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Vitamins, Trace Minerals and Feed Additives

Richard C. Wahlstrom

Most swine diets are composed of one or more of the cereal grains and a protein supplement as the major feed ingredients to furnish the energy and protein needed. The quantitative need of swine for vitamins, trace minerals and feed additives is small compared to their need for energy and protein. Approximately 30 different vitamins and minerals are required by swine and each performs an important function despite the small amount which may be required.

Although natural feedstuffs supply varying amounts of most of the vitamins and trace minerals, practical diets for swine are generally supplemented with certain of these nutrients. This article will discuss those vitamins and trace minerals that need more attention in swine feeding and feed additives that are used for growth promotion.

Vitamins

Those vitamins that should be added to swine diets are the fat soluble vitamins A, D, E and K and the water soluble vitamins (also known as the B complex) riboflavin or B₂, pantothenic acid, niacin, choline and vitamin B₁₂. Recommended levels of these vitamins in swine diets are shown in table 1.

The vitamin A needs of swine can be met by either vitamin A or carotene. Vitamin A does not occur in plant products, but carotene present may be converted to vitamin A by the pig. Corn contains carotene but is not a dependable source because much may be destroyed in storage. Therefore, in formulating swine diets the carotene content of corn is disregarded. Other cereal grains are low or devoid of carotene. Dehydrated alfalfa meal, good quality alfalfa hay and green pastures are good natural sources of carotene. Supplemental vitamin A can be provided by the use of stabilized vitamin A supplements.

Vitamin D is known as the "sunshine vitamin," as animals having access to sunlight produce vitamin D by irradiation. With the exception of sun-cured hays, most feedstuffs are practically devoid of vitamin D. Therefore, fortification of diets with vitamin D is necessary when pigs are fed in confinement. Vitamin D is needed for efficient utilization of calcium and phosphorus. A lack of this vitamin results in stiffness, lameness, rickets, broken or deformed bones and general unthriftiness.

Although it is difficult to produce a vitamin E deficiency in swine fed practical diets, vitamin E deficiency symptoms have been reported. Grains low in selenium increase the need for vitamin E as the dietary level of one of these nutrients affects the requirement of the other. Deficiency symptoms in the growing pig are sudden death, jaundice, edema, white muscles and liver necrosis. Sows may show a high level of embryonic death.

Most natural feedstuffs contain vitamin K and it is also synthesized by intestinal microflora. However, a deficiency has been reported in practical swine diets and is frequently associated with moldy feeds. Internal bleeding is common and death may occur. Dehydrated alfalfa meal (2.5% of the diet) is a good source of vitamin K or it may be supplied by menadione sodium bisulfite.

The cereal grains and plant by-products such as soybean meal are relatively poor sources of the B vitamins riboflavin, pantothenic acid and B₁₂. Niacin in cereal grains occurs in a bound form and is largely unavailable to the pig. With practical diets deficiency symptoms most apt to occur would be poor growth or diarrhea. These nonspecific symptoms may be due to a low dietary level of all of these B vitamins. Vitamin supplements containing these four vitamins are readily available for use in mixing with natural feedstuffs.

Choline is needed in swine diets but the exact amount necessary has not been determined. Research has indicated that feeding supplemental choline increased litter size when pregnant sows were fed corn-soybean meal diets. It has been suggested that choline deficiency is the cause of spraddle legs in newborn pigs. However, this has not been proved in research so there apparently are other causes of the spraddle leg condition.

Trace Minerals

Most swine diets require supplementation with a source of calcium and phosphorus and salt to supply sodium and chlorine. In addition to these four minerals the pig requires at least ten more mineral elements in small amounts and these are called trace minerals. The natural feed ingredients in swine diets will usually furnish adequate amounts of cobalt, magnesium, potassium and sulfur. However, a trace mineral supplement may be needed to supply small amounts of copper, iodine, iron, manganese, selenium and zinc. These minerals may be provided in a trace mineral premix or by the use of trace mineral salt. Excessive feeding of minerals should be avoided as it can reduce performance as much as with a shortage of minerals. Table 2 gives suggested levels for these trace minerals in swine diets.

It has been shown that feeding pigs practical diets formulated from ingredients grown on low selenium soils can result in a selenium deficiency. The FDA has approved the addition of 0.1 part per million (ppm) of selenium to source diets. Most areas of South Dakota have adequate selenium present in the soil so that a deficiency of selenium should not exist. In fact, a few isolated areas have problems with excess selenium. However, the level of selenium added to swine diets, 0.1 ppm, is low enough that it should not cause any problems if added to diets formulated from South Dakota grown ingredients.

Feed Additives

Additives used in swine diets for growth promotion include antibiotics, arsenicals and nitrofurans. These compounds are not nutrients but are drugs and their use is regulated by the Food and Drug Administration. Many of these products are required by law to be withdrawn from the diet for a specified time before slaughter. Regulations concerning levels and withdrawal time are subject to change so it is important to follow the directions stated on the feed tag or package of the drug used.

These feed additives may also improve the health of the animal. Although feed additives can help control disease problems, they should not be considered a substitute for good management.

The greatest response from these additives is in pigs up to a weight of 100 pounds. High levels of antibiotics during the breeding season have been reported to increase conception rate, and feeding just prior to and following farrowing may improve pig livability and performance. Recommended levels of antibiotics range from 100 grams per ton in pig starter diets to 10 grams per ton for finishing pigs. Continuous feeding of the same additive may decrease its effectiveness. Periodic changing of drugs is a good practice. A list of feed additives approved for use in growth promotion of swine is shown in table 3.

Table 1. Recommended Vitamin Additions Per Ton of Swine Diets

Vitamin	Starter diet	Grower-finisher diet	Sow diet ^a
Vitamin A, IU	4,000,000	2,400,000	4,000,000
Vitamin D, IU	400,000	240,000	400,000
Vitamin E, IU	10,000	10,000	10,000
Vitamin K, g	2	2	2
Riboflavin, g	3	2.4	4
Pantothenic acid, g	16	12	16
Niacin, g	20	16	20
Vitamin B ₁₂ , mg	20	12	20
Choline, g	170	100	500

^aBased on daily intake of 4 to 5 lb. for gestation and 9 to 12 lb. during lactation.

Table 2. Recommended Trace Mineral Additions Per Ton of Diet

Trace mineral	Level of mineral
Copper, g	5.4
Iron, g	54.0
Iodine, g	0.5
Manganese, g	18.0
Zinc, g	45.0
Selenium, mg	90.8

Table 3. Feed Additives Approved for
Growth Promotion of Swine

Additive

Bacitracin
Zinc bacitracin
Bambermycin (flavomycin)
Chlortetracycline (aureomycin)
Erythromycin
Oleandomycin
Oxytetracycline (terramycin)
Penicillin
Streptomycin
Tylosin
Virginamycin
Carbadox (use to 75 lb. only)
Furazolidone
Arsanilic acid
3-nitro-4-hydroxyphenylarsonic acid (Roxarsone)
