Minerals for Swine

M. P. Plumlee

J. H. Conrad


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M. P. Plumlee and J. H. Conrad, Animal Sciences Department

Introduction

Mineral elements comprise approximately 5 per cent of the total body weight of swine. Selected tissues show values such as: skeleton, 29%; teeth, 70%; muscle, 0.9%; fat, 0.5%; and blood and lymph, 0.9 per cent, respectively. Sow's milk contains about 1.1 per cent mineral as compared to 0.72 per cent in cow's milk. These elements are essential for most of the important reactions in the body including acid base balance; osmotic pressure regulation; energy transfer; digestion and metabolism of proteins, fats and carbohydrates; and structure of chromosomes, enzymes, coenzymes, vitamins, hormones, nerves, blood, skeleton, hair and milk. Thus, they play major roles in heredity, growth and production, wound healing and even resistance to parasites and diseases.

Generally speaking, swine depend upon their daily feed to supply the needed minerals. Body stores are used in emergencies but only in amounts to provide less than maximum production. For example, an average sow milking from 12 to 15 pounds per day will show a sharp drop in milk production within a day or two following the feeding of a low calcium diet. Or, a pig loaded with iron at birth will exhaust its body stores within 7 days. Not all of these minerals consumed by swine become a part of a useful product since considerable amounts are lost, through inefficiency, in the excreta.

Mineral deficiencies of swine are more likely to occur than in other four-footed farm animals. Some reasons are: grow faster for their size, reproduce at an earlier age and while still growing; more prolific; fed in confinement (often on concrete); grain, the principal feed is low in required minerals; often limit fed (sows and boars); very susceptible to diarrhea which results in rapid and often fatal loss of body mineral stores; and their bodies are more sensitive to mineral imbalances than are ruminants.

Minerals Required

Fairly clear research results show that swine require at least 15 mineral elements in their diet. They are: calcium, phosphorus, sodium, chlorine, potassium, sulfur, magnesium, manganese, zinc, iron, iodine, copper cobalt (in vitamin B₁₂), fluorine and selenium. In addition, recent data encourages the suggestion that molybdenum, vanadium and chromium may be added to the above list in the near future. Only 7 of these required minerals are likely to be deficient in swine rations in the Midwest. They are calcium (Ca), phosphorus (P), sodium (Na), chlorine (Cl), iron (Fe), zinc (Zn) and iodine (I).

Source of Protein Important

Recent research has shown that the total dietary mineral requirement of swine
(especially of trace minerals) is greater when plant sources of protein are fed in comparison to animal sources such as meat and bone meal, tankage or fish meal. For example, growing pigs on a corn-soy diet require approximately 50 ppm of dietary zinc. Substituting an animal protein source for the soybean meal reduces the requirement to less than 20 ppm in the total air dry feed. This protein effect is apparently due to the fact that from 50 to 70 per cent of the phosphorus in plant proteins is in the form of "phytin" which, in turn, greatly reduces the absorption of zinc from the digestive tract. At the same time, plant protein sources contain far less mineral than do animal sources. Thus, one can see that the present trend of using more soybean meal is accelerating the need for a closer look at the mineral fortification of swine feeds.

Other factors which affect the animals daily mineral requirement besides source of protein include: energy and protein intake, growth, reproduction and milk production, source of mineral used and the balance or amount of other mineral elements in the diet.

Mineral Balance Extremely Important

National Research Council Publication 1192 is the most authoritative single source of information on the nutritive requirements of swine. Tables 1 and 2 show the mineral recommendations based on this publication. It is important to recognize that the amount of any one mineral element required for best performance will vary with the amount of other minerals and nutrients present in the particular diet. Thus, the phosphorus requirement of a 50 pound pig is 0.4 per cent of the diet provided the calcium content is 0.5 per cent, the protein is at least 14 per cent and the vitamin D level is at least 125 I.U. per pound. Increasing the calcium level to 0.7 per cent would tend to increase the phosphorus and zinc requirement since the excess calcium makes these and other nutrients less digestible. Excess zinc tends to depress the availability of manganese and copper, and perhaps other trace elements in a similar way.

Limited feeding as usually practiced with gestating swine and in some herds with lactating sows and gilts can result in mineral, protein and vitamin deficiencies. This is true because nutrient requirements and thus fortification of rations has been based on higher levels of feed intake. Thus, when limit feeding, a ration containing the recommended percentages of nutrients will be adequate only if it also supplies the daily amount of the nutrient required. For example, (from Table 2) a ration containing 0.5 per cent phosphorus will supply the limited fed pregnant gilt the daily requirement of 10 grams of phosphorus if she consumes 4.4 pounds of the ration. If only 3.0 pounds of this same ration were fed, the daily phosphorus intake would be only 6.8 grams; thus, resulting in a daily deficit of 3.2 grams of phosphorus.

Full feeding will often "cover up" or minimize the effect of ration mineral deficiencies or imbalances. However, such a practice is wasteful and expensive in a sow-pig enterprise.

The Seven Most Important Swine Minerals

Salt (sodium and chloride) will be deficient in all common swine rations. The total daily salt requirement for all swine is approximately 0.35 per cent of the total dry matter intake regardless of the method of feeding. For convenience a level of 0.5 per cent is most commonly recommended and added. Encouraging animals to eat extra salt by oversupplementing the complete mixed ration or by adding palatability ingredients such as sugar or molasses to the salt or mineral mixture for free choice feeding can be harmful and is not recommended by the authors. Since salt cannot be stored in the body to any great extent, consumption