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Cooperative Extension Service

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July 1979

4 pages

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pork industry handbook

COOPERATIVE EXTENSION SERVICE

• MICHIGAN STATE UNIVERSITY

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Vitamins are one of the classes of nutrients required for normal metabolism functions in the animal body. They are required in much smaller amounts than most of the other nutrients as they are not used as an energy source or a structural component. Some of the vitamins can be produced within the pig's body in sufficient quantities to meet the pig's need. Others are present in adequate amounts in feedstuffs commonly used in swine diets. However, several vitamins need to be added to swine diets to obtain optimal performance. Vitamin needs are more critical today than previously because of the use of simpler type diets containing fewer ingredients and the trend toward confinement rearing which has reduced the use of pasture. Young, lush green grass or legumes are good sources of vitamins.

Vitamins Needed

Those vitamins that should be added to swine diets can be divided into two groups.

- Fat soluble vitamins
 - Vitamin A
 - Vitamin D
 - Vitamin E
 - Vitamin K
- Water soluble vitamins (known as B complex vitamins)
 - Riboflavin or B₂
 - Pantothenic acid
 - Niacin
 - Vitamin B₁₂
 - Choline

Each of these vitamins will be briefly discussed. Recommended levels of these vitamins in swine diets are shown in Tables 1 and 2. Table 1 lists requirements for the pig from weaning to market weight, and Table 2 gives the requirements for reproducing animals as an amount per pound of diet based on a daily feed intake of 4-5 lb. during gestation and 9-12 lb. during lactation. These vitamin levels

should also be satisfactory for boars fed 6 lb. of feed daily. At feeding levels other than those indicated here, the diets should be fortified to meet the daily needs. Higher levels of vitamins have not further improved performance of swine. However, in periods of stress, such as diseases that might affect absorption of nutrients, vitamin levels could be increased.

Diets may occasionally become deficient, under unusual or stress conditions, in other vitamins—biotin, pyridoxine (B₆), folic acid and vitamin C. All of these vitamins should be present in adequate amounts when diets are composed of natural feedstuffs, and it is not recommended that they be added in routine vitamin supplementation.

Vitamin A. The vitamin A needs of swine can be met by either vitamin A or carotene. Vitamin A does not occur in plant products, but the pigment carotene can be converted to vitamin A in the intestinal wall of the pig. Good natural sources of carotene are green pastures and green leafy alfalfa hay or meal. 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.

Deficiency symptoms in growing pigs are incoordination of movement, weakness of the back, paralysis, night blindness and total blindness. Sows may fail to come into estrus, have a poor conception rate, resorb their fetuses and have weak pigs at birth or pigs born dead with various deformities. Sterility may occur in boars.

Vitamin D. Swine that have daily access to sunlight produce vitamin D by irradiation. However, fortification of diets with vitamin D is necessary when pigs are fed in confinement. Also, most feedstuffs are practically devoid of vitamin D except for sun-cured hays. Both vitamin D₂, the

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form found in plant products, and D₃, the animal product form, have the same value for swine.

Vitamin D is needed for efficient absorption and metabolism of calcium and phosphorus and therefore is required for normal calcification of bones. A deficiency in young pigs results in rickets, stiffness and lameness, enlargement of the joints and general unthriftiness. In mature animals, fractures of the bones are common.

Vitamin E. A decline in use of pasture for pigs and an increase in artificial drying of grains has resulted in a lowering of vitamin E intake and an increase in the occurrence of deficiency symptoms. Grains low in selenium increase the need for vitamin E as the dietary level of one of these nutrients affects the requirement for the other.

Signs of vitamin E deficiency in the growing pig are sudden death, jaundice, edema, white muscles and liver necrosis. Pregnant sows may have a higher level of embryonic death, and pigs nursing sows deficient in vitamin E may show muscular incoordination.

Vitamin K. Although vitamin K occurs in many natural feedstuffs and is also synthesized by intestinal microflora of the pig, a deficiency in practical diets has been demonstrated. The deficiency is frequently associated with moldy feeds. Its characteristics are hemorrhaging and prolonged blood clotting time but may also include blood tinged urine, lameness and listlessness. Vitamin K can be supplied by using 2.5% dehydrated alfalfa meal or by a synthetic product called menadione sodium bisulfite at a level of 2 gm. per ton of feed.

Riboflavin (B₂). Cereal grains and plant by-products such as soybean meal are relatively poor sources of this B vitamin. It functions in the body as a constituent of several enzyme systems. Therefore, a deficiency of riboflavin results in a wide variety of symptoms. In growing pigs, a deficiency may cause loss of appetite, stiffness, dermatitis and lowered growth rate. Poor conception and reproduction have been noted in sows fed riboflavin-deficient rations. Pigs may be born prematurely, dead or too weak to survive.

Pantothenic Acid. Corn and soybean meal diets will be deficient in pantothenic acid, another vitamin of the B complex. A deficiency may result in lowered fertility, reduced growth rate, diarrhea and an incoordinated, wobbly or high stepping gait (called goosestepping). Many of these symptoms are similar to those observed from other deficiencies and indicate that in practical feeding situations it is difficult to determine which vitamin may be lacking. In fact, in many cases it is a combination of vitamins in inadequate amounts that causes the problems that may be observed.

Niacin. Although niacin is present in adequate amounts in most cereal grains, it exists in a bound form that is largely unavailable to the pig. The protein source and content of the diet can also affect the dietary need for niacin because an excess of the amino acid tryptophan can be converted into niacin. Slow growth, diarrhea, dermatitis, loss of hair and occasional vomiting are deficiency symptoms. Alfalfa meal and good pasture are good natural sources of riboflavin, pantothenic acid and niacin.

Vitamin B₁₂. The cereal grains and plant products are poor sources of B₁₂, but the animal products are good sources. The requirement for this vitamin is approximately one-thousandth of the amount of the other B vitamins discussed. Signs of a deficiency are reduced growth rate and anemia.

Choline. The specific requirement for choline has not been determined. The need for choline is increased in diets low in the amino acid methionine. Recent research has indicated that supplemental choline increased litter size when gestating sows were fed corn-soybean meal diets. Choline deficiency has been implicated by some as the cause of spraddle legs in newborn pigs. However, this has not been proved in research where sows are fed practical type diets during gestation. Apparently, there are other causes of the spraddle leg condition.

Synthetic Vitamins

Since the natural sources of the vitamins listed may not be present in swine diets, it is recommended that a vitamin supplement be added. Synthetic vitamins are produced by many companies and are sold individually or in various combinations of vitamins or as vitamin-mineral combinations. Often these can be purchased in 5 or 10-lb. quantities that can be added to 1 ton of feed. An example of a synthetic vitamin premix is shown in Table 3. It contains all of the vitamins needed to be added to swine starter, gestation or lactation diets when 10 lb. are added per ton of feed, and for growing and finishing diets by including 6 lb. per ton. Commercial protein supplements generally contain supplemental vitamins. Check to see if the levels are adequate. If not, add vitamins that are needed in necessary amounts.

Mixing Instructions

The vitamin premix should be purchased from a commercial company. These suppliers have much better quality control and mixing facilities to handle the small quantities of vitamins that are required. Purchase no more than what will be used in 3-6 months (use in 3 months in hot, humid areas) and store in a dry, cool area to reduce storage losses. Mix only enough feed for 3-4 weeks as certain combinations of ingredients can increase vitamin losses over time.

Special care should be taken when mixing the vitamin premix to obtain a thorough dispersion throughout the feed. One method is to mix the vitamin premix for 1 ton of feed with about 20-40 lb. of finely ground corn and then add this total mixture to the mixer.

Table 1. Recommended vitamin additions for pigs, weaning to market (amount per pound of diet)

Vitamin	Starter diet	Grower-finisher diet
Vitamin A, IU	2,000	1,200
Vitamin D, IU	200	120
Vitamin E, IU	5	5
Vitamin K, mg.	1	1
Riboflavin, mg.	1.5	1.2
Pantothenic acid, mg.	8	6
Niacin, mg.	10	8
Vitamin B ₁₂ , mcg.	10	6
Choline, mg.	85	50

Table 2. Recommended vitamin additions for reproduction*

Vitamin	Amount per pound of diet
Vitamin A, IU	2,000
Vitamin D, IU	200
Vitamin E, IU	5
Vitamin K, mg.	1
Riboflavin, mg.	2
Pantothenic acid, mg.	8
Niacin, mg.	10
Vitamin B ₁₂ , mcg.	10
Choline, mg.	250

*Recommendations based on daily feed intake of 4-5 lb. for gestation and 9-12 lb. during lactation.

Table 3. Example of vitamin premix to be added to 1 ton of feed*

Ingredient	Concentration (per 10 lb.)
Vitamin A	4,000,000 IU
Vitamin D	400,000 IU
Vitamin E	17,000 IU
Vitamin K	3.33 gm.
Riboflavin	4 gm.
Pantothenic acid	20 gm.
Niacin	27 gm.
Vitamin B ₁₂	20 mg.
Choline	170 gm.
Carrier (such as ground corn)	To bring total to 10 lb.

*This premix could be used at 10 lb. per ton for gestation, lactation and starter diets and 6 lb. per ton for growing and finishing diets. To meet the recommended level of choline in the gestation ration, add 3 lb. of choline chloride (25% choline) per ton of gestation ration.

