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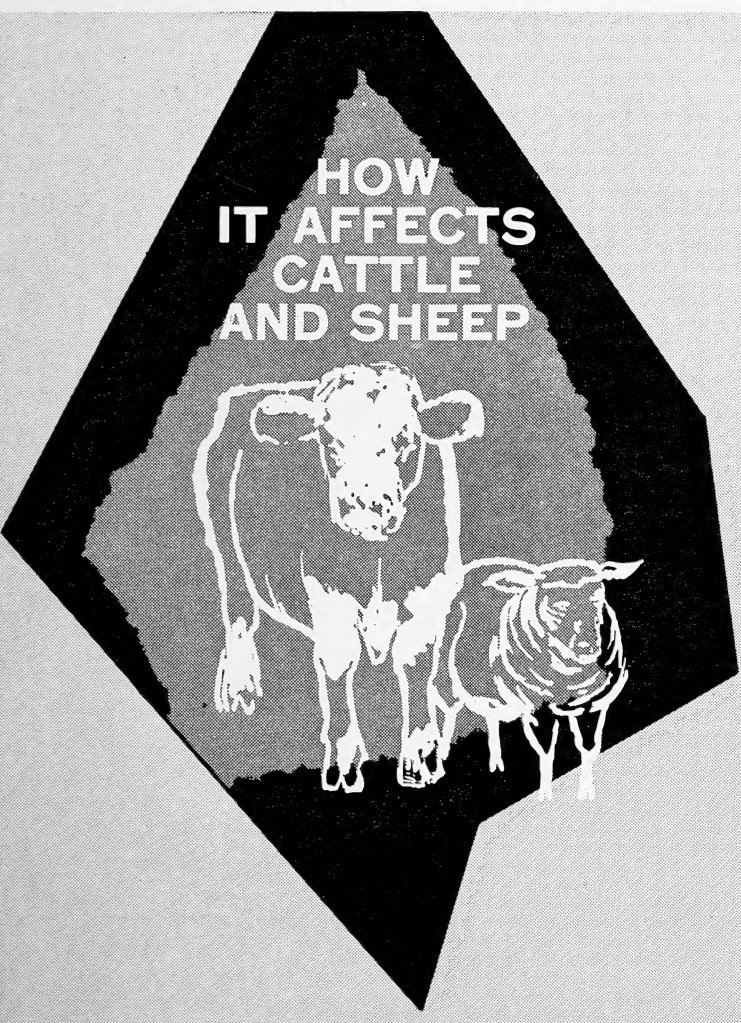
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COBALT DEFICIENCY

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IN SOILS AND FORAGES



In 1935 workers in Australia discovered that cobalt was a limiting factor in the nutrition of cattle and sheep. Later, U.S. workers were able to identify the cause of “salt sick” of Florida, “neck ail” of Massachusetts, “Grand Traverse disease” of Michigan, “Burton ail” or “Albany ail” of New Hampshire, and other troubles of cattle and sheep as a cobalt deficiency.

If cattle and sheep are given cobalt supplements or if cobalt-deficient soils are treated by adding cobalt, the health and productivity of these ruminants are improved substantially.

COBALT DEFICIENCY IN SOILS AND FORAGES:

How It Affects Cattle and Sheep

Prepared by U.S. Plant, Soil, and Nutrition Laboratory, Soil and Water Conservation Research Division, Agricultural Research Service

Cattle and sheep grazing on plants in some areas of Eastern United States will sicken and frequently die. The earliest settlers noted these symptoms in their livestock, but were unable to find the cause. In 1937 workers at the Florida Agricultural Experiment Station identified this ailment in cattle as cobalt deficiency.

Cobalt is one of the metallic elements and is similar in properties to nickel and iron. It is not one of the more abundant elements found in the earth's surface, but it is very common.

Only ruminants—cattle, sheep, goats, deer, and moose—require cobalt in their diet; an infinitesimal quantity of this element in forage will meet their needs and prevent the sickness.

Why are certain soils and plants deficient in cobalt?

Although cobalt is found nearly everywhere, some rocks and soils contain much more of the metal than do others. The cobalt present in soils is derived from the rock from which the soil is formed. Soils developed on basic, dark-colored rocks that contain olivine and pyroxene usually provide ample cobalt for the crops growing on them. Certain other soils are developed on geological material that has been eroded, transported, and deposited on low-lying areas. In many cases, such materials lose a portion of their cobalt. Some sandy soils—especially the ground-water Podzol soils developed on sandy materials—will be low in cobalt in the low-lying areas. Clays generally have higher quantities of cobalt than do sands.

The cobalt taken up by plants is related to the soil on which they



Areas where soil conditions, plant composition, or nutritional problems in animals indicate a deficiency of cobalt.

grow and to the soil drainage. More cobalt is found in plants growing on poorly drained soils than on well-drained soils. Also, large quantities of organic matter on the surface help to maintain cobalt in forms generally available to plants.

Many soils have been leached of the mineral material they originally contained. Cobalt can be translocated downward from the surface in the same manner as iron. In many soils of the Southeast and Northeast, less cobalt is found in the surface foot or two than in lower depths. Plants obtain most of their nutrients from the surface foot of soil. Therefore, those plants growing on cobalt-deficient soils are often deficient in cobalt.

Where does cobalt deficiency occur?

Soils deficient in cobalt occur intermittently throughout the Northeast from the eastern tip of Wisconsin, across Michigan, in northeastern New York, and in New Hampshire. Cobalt-deficient areas may also exist in eastern Vermont and southwestern Maine. Some very extensive deficient areas occur in the Coastal Plain of North Carolina and South Carolina. Cobalt-deficient soils are widely distributed over Florida. Ground-water Podzol soils are frequently found in all these areas, and most of the cobalt-deficiency troubles are on these soils.

Cobalt deficiency has not been reported in the Gulf Coastal Plain.

Sandy soils occur in this section from Georgia through Texas. However, these soils differ from those of the Atlantic Coastal Plain; no ground-water Podzol soils have been found in this section.

Cobalt deficiency is not known to occur on the heavier soils of the South or Middle West. Most Western soils and forage crops grown thereon appear to contain ample cobalt. However, a few areas bordering on cobalt deficiency are found in Utah and Nevada.

How do forages differ in cobalt content?

Forage crops differ in the amounts of cobalt taken up and stored in their tissues. Legumes take up twofold to tenfold more cobalt than do grasses growing on the same soil. Some grasses, like Kentucky bluegrass, take up more cobalt than other grasses. The uptake of cobalt is important in forage crop management on cobalt-deficient soils.

The amount of cobalt in forage may range from 0.01 to 0.5 part of cobalt per million parts of dry forage or hay. A good forage will contain 0.1 part per million (p.p.m.) or more of cobalt. A cobalt-deficient forage contains less than 0.05 p.p.m. There may be less than 2 ounces of cobalt in 500 tons of good hay.

In a cobalt-deficient soil area in New York, hay containing 25 to 50 percent of a legume, such as alfalfa

or clover, supplied an adequate quantity of cobalt for dairy cattle. Grass hays from the same areas failed to do this.

In the Southeast some native plants take up and store large quantities of cobalt in their leaves. Swamp blackgum and the pepper bush are examples. Cows and sheep free to graze large areas of woodlands will browse such plants and obtain their cobalt requirements. These animals, confined to small pastures on cobalt-deficient soils, may not obtain enough cobalt from the vegetation and will sicken and frequently die.

How much cobalt do ruminants require?

Forage containing 0.1 part per million of cobalt will supply the needs of cattle or sheep. Both ruminants require about 0.1 milligram of cobalt per day for each 100 pounds of body weight. If a 100-pound lamb eats $2\frac{1}{2}$ pounds of hay daily, it will obtain the minimum requirement of cobalt from forage that contains 0.09 p.p.m. of cobalt. However, if the forage contains only 0.03 p.p.m. of cobalt, the lamb will receive about one-third of its minimum requirement per day. The balance of about 0.07 milligram of cobalt must be fed as a supplement.

What are the symptoms of cobalt deficiency?

Symptoms of cobalt deficiency in cattle are hard to detect. The prin-

ciple one is gradual loss of appetite. Sometimes a cow on lush pasture will refuse to graze, even though it is starving to death. Or, it may refuse hay or grain. As a result of starvation, it becomes anemic, weak, and emaciated, and develops a rough coat.

Why do ruminants need cobalt?

The food of ruminants must be broken down in the rumen by micro-organisms such as bacteria before the nutrients can be utilized. As a byproduct of this function, some micro-organisms manufacture vitamin B₁₂, which contains a small quantity of cobalt. If the food contains no cobalt, the micro-organisms that produce vitamin B₁₂ cannot thrive and multiply. This results in a change in the types of rumen bacteria, and digestion is inhibited. Moreover, lack of vitamin B₁₂ causes anemia and similar disorders.

As soon as cobalt is added to the ration, rumen organisms again become active. They produce the vitamin B₁₂ required by the animal. The organisms transform the feed components—protein, carbohydrates, and fat—to forms that the animal can use.

How can cobalt deficiency in ruminants be corrected?

Cobalt deficiency in ruminants can be corrected in a number of ways.

- Adding cobalt to the feed.

- Giving cobalt to the animal directly.
- Adding cobalt to salt.
- Applying cobalt to pasture soils.
- Increasing the proportion of legumes in the forage.

If you use either of the first two methods, ask a veterinarian or a druggist to prepare the proper cobalt solution for you. Because the quantities needed are so small, it is generally not practical to prepare home mixtures containing cobalt.

A convenient solution to use consists of 4 grams of cobalt sulfate¹ (which contains about 20 percent of cobalt) dissolved in 1 gallon of water. One teaspoonful of this solution will supply the daily needs of a 1,000-pound cow or ten 100-pound sheep.

This solution can be given to the animal directly in a drench or it can be mixed with the feed. Continue the treatment for at least 2 weeks. If cobalt deficiency has been causing the animal's lack of appetite, you should notice a distinct improvement in 2 weeks. If the animal does not improve after a month of treatment, it is doubtful if a cobalt deficiency exists.

Cobalt can also be added to salt. About 25 grams of cobalt sulfate mixed thoroughly with 100 pounds

of salt will supply the needs of either cattle or sheep. However, the simplest method to correct the deficiency is to supply a mineralized salt containing cobalt. Several such mixtures are available.

Do not feed too much cobalt. Feeding more than the quantities recommended may produce toxic effects.

Other sources of cobalt available commercially include large pellets of cobalt oxide. It is claimed that these pellets, when given to cattle, will remain in the rumen for 4 to 7 months and will provide adequate daily amounts of cobalt. Consult your veterinarian about their use.

Cobalt deficiency in soil has been corrected by mixing cobalt salts with superphosphate or sand and spreading the mixture over pastures. In Florida, some experiments have been made in spreading a salt of cobalt by airplane. At present, however, applying cobalt to the soil does not appear to be practicable.

Increasing the proportion of alfalfa and clover in forages should supply the cobalt needs of ruminant animals except in the most critical areas of cobalt deficiency. Severe deficiencies may require treating the animals as well as improving forage and hay quality.

¹ Cobalt sulfate= $\text{CoSO}_4 \cdot 7\text{H}_2\text{O}$.



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