



Copper is Key for Cattle Immunity

By Jackie Nix

Economic losses due to mortality and morbidity caused by disease cost cattle producers hundreds of thousands of dollars every year. Aside from the obvious losses resulting from dead animals and medical costs, there are added losses from a lack of efficiency and productivity. These may manifest in poor feed conversion, sub-optimal weight gains and/or milk production and increased days open.

It is widely proven that trace mineral nutrition directly influences immunity in cattle. Proper mineral supplementation can enhance an animal's immunity against bacterial and parasitic infections by increasing resistance and decreasing the severity of infections when they do occur. A cow's mineral requirements are influenced by many factors including age, breed, stage of production, presence of antagonists in the diet, and level of overall stress. While many trace minerals perform important roles in the development and maintenance of the immune system, copper stands out as especially important in many instances.

Copper and the Immune System

Copper is needed for proper development and maintenance of the immune system including the formation of antibodies and white blood cells in addition to antioxidant enzyme production. Copper deficient cattle are more susceptible to infections and do not respond as well to vaccinations. In addition, they tend to be less resistant to parasitic challenge. Studies have shown that cattle receiving proper copper nutrition tend to be less susceptible to infections and have less severe infections when disease does occur.

Non-specific Immunity

Non-specific immunity refers to the immune functions that are non-specific in nature. No prior exposure is required for these systems to be effective. The skin, as well as mucus tissues in the respiratory, gastrointestinal and reproductive tracts, act as a non-specific physical barrier to microorganisms. Copper (in addition to zinc) plays an important role in the maintenance of these epithelial tissues. Phagocytic cells that ingest and destroy bacteria and toxins are also components of non-specific immunity. Copper deficiency has a profound effect on several types of phagocytic cells. Copper deficiency both decreases the number of circulating phagocytic cells and impairs the functioning of those that are left.

Copper (as well as zinc, selenium, manganese and vitamin E) is also involved in antioxidant activity that protects cell membranes from damage caused by free radicals. Free radicals are electrically imbalanced molecules that attack healthy body tissues. Free radicals are the natural byproduct of immune responses within the body. Exposure to drugs, chemicals, preservatives and inhaled impurities in the air may also generate free radicals. Antioxidants act to neutralize free radicals before they can damage normal body tissues. The need for antioxidants increases with onset of infections or wounds, injuries, and stress of any type. Symptoms of inadequate antioxidant activity include poor stress tolerance, more frequent infections and poor wound healing.

Acquired Immunity

Acquired immunity results from interaction with a specific foreign invader (either by natural exposure or vaccination). Foreign molecules (antigens) stimulate the body to produce antibodies (also known as immunoglobins) that are specific in nature. Copper deficiency, in general, reduces the effectiveness of the acquired response. Antibody production is significantly reduced in copper deficient animals. For this reason, copper nutrition is an essential component for the success of vaccination programs in cattle. Calves may be deficient at levels that affect immunity without displaying clinical signs of deficiency (see Figure 1).

Passive Immunity

The ability to mount an immune response does not develop immediately in newborn animals. Therefore, the calf is dependant on its dam for immune protection. The calf receives antibodies from its mother through colostrum (first milk) thus conferring what is known as passive immunity. It is vital that calves receive colostrum within the first 24 hours of life (ideally within 12 hours or less) in order to be able to effectively absorb these protective antibodies. Calves that receive adequate colostrum within the first 24 hours will receive passive immunity benefits for the first 3 to 5 weeks of life.

Proper copper nutrition in pregnant cows is critical to the immune health of newborn calves. Research has shown a significant transfer of copper from the dam to the fetus during the last trimester of pregnancy. (Cows with adequate liver copper stores pre-calving, became marginal at the time of calving.) Newborns are very dependent on copper acquired during the prenatal period since milk is a poor source of copper. Calves have a high copper demand during the first few months of life. Additionally, copper status in the dam is critical to the production of high quality colostrum. As mentioned above, copper-deficient animals produce fewer antibodies. Calves born to copper deficient cows experience increased death losses, reduced growth and poor production efficiency.

Copper and Stress

Stress increases an animal's mineral needs and tends to exacerbate existing mineral deficiencies. This is especially important with weaned calves. Studies have shown that copper deficient calves have more health problems, gain weight less efficiently and have lower net returns. For this reason it is vital that calves receive adequate mineral nutrition BEFORE weaning because even a proper mineral program cannot overcome existing mineral deficiencies once stress sets in. Calves going into stocker or feedlot situations will perform better when they have received adequate copper nutrition prior to weaning.

Don't Cattle Get the Copper They Need?

Marginal to severe copper deficiency in cattle is widespread across the United States. Typical deficiency symptoms include: rough, discolored hair coats (Figure 2); winter coats that are slow to shed; decreased conception rates; increased days open; hoof problems; depressed immunity; anemia; reduced growth rate and, in some cases, diarrhea. Copper deficiency in cattle is brought on by a combination of factors including: low soil copper levels; high soil concentrations of antagonistic minerals; plant effects and breed factors. Also, fertilization practices, such as improper liming and use of poultry litter on pastures, can negatively impact copper levels in forages. For all of these reasons, many situations exist in which cattle respond favorably to copper supplementation.

How Can I Provide Enough Copper for My Cattle?

The key in providing adequate copper is to provide YEAR-ROUND access to a free choice complete mineral supplement that delivers sufficient copper. Do not skimp on mineral supplementation during spring and summer months when forage quality is relatively good. Remember that most soils are deficient in copper so the forages grown on those soils will be deficient too. It is also important to

eliminate use of yellow sulfur salt blocks. These sulfur blocks can artificially increase sulfur levels to the point of inducing copper deficiency.

Cattle producers who have observed any of the following symptoms in their cattle: rough, discolored hair coats --red tinge on black hair or loss of pigment around the eyes (see Figure 2); winter coats that are slow to shed out; depressed immunity, decreased conception rates; increased days open and/or hoof problems should consider use of one of the **Sweetlix® CopperHead®** line of mineral supplement products.

All CopperHead® supplement products deliver enhanced levels of copper as well as balanced levels of other essential minerals and vitamins. The CopperHead® line of mineral supplements contains organic forms of not only copper, but also zinc, manganese and cobalt for optimum bioavailability and thus optimum productivity. Organic minerals are particularly beneficial during times of stress such as calving, lactation and weaning. Sweetlix® CopperHead® supplements also now have the added advantage of **RainBloc®** for improved resistance to moisture.

CopperHead® Max 16:8 with RainBloc®

- Enhanced levels of trace minerals for maximum productivity
- Contains 2500 ppm copper for enhanced copper nutrition
- 2:1 Ca to P ratio (16% Ca : 8% P)
- Ideal for brood and growing cattle on summer pastures

CopperHead® Max 12:4:14 with RainBloc®

- Enhanced levels of trace minerals for maximum productivity
- Contains 2500 ppm copper for enhanced copper nutrition
- High magnesium to help protect against grass tetany
- Ideal for brood cattle on spring or fall pastures

CopperHead® Max 12:12 with RainBloc®

- Enhanced levels of trace minerals for maximum productivity
- Contains 2500 ppm copper for enhanced copper nutrition
- High phosphorus for enhanced growth and reproduction
- Ideal for growing and brood cattle on forages known to be low in phosphorus

CopperHead® Fescue Max with RainBloc®

- Designed especially for endophyte-infected fescue pastures
- Contains two sources of organic, chelated minerals for optimum bioavailability
- Contains 2000 ppm copper
- Ideal for all classes of cattle on fescue forages

6% CopperHead® with RainBloc®

- Contains 1800 ppm copper for enhanced copper nutrition
- Moderate phosphorus level – 6%
- Highly palatable, economical supplement
- Ideal for summer pastures and when hay is being fed

CopperHead® Hi Mag with RainBloc®

- Contains 1800 ppm copper for enhanced copper nutrition
- High magnesium for protection against grass tetany
- Highly palatable, economical supplement
- Ideal for brood cattle on spring and early fall pastures

6% CopperHead® LS with RainBloc®

- Low salt version of the original 6% CopperHead®
- Ideal for coastal regions with high soil salt levels
- Logical choice for coastal cattle that have had mineral consumption problems in the past

In summary, copper is essential for the development and maintenance of a healthy immune system. Many cattle show copper deficiency symptoms including: discolored hair coats, slow to shed out of winter coats, depressed immunity, decreased conception rates, increased days open, and hoof problems. If your cattle experience any of these symptoms, you should strongly consider use of one of the Sweetlix® CopperHead® line of mineral supplements to help enhance copper nutrition. Ask for **CopperHead®** by name at your local Sweetlix® dealer or call 1-87SWEETLIX to learn more about these and other Sweetlix supplement products for cattle.

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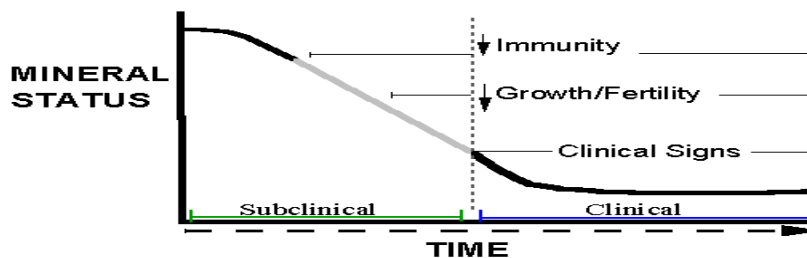


Figure 1. The relationship between mineral status and onset of subclinical and clinical disease symptoms. Based on S. Wikse, 1992. Texas A&M Univ. Beef Cattle Short Course.



Figure 2. An example of a calf displaying a discolored hair coat typical of copper deficiency. Note the red tinge on the black hair.