vitamin B_{12} content needs to receive little attention.

Any statement regarding the levels of antibiotics for feeding are only estimates at the present. It should be expected that the optimum levels of the different antibiotics will vary under different feeding conditions and systems of managements. A tentative guide is to feed the equivalent of 10 grams of antibiotic per ton of mixed feed for pigs between weaning and 125 pounds. For pigs from 125 pounds to market weight, a more economical level is probably nearer 5 grams of antibiotic per ton of mixed feed. If antibiotic is included in the protein supplement (containing 35% to 40% protein) only, the level of supplementation should be from 30 to 40 grams per ton of supplement. For example, if a pound of an antibiotic supplement contains 5 grams of antibiotic, 6 to 8 pounds of the product should be added to each ton of protein supplement. This will automatically provide higher intakes of antibiotic during the early growth period.

For suckling pigs, antibiotic levels in relation to grain and supplement should probably be increased, since these feeds are only part of the total feed consumed. In addition, this period of the pig's life is more critical and cost is a less important factor. For creep rations, the level of antibiotic should probably be increased to 20 grams per ton of total ration.

Miscellaneous Factors for Consideration of Protein Supplements

Considerable differences exist in the palatability of the ingredients which may be used in protein supplements. Much of the unpalatability of various feeds is probably due to nutrient deficiencies. If these deficiencies are corrected, very few ingredients are unpalatable enough to prevent adequate intake of protein. Swine allowed soybean meal free-choice with grain may consume much more protein than is necessary to balance the ration. If soybean meal is mixed with an equal part (by weight) of another supplement or with one-third alfalfa meal, swine will usually not eat excessive amounts.

The energy contribution of protein supplements should not be overlooked, even though the cereal grains furnish the greater proportion of the energy in rations. Some of the important sources of vitamins in supplements are either relatively low in protein or high in fiber (alfalfa, for example). However, care should be taken to exclude fibrous feeds that do not make definite contributions to the supplement. Excellent protein supplements containing adequate levels of vitamins can be compounded from natural ingredients and still contain 35% or more protein.

Recommended Intakes of Protein

The following levels of protein are recommended for the various age and weight groups of swine. These recommendations are based on recent findings at the Nebraska Agricultural Experiment Station, other experiment stations and the recommendations of the National Research Council Committee on Swine Nutrition.

Market stock		
Weight	Per cent protein of ration	
	Dry lot	Pasture
Weaning to 75 lbs.	15 to 17	14 to 16
75 lbs. to 125 lbs.	13 to 15	12 to 14
125 lbs. to market	11 to 13	10 to 12
Beyond 220 lbs.	11	10

Breeding stock

Class	Per cent protein in ration	
	Dry lot	Pasture
Gestation-gilts	15	12-13
Gestation-sows	12-14	10-12
Lactation-sows & gilts	15	

It is recommended that boars receive the same levels of protein as gilts and sows during gestation. As a general rule, about 2% less protein than the levels shown in the table above is recommended in rations for swine on very good pasture. A few reports have indicated that the recommended levels of protein are higher than necessary. In some instances swine will make good gains on diets containing lower levels of protein than those recommended, if the protein supplement is balanced with respect to amino acids, is highly digestible and contains adequate amounts of all required vitamins. For the present, the swine producer interested in maximum gains should feed the recommended levels of protein if economic conditions permit.

The Cereal Grains

Since corn is the most widely used of the cereal grains for swine, a discussion of this feed might include the values and limitations of corn as a source of nutrients and its use as a yardstick in appraising the nutritive value of the other grains. Corn is an excellent source of energy, but it contains inadequate amounts of certain other nutrients as was emphasized in the previous discussion (see table 1). The small amount of protein in corn is of poor nutritive value. Supplements for corn should not only be designed to increase the protein intake, but in addition, to correct the lysine and tryptophan deficiencies of corn protein (see previous discussion on proteins). Other cereal grains generally contain more tryptophan than corn.

Corn is deficient in some of the mineral elements. It contains very little calcium and only marginal amounts of phosphorus. The levels of several vitamins in corn are also low. Yellow corn that has not been stored too long usually furnishes enough carotene (vitamin A value) for growing and fattening swine. Additional carotene must be supplied to brood sows. Good legume hay and green pasture are excellent sources. The carotene content of corn decreases during storage. White corn and the other cereal grains furnish little, if any, vitamin A value.

Soft corn can be utilized very efficiently by swine. Provided it is not moldy, corn with a high moisture content is usually equal to normal corn on the basis of dry matter content. Gains may not be as rapid, but feed utilization will probably be as efficient. The feeding value of corn containing 25% moisture should be worth approximately 88% as much as corn containing 15% moisture (75 ÷ 85). The two samples of corn dried at moderate temperatures to the same moisture content should be of about equal value.

Pigs weighing 75 pounds or more generally use soft corn to better advantage than younger pigs. The change from normal to soft corn should be gradual, in order to lessen the chance of causing scours.

Many types of mold are found on corn. Many of these are harmless but some may prove toxic. Moldy corn is not necessarily lower in palatability but it is quite likely to be lower in feeding value, because of the destruction of the most readily digestible nutrients. It is generally considered a poor practice to feed unsound grains to pregnant and lactating sows.

The most value from oats for swine can be obtained by including them in gestation rations for sows. Since a pound of oats furnishes 80% to 90% as much energy as a pound of corn, their use in rations designed for rapid and efficient gains should be limited. Good quality oats have nearly the same value as corn, pound for pound, if when ground they constitute as little as one-fourth of the ration (by weight).

Much of the satisfactory experience from including oats in swine rations is probably due to their higher content of protein (which has a slightly higher nutritive value than corn protein), and to their higher content of some vitamins and minerals.

Hulled oats are in special favor for creep-fed pigs. Young pigs seem to prefer them to most other feeds. The price of hulled oats is usually rather high, but the small amount consumed by suckling pigs and the benefit from feeding them may more than offset the extra cost.

Barley ranks about midway between oats and corn as a source of energy for swine. A pound of good quality ground barley is worth about 90% as much as a pound of corn for hogs. Barley is a much better source of niacin than either corn or oats but contains only slightly more riboflavin and pantothenic acid than corn. Barley infected with scab is unpalatable to hogs. If barley is very scabby, it should not be fed to hogs. If it is only moderately infected, it may sometimes be fed safely at no more than 10% of the ration. Even then, it should not be fed to brood sows or young pigs.

Most of the grain sorghums are worth 90% to 95% as much as corn. They may be mixed with other grains or fed as the only source of grain.

Wheat is usually too high in price to warrant feeding it to hogs. Several tests have shown that wheat is equal to or gives slightly better results than corn. Wheat is higher in protein, niacin and pantothenic acid than corn, but is deficient in carotene (vitamin A value). It is generally considered economically sound to feed wheat when the price per bushel is not over 106 to 110 per cent than of corn.

In many tests, rye has not been entirely satisfactory as a swine feed. Rye infected with ergot fungus will produce poor results. Ergot may cause abortion in brood sows. Some experiments have shown that good quality disease-free rye is worth about 90% as much as corn. Best results are obtained when it is fed in combination with other grains and to hogs weighing over 100 pounds on pasture.

Grinding Grains for Swine

Below are estimated increases in feeding value that can be expected from grinding or rolling grains for swine:

Grain*	If hand-fed	If self-fed
Corn	5%**	Very little increase
Oats	25%	25%
Barley	20%	15%
Sorghum grains	15%	3%**
Wheat	20%	5%**

*It usually pays to grind rye for swine.
**Will usually not pay for additional cost of grinding.

As a general rule, older hogs (brood sows and boars) do not chew the grains thorougly enough to prevent waste. Hard corn should be ground and corn fed to hogs weighing over 225 to 250 pounds should be ground.

Pastures for Swine

The importance of good pasture for swine cannot be overemphasized. Table 1 illustrates a few of the important nutrient contributions of alfalfa. In addition to supplying more protein than the cereal grains, good pastures (especially legumes) are good sources of calcium and many of the vitamins.

Hogs on pasture will usually not gain more than similar thrifty hogs in dry lot fed a good balanced ration, but less of the expensive supplements are required to balance the cereal grains. It has been estimated that an acre of good pasture utilized properly for hogs will save 500 to 800 pounds of a good protein supplement. Pasture-fed hogs require

about half as much protein supplement as hogs fed in dry lot. Since pasture supplements need not contain alfalfa meal, they will usually cost approximately 25% more per pound than dry lot supplements. This amounts to about 40% net reduction in the cost of protein supplement required to balance a ration for hogs on good pasture.

Swine on clean pasture are usually more thrifty than hogs in dry lot. A good sanitation program is more easily carried out if pasture is used. In addition, less labor is required in caring for hogs on pasture.

Alfalfa is one of the most palatable and nutritious forages for swine. It provides excellent grazing from early spring until late fall. Depending on the many factors affecting the growth of alfalfa, one acre will usually be enough for 15 to 25 growing-fattening hogs or half this number of bred sows.

In areas where Ladino clover can be satisfactorily grown, it is fully equal to alfalfa as a pasture it it is not grazed too closely. In some tests it has been superior to alfalfa. It makes good growth during midsummer when some of the other pasture crops make less abundant growth.

Red clover approaches the value of alfalfa pasture for hogs. Its carrying capacity is slightly less and it is usually not ready for grazing as early in the spring as alfalfa. It is palatable to hogs if not allowed to become too mature.

Lespedeza is usually less palatable than alfalfa or red clover for hogs and cannot be grazed as early as these crops. Where it can be grown for hogs, the value of lespedeza is greatest for insurance grazing during the summer months.

Sweetclover is reasonably good pasture for hogs during the first year's growth. Hogs will eat much less of it than alfalfa pasture. However, considerable value can be obtained from sweetclover if pastured before it becomes too rank.

Rape is nearly equal to alfalfa or red clover for hogs. It is quite palatable and has the advantage of furnishing excellent pasture soon after seeding. It can be seeded early and is ready for grazing within 6 to 8 weeks. It furnishes pasture until late fall. Rape sometimes causes blistering of thin-skinned hogs if grazed when wet. This is not a serious problem during the late summer months or if the plants are dry.

Sudan grass, when succulent, is very palatable to pigs. It is especially useful during the hot summer months when other pastures are dormant. Because of its rank growth, it is best adapted to larger hogs. Sudan grass is more palatable if grazed closely. It is sometimes advisable to graze only part of the pasture and keep the remaining pasture clipped, if the carrying capacity exceeds the number of hogs.

Bromegrass is a very satisfactory pasture for swine. It supplies an abundance of early pasture and withstands rooting and trampling exceptionally well. Gains of pigs on bromegrass pasture are not as good as on alfalfa pasture. Its greatest value is during spring and fall in comparison to its decreased growth and palatability during July and August. Mixtures of bromegrass and alfalfa usually give as good results as alfalfa alone.

Fall seeded rye is a good pasture for fall pigs or bred sows during an open winter. Its best use is for early spring pigs before other crops are ready for grazing. It should be seeded at a heavy rate.

EXAMPLE RATIONS for VARIOUS CLASSES of SWINE

Table 1 shows the approximate nutrient content of several feeds. The figures are intended as guides and not as absolute values for specific feeds. Considerable variation may exist between different samples of the same feed.

By keeping the values and limitations of the grains in mind and recognizing the importance and sources of nutrients for swine, excellent diets can be formulated from a few simple feeds and supplements. Under certain conditions, some of the more expensive supplements may improve the performance of swine fed rations shown in tables 2 to 7. However, the cost of such supplements may not be offset by the increased performance. The value of certain "high potency" supplements for swine depends entirely on the adequacy of the ration to which they are added. For example, the value of milk products is much less for hogs receiving good alfalfa meal or pasture than for hogs receiving only the cereal grains and common protein supplements. Likewise, the value of milk products is greater for young pigs during the critical growth period than for hogs nearer market weight.

If no more milk is fed than is needed to balance the rations, it can be assumed that one gallon of liquid skim milk or undiluted buttermilk is equivalent to one pound of an excellent protein supplement. Waste will be eliminated if no more than one gallon of skim milk per head daily is fed to hogs in dry lot or about half this amount to hogs on good pasture. Liquid skim milk contains approximately 10% dry matter. The value of other milk products can be calculated on the basis of equivalent amounts of dry matter.

Thorough mixing of diet ingredients cannot be over-emphasized. This is especially true of the ingredients needed in small quantities (for example, mineral, vitamin and antibiotic supplements). Careless mixing will not only result in waste of certain ingredients, but may also prevent some of the animals from receiving adequate intakes of some nutrients. If a small amount of an ingredient is added, it must be premixed with a larger quantity of some ingredient included at a higher level before it is added to the complete mixture. Even though feeds can be mixed satisfactorily by hand, the swine producer who practices "home mixing" extensively should have access to a good mechanical mixer.

Table 2. - - Types of protein-mineral-vitamin supplements.

	In dry lot						On pasture			
	A	B	C	D	E	F	G	H	I	J
Soybean oil meal	400	400	400	300	200	200	500	600	600	400
Linseed meal				100						
Tankage*	300	200		300	200		500		200	
Meat & bone scraps			300			300		400		300
Fish meal (Menhaden)		100			100				200	
Alf. meal (sun-cured)**	300	300	300	300	500	500				300
Ground limestone					20					
Steamed bone meal	20	25		25					20	
Iodized salt	20	20	20	20	20	20	20	20	20	20
	1040	1045	1020	1045	1040	1020	1020	1020	1040	1020
Approx. crude protein content, %	37	37	35	37	32	30	50	45	48	3.5
Approx. calcium content, %	3.0	3.0	3.2	3.0	3.2	3.4	3.1	3.6	3.0	3.2
Approx. phosphorus content, %	1.6	1.6	1.6	1.6	1.7	1.6	2.0	2.1	1.9	1.6

*Tankage and meat and bone scraps are interchangeable.

**Dehydrated alfalfa meal can be substituted for sun-cured alfalfa meal if hogs are exposed to sunlight.

Types of Supplements

The formulation of protein supplements need not be a complicated procedure. The examples shown in table 2 are relatively simple protein-mineral-vitamin supplements that will satisfactorily balance the nutrient deficiencies of most cereal grain rations fed

to swine on Nebraska farms. In setting up these formulas, alfalfa meal has been used extensively because of its potency in the B-vitamins. The levels of alfalfa meal shown in the protein supplements are calculated to furnish the required amounts of these nutrients when the supplements are properly used with corn and other grains fed in Nebraska. Alfalfa meal should always be of high quality and if sun-cured meal is used it should be obtained from third or fourth cutting hay. If alfalfa hay of good quality is not available it is possible to use one of many high quality B-vitamin supplements which will adequately fortify a supplement when added at a rate of 10 to 20 pounds per ton. Likewise, antibiotic (and antibiotic and vitamin B_{12}) feed supplements can be added to the supplement when it is mixed. Antibiotic feed supplements should be added to furnish 30 to 40 grams of antibiotic activity per ton of supplement for growing-fattening pigs.

Feeding Sows and Gilts During Gestation

An adequate ration during the breeding season and during gestation is necessary for brood sows to farrow strong healthy pigs. In addition to supplying nutrients for her own body processes and the unborn litter, it is important that she build up body reserves of nutrients for use during the drain of lactation. The adequacy of gestation rations can influence the survival and growth of suckling pigs.

Optimum gain in weight of sows and gilts during gestation depends on several factors. Gains should be regulated according to the age, type and weight of the sow. Sows that are bred when thin must receive extra feed to cover the additional gain required. Gilts must receive enough feed to meet requirements for both growth and the developing litter. In general, gilts should be expected to gain 100 to 125 pounds during gestation. Sows that are in good condition when bred should gain 75 to 100 pounds. As previously mentioned, deviations from these gains are sometimes desirable.

Table 3. - - Type of rations that may be hand-fed during gestation.

	Dry lot (and in winter)					On Pasture			
	A	B	C	D	E	A	B	C	D
Ground yellow corn	725	385	400	700	380	455	875	440	830
Ground oats	---	360	400	---	380	440	---	440	---
Sun-cured alf. meal	150	150	---	---	---	---	---	---	---
Meat Scraps	60	---	---	---	---	50	---	---	---
Tankage	---	60	---	---	---	---	50	---	---
Soybean oil meal	60	40	---	---	---	40	60	---	---
Steamed bone meal	---	---	---	---	---	10	10	20	10
Iodized salt	5	5	---	---	---	5	5	---	---
Supp. E or F	---	---	---	300	240	---	---	---	---
Supp. B, C, D, or J	---	---	200	---	---	---	---	100	160
	1000	1000	1000	1000	1000	1000	1000	1000	1000

	Bred gilts weighing:			
	250	300	350	400
Pounds of feed required per day				
First two-thirds	4.0 to 4.5	4.8 to 5.4	5.6 to 6.3	6.4 to 7.2
Latter third	4.5 to 5	5.4 to 6.0	6.3 to 7.0	7.2 to 8.0

	Bred sows weighing:				
	300	350	400	450	500
Pounds of feed required per day					
First two-thirds	3.6 to 4.0	4.2 to 4.9	4.8 to 5.6	5.4 to 6.3	6.0 to 7.0
Latter third	4.2 to 4.8	4.9 to 5.6	5.6 to 6.4	6.3 to 7.2	7.0 to 8.0

The gain of bred sows and gilts can be controlled in either of two ways: hand-feeding a limited amount of grain and supplement or self-feeding a bulky ration. Some rations suitable for hand-feeding are shown in table 3. The examples are set up so that a complete mixed ration can be prepared or so that a simpler procedure of mixing supplement and adding the supplement to farm grains can be followed. The example rations shown should be fed at a rate of 1.2 pounds of total ration to each 100 pounds of body weight to mature sows during the first two-thirds of gestation and at 1.4 pounds of total feed per 100 pounds body weight during the latter third of gestation. Bred gilts will require 1.6 to 1.8 pounds of feed per 100 pounds body weight during the first two-thirds of gestation and 1.8 to 2 pounds of feed per 100 pounds of body weight during the latter third of gestation. The rations shown in table 3 are set up so that the bred sow or gilt will consume about 15 per cent of her total feed as alfalfa hay or meal. All rations for bred sows and gilts are calculated to contain 15 per cent of crude protein although bred sows may require less. This method is followed because it is felt that on the farm it will not be feasible to prepare separate rations for sows and gilts.

The rations for hand-feeding to bred sows and gilts are shown for both dry lot and pasture feeding. Unless sows are on very high quality rye pasture during the winter they must be considered as in dry lot. Likewise sows must be considered as in dry lot during the spring and summer unless they have access to high quality legume or grass pasture. The feed allowance for sows on pasture should be reduced by 1/6 to 1/3 (in some cases more) so that the sows will eat the forage. Choice quality alfalfa hay can be offered in a rack to sows fed in dry lot with no change in the rations.

Some swine producers prefer to feed hay in the rack rather than include it in the protein supplement. The amount of hay consumed under such a system varies considerably. However, it can be assumed that sows and gilts will eat at least 0.5 to 1.0 pound of good quality hay per head daily. If a 350-pound bred gilt consumes 0.8 pound of hay daily, she should require only 5.5 to 6.2 pounds of supplement and grain. Since a supplement containing no alfalfa will be higher in protein, only 12 to 14% of the total feed should be supplement (supplements shown in table 2 without alfalfa). Accordingly, sows and gilts on good pasture do not require alfalfa in their supplement and thus need less total grain and supplement.

Satisfactory rations that can be self-fed to sows and gilts during the breeding season and gestation are shown in table 4. These rations are bulky enough to prevent excessive fattening. The proportion of alfalfa in the rations can and should be varied to permit the gains desired (compare rations A and C). This method of feeding requires much less labor and prevents timid sows from receiving insufficient feed. Since the sows are not observed during feeding, it is very important that close attention be given them by a caretaker who can recognize the ones that are "off feed." Another disadvantage is that many self-feeders are not designed to handle bulky feeds and require considerable attention. These rations are not varied for pasture or dry lot feeding because sows that are self-fed do not graze readily and because it is important to maintain the alfalfa meal as a source of vitamins. Alfalfa meal is also necessary as a bulking agent to reduce the net energy content of the ration. We have not attempted to set up separate rations for bred gilts or mature bred sows, and we feel that under farm conditions separation of the sow herd is not practiced.

When sows are hand-fed after farrowing they sometimes become restless because of hunger and this can sometimes be overcome by feeding a small amount of the bulky ration. Overfeeding may cause pigs to show diarrhea due to excessive milk flow of the sow, a condition which should be avoided but which is not disastrous. When diarrhea is observed it is well to eliminate such causes as spoiled or sour feed in the trough. It is also important that the caretaker be able to distinguish between diarrhea caused by excessive milk flow and those diarrheas resulting from diseases such as gastro-entritis which are pathological and which may cause serious losses.

Lactation Rations

By the time the pigs are 10 days or two weeks old, the sow should be self-fed a ration designed for maximum milk production. The rations shown in table 5 are suitable for self-feeding during lactation. Very good results can also be obtained by feeding shelled corn or ground barley, wheat or sorghum grains and a protein supplement free-choice. A satisfactory protein supplement is one containing equal parts of soybean meal, tankage and alfalfa meal with the addition of approximately 2% salt.

For sows suckling litters on good pasture, alfalfa meal can be omitted from the rations shown in table 5 and from protein supplements fed free-choice with grain.

Feeding Sows at Farrowing Time

The amount of feed given the sow should be decreased when she is confined to the farrowing pen and the ration should be made more bulky and slightly laxative. A mixture of 2 parts gestation ration and 1 part wheat bran usually works quite well. The sow should not be fed immediately prior to farrowing and for about 12 hours after farrowing; however, she should be given plenty of fresh water during this period. Sows should gradually be returned to full feed using a ration similar to the bulky gestation rations shown in table 4. Most sows will be on full feed when the pigs are 7 to 10 days old, at which time the more concentrated rations shown in table 5 should gradually replace the bulky ration so that sows are on full feed of the contentrated lactation rations when the pigs are about 2 weeks old.

Table 4. - - Types of rations for self-feeding during gestation.

	A	B	C	D	E	F
Ground yellow corn	300	300	---	500	300	300
Ground sorghum grain	---	---	400	---	---	---
Ground oats	300	400	300	---	300	350
Alfalfa meal (sun cured)	300	200	200	400	250	150
Meat and bone scraps	50	50	50	50	---	---
Soybean oil meal	50	50	50	50	---	---
Steamed bone meal	---	---	---	---	---	---
Iodized salt	5	5	5	5	---	---
Supplement B or C	---	---	---	---	150	---
Supplement E or F	---	---	---	---	---	200
	1005	1005	1005	1005	1000	1000

Table 5. - - Types of rations for self-feeding sows and gilts during lactation.

	A	B	C	D	E	F
Ground yellow corn	525	545	395	440	540	560
Ground oats	150	---	150	150	150	---
Wheat middlings	---	150	150	150	---	150
Alf. meal (sun-cured or dehydrated)	150	150	150	100	100	50
Tankage*	60	---	---	---	---	---
Meat & bone scraps	---	60	60	---	---	---
Soybean oil meal	100	80	80	---	---	---
Steamed bone meal	10	10	10	10	10	---
Iodized salt	5	5	5	---	---	---
Supplement A or B	---	---	---	150	---	---
Supplement C or D	---	---	---	---	200	---
Supplement E or F	---	---	---	---	---	240
	1000	1000	1000	1000	1000	1000

*Tankage and meat and bone scraps are interchangeable.

It is possible to self-feed the bulky rations as soon as the sow will eat after farrowing. Her condition and feeling of well-being usually regulate her feed intake fairly well. If a limited amount of bulky ration is placed in the feeder the more concentrated ration can simply be added so that it mixes with the bulky ration for the first three to five days after its addition.

Rations for Suckling Pigs

Creep starters should be placed before the pigs when they are a week to ten days old. Fresh water should also be readily available to the little pigs. The milk production of the sow reaches its peak when the pigs are about three weeks old and declines thereafter. If the pigs can be induced to eat a creep starter early they will continue to eat and do well although the sow is not milking as well.

During this period, palatability of the feed is exceedingly important. Numerous tests have shown that young pigs prefer whole corn (if corn is not too hard) or coarsely cracked corn to finely ground grains. Pelleted feeds are more palatable to young pigs than finely ground grains and supplements. Rolled or hulled oats are very palatable to young pigs.

Several procedures may be followed in creep-feeding suckling pigs. Many producers get good results by self-feeding shelled corn, cracked corn, rolled otas, hulled oats or a combination of rolled oats and cracked corn free-choice with a high quality pig supplement. Improved performance will more likely result where the grains and supplement are mixed to provide a complete starter. Examples of protein supplements for suckling-age pigs are shown in table 6. Provision is made in these supplements for vitamin and antibiotic additions. No provision is made for addition of trace mineral mixtures; however, this can easily be accomplished by substituting a trace mineralized salt for the iodized salt.

Excellent results are reported from the use of complete pig starters. Many such starters are available commercially in pelleted form and most of the good ones are formulated to take advantage of the latest findings in research with suckling-age pigs. Where these starters can be purchased at a price which is within the limits of sound economics of hog production it will often be simpler to purchase a complete starter. This will often be the sounder approach because well formulated pig starters are not easily mixed and also because relatively small amounts are required for young pigs. Hog producers who have access to mechanical mixers and to vitamin and antibiotic supplements may prefer to mix their own starters. Several rations are also shown in table 6. These examples are based upon the use of supplements with other ingredients as such a practice eliminates much tedious weighing of small amounts of vitamin concentrates and other ingredients required in small amounts.

Several tests have shown that creep starters which contain 10 per cent of sugar give superior results because of improved palatability. Likewise, the use of 10 per cent of dried skim milk has been shown to improve the palatability of creep starters. Improved performance has also been shown to result where antibiotics are added to pig starters. A level of 20 to 40 grams of effective antibiotic per ton of mixed feed appears to be adequate.

Suckling-age pigs have a limited capacity for the digestion of feed, hence bulky feeds are to be avoided. The protein supplements and mixed rations shown in table 6 are based on the use of crude concentrates as sources of vitamins and antibiotics. Many such concentrates are available from reliable manufacturers.

Rations for Pigs After Weaning

The protein supplements shown in table 2 are but a few of the many good combinations which may be fed free-choice with shelled corn after weaning. Inasmuch as the supplements in table 2 are intended as general supplements which can also be used in brood sow rations it will be well to avoid those containing very high levels of alfalfa meal.

Some producers will find it advisable and economical to feed mixed rations so that protein level can be controlled. This is most easily accomplished by mixing ground corn

with the already prepared or purchased supplement. The ratios shown in table 7 indicate the proportions of ground corn and supplement required to provide the desired protein level.

As discussed earlier, feeding antibiotics to hogs in dry lot will increase gains and feed efficiency under many conditions (see discussion of antibiotics). A guide for feeding them is to add the equivalent of 10 grams of antibiotic to each ton of mixed feed for hogs up to 125 pounds, and half this amount for hogs from 125 pounds to market weight. If the antibiotics are added to the protein supplement only, they should be added at the rate of 30 to 40 grams per ton. Antibiotic supplements also increase gains of hogs on pasture under many conditions, but the benefit is usually less apparent than for hogs in dry lot. It is difficult to predict whether their addition to rations for thrifty hogs on good pasture will always be economical in terms of extra gains and feed efficiency. In some cases, the added gains per unit of feed will more than pay for the cost of the antibiotics added to rations fed to hogs on pasture.

Table 6. - - Types of protein supplements for suckling-age pigs.

Approximate protein content 1/	A 51	B 40	C 32	D 28	E 26	F 33	G 29	H 29
Soybean oil meal	330	270	250	230	350	270	90	280
Meat & bone scraps	330	260	100	---	340	270	150	---
Fish meal	330	260	100	100	---	---	150	100
Distillers' solubles (dried)	---	---	100	100	---	---	---	---
Dried whey	---	---	---	50	---	50	---	50
Dried skim milk	---	---	200	150	---	200	300	200
Dried buttermilk	---	---	---	100	---	---	---	100
Sugar (cane, beet or corn)	---	200	200	200	300	200	300	200
Steamed bone meal	---	---	40	60	---	---	---	60
Iodized salt	10	10	10	10	10	10	10	10
	1000	1000	1000	1000	1000	1000	1000	1000
	Ratios of grain or grain mixtures to supplement to give mixed rations containing 18 per cent protein for suckling-age pigs.							
Rolled oats	84:16	78:22	70:30	65:35	75:25	71:29	65:35	65:35
1/2 cracked corn & 1/2 rolled oats	83:17	74:26	64:36	58:42	70:30	66:34	58:42	58:42
1/2 cracked corn, 1/4 rolled oats and 1/4 wheat middlings	84:16	77:23	68:32	63:37	73:27	70:30	63:37	63:37

1/ It is recommended that vitamin-antibiotic additions be made to supply 10,000 I. U. vitamin A, 1000 I. U. vitamin D, 6 grams of riboflavin, 12 to 15 grams of pantothenic acid (calcium pantothenate), 27 to 30 grams niacin and 20 grams of antibiotic. The correct proportions can be used where smaller amounts of supplements are prepared. Optimum performance cannot be expected if vitamin supplementations are not made.

Feeding Minerals Free Choice

Mineral mixtures can be fed free-choice to swine instead of mixing them with protein supplements or mixed rations. No one mineral mixture is ideal for all of the various classes of swine fed different rations. Some of the rations need no added calcium or phosphorus, some need only added phosphorus or calcium, while others should be supplemented with both calcium and phosphorus.

Table 7.--Ratio of corn to protein supplements needed to obtain the desired level of protein in a ration.

Desired per cent of protein in ration		Percent protein in supplement					
		32	36	40	44	48	52
17	corn*	64	69	73	76	78	80
	supp.	36	31	27	24	22	20
16	corn	68	73	76	79	81	83
	supp.	32	27	24	21	19	17
15	corn	72	76	79	82	84	85
	supp.	28	24	21	18	16	15
14	corn	77	80	83	85	86	87
	supp.	23	20	17	15	14	13
13	corn	81	84	86	87	89	90
	supp.	19	16	14	13	11	10
12	corn	85	87	89	90	91	92
	supp.	15	13	11	10	9	8
11	corn	89	91	92	93	94	95
	supp.	11	9	8	7	6	5

*The values apply to corn containing 8.5% protein.

Table 8.--Feed consumption and efficiency of gains of pigs of various weights.*

Live weight of pig	Cumulative feed per pig from 35 lbs.	Feed per 100 lb. gain during period	Cumulative feed per 100 lb. gain from 35 lbs.	Cumulative feed per 100 lb. gain, including feed for breeding herd
pounds	pounds	pounds	pounds	pounds
35 (wean. wt.)	---	---	---	766**
50	51	340	340	638
75	138	348	345	541
100	228	360	351	496
125	322	376	358	472
150	420	392	365	459
175	522	408	373	451
200	628	424	381	448
225	741	452	390	448
250	858	468	399	450
275	982	496	409	455
300	1113	524	420	460

*From data in U. S. D. A. Technical Bulletins 894 and 917.

**Includes feed consumed during the suckling period and the pig's share of the feed consumed by the breeding herd. The average total amount for a 35-pound pig at weaning is approximately 268 pounds.

It is not advisable to force pigs to eat ground limestone and steamed bone meal to supply sufficient salt. If mineral mixtures are fed free-choice and no additional salt is offered, approximately 0.25% salt should be added to a mixed ration. If salt is added to the protein supplement only, about four times this amount (one per cent) should be included.

Using the proportions of ground limestone, steamed bone meal and salt added to the supplements shown in table 2, mineral mixtures can be devised for feeding free-choice. If 1% salt is included in the protein supplement (half the amount shown in table 2), or if it is fed free-choice, a mineral mixture consisting of two parts ground limestone, one part steamed bone meal and one part salt will provide approximately correct proportions of calcium and phosphorus. Equal parts of ground limestone, steamed bone meal and salt; two parts of ground limestone, two parts of steamed bone meal and one part of salt; or 4 parts steamed bone meal and 1 part salt are also satisfactory mineral mixtures for self-feeding.

Feeding Required in Terms of Gains

Since feed costs may account for as much as 80% of the total cost of producing swine for market, it is interesting to note how these costs are distributed over the growth period.

The data shown in table 8 are from those collected by Atkinson and Klein of the U. S. Department of Agriculture. These data represent twelve experiments with 813 hogs at several experiment stations. The data in the second column show that each hog required approximately 628 pounds of feed from a weight of 35 pounds to 200 pounds. The third and fourth columns show that with each unit increase in weight, pigs utilize their feed less efficiently. The data in the last column show the net feed efficiency of pigs up to indicated weights.

Even though young pigs utilize feed more efficiently than older hogs, the feed for the breeding herd assessed to them is greater per unit of body weight. As the pigs grow, the feed consumed by the breeding herd is distributed over more pounds of liveweight. At 200 pounds body weight, the pigs have utilized the total feed consumed by them and the breeding herd at a maximum rate of efficiency. At weights over 225 pounds the gains are less efficient because of the decreased feed utilization. Although the number of pigs raised per sow, the type of management, and the adequacy of the ration influence the outcome of experiments such as these, the data show that under average conditions the feed cost per pound of pork is lowest if hogs are marketed at 200 to 225 pounds.