

NEW SOURCES OF MINERAL ELEMENTS IN ANIMAL NUTRITION

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Introduction.—In the national war effort, many scarce and necessary materials have been designated as "strategic materials." Among these are certain metals of nutritional importance which are called "trace elements" in nutrition and which are essential to animal life. They overcome some "hidden hungers," and it is therefore important under many conditions of livestock feeding to supply available sources of these elements.

Manganese, cobalt, and copper are among the most important of these elements. Manganese in the form of a soluble salt is now included in the majority of poultry feeds to prevent perosis or slipped tendons and to improve egg production and hatchability of the egg. It also prevents certain types of lameness in pigs according to recent work from the Pennsylvania Agricultural Experiment Station.

The element cobalt is lacking in the soils and vegetation of many regions of the world. In this country, such cobalt deficient areas are found in Florida, Texas, Michigan, and other regions. Cobalt is necessary for the normal nutrition of domestic animals, particularly cattle and sheep, and a deficiency produces a typical anemia which may be very severe and result in great economic loss.

Copper is known to be necessary for the building of the hemoglobin of the blood and for the utilization of iron in

the body. A copper deficiency has been demonstrated in the soils of Florida, and it has been shown that the administration of copper compounds to livestock has given remarkable results.

All of these elements are commonly supplied in livestock feeds in the form of soluble salts such as the sulphates. Since these salts have become "strategic materials," it has become important to investigate non-strategic substitutes such as the crude ores and other unrefined forms of these metals.

Experimental.—The experimental procedure has been as follows:

First, to locate deposits of ores and other impure sources of the metal in question; second, to analyze for the elements desired and also for any toxic materials; third, to determine the availability to the animal of each source; and, fourth, when the form was found non-assimilable, to devise treatments to increase its assimilation by the animal.

The investigations have covered manganese ores from Tennessee, Arkansas, and Missouri, cobalt ores and impure concentrates from Missouri, Nevada, Arizona, and Oregon, and copper ores from Missouri, Nevada, and New Mexico. The analysis of these ores varied widely, and, in a few instances, ores have been found unsuitable for further study because of toxic impurities such as lead.

Manganese.—A typical experiment on the availability of manganese ore in-

volved the use of young chicks on a perosis-producing ration, which was high in phosphorus and low in manganese. Five lots of twenty chicks each were fed for six weeks on the experimental rations and the incidence of perosis observed. Supplying fifty parts per million of manganese in the form of a Tennessee ore or an Arkansas ore, or even one hundred parts per million as the Arkansas ore, failed to give protection against perosis. The results were no better than in the lot receiving no manganese. On the other hand, fifty parts per million of manganese in the form of manganese sulphate protected all but one bird.

Schaible and his co-workers at Michigan State College reported good utilization of numerous manganese ores, including oxide ores. Tennessee and Arkansas ores studied in our laboratory were stated by the producers to be oxide ores. The findings reported therefore do not agree with those of Schaible.

Laboratory investigations show that the manganese ores are made soluble and thus available by a simple treatment with hydrochloric or sulphuric acid.

Cobalt.—The availability of cobalt to the animal was determined with rats by the production of a polycythemia or increase above normal in the red cell count and hemoglobin content of the blood. Groups of rats on a mineralized milk ration and receiving cobalt at the rate of 0.6 of a milligram per rat per day

showed a marked rise in hemoglobin with cobalt sulphate but only a slight response to the cobalt in a Missouri ore or crude cobalt oxide.

The method used may be open to question, since cobalt in these ore forms might be utilized by an animal in need of it, where as it might not be effective in stimulating the hemoglobin to abnormally high levels. Nevertheless, it furnishes a basis of comparison of the relative availability of cobalt sources.

Preliminary laboratory treatments of cobalt ores have indicated that at least partial availability may be achieved by relatively simple acid treatments.

Copper.—The availability of copper compounds was studied with young albino rats made anemic by the method of Elvehjem, using dried whole milk. Rapid hemoglobin regeneration was produced by 0.03 of a milligram per rat per day of copper in the form of copper sulphate or of a copper carbonate ore from Arizona; however, the copper in a copper sulfide ore from Nevada produced no greater recovery from the copper anemia than did iron alone in the negative control group.

Conclusion.—Much more work needs to be done, but this progress report shows that it is entirely feasible, by the use of such methods as those described, to develop new sources of the trace elements suitable for animal feeding and thus conserve the pure metallic salts.