

## Copper Toxicity in Sheep

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Sheep are unique among food and farm animals in the way they utilize copper. Copper is a required mineral for all farm animals and also is potentially toxic to all of the food-producing animals. Sheep are the most susceptible of all food-producing animals to copper toxicosis.

Copper nutrition in sheep is quite complicated. It is a required mineral for sheep, yet highly toxic. Copper status of sheep is influenced by breed, age of animal, health status of animal, levels of other minerals consumed, and even levels of some feed additives in the diet.

Copper metabolism in sheep is influenced by the breed or crosses of breeds the sheep are. Generally, the down type, medium wool sheep of British or European origin, are the most susceptible to copper toxicity. Sheep from Texel breeding are the most susceptible to copper toxicity. Fine-wool type sheep are intermediate in susceptibility to copper toxicosis, while sheep with a high percentage of Finnsheep breeding are least susceptible to copper toxicity.

Presence or absence in the diet of sheep of other minerals and some ionophores affects the copper metabolism of sheep. Especially the level of molybdenum and sulfur in the diet. Molybdenum and sulfur act as antagonists to copper. The presence of these compounds bind with copper and prevent gut absorption and increase excretion of absorbed copper in the liver and body tissues. Molybdenum is often added to sheep diets to try to help prevent copper toxicity. However, molybdenum added at too high of levels can actually result in sheep having a copper deficiency. Also, feeding ionophores (monensin, lasalocid) to sheep, which is done frequently, can result in increased efficiency of copper absorption by sheep.

So, it becomes quickly apparent that copper nutrition in sheep is pretty complicated. It is no wonder that it is a significant concern in mid-western sheep operations. Sheep have a narrow range or band between required levels of copper and levels where toxicity can occur. In general, sheep need four to eight ppm of copper in the diet, depending on breed, sulfur, and molybdenum levels in the diet. Consider the fact that a sheep diet of 80% mixed hay and 20% of a grain mix can have copper levels of 14 to 15 ppm, without any added copper, and it is easy to see why copper toxicity can be a problem. In general, copper levels in a diet for sheep with molybdenum levels at three ppm or slightly higher can usually tolerate 20 to 25 ppm copper. Sheep fed diets lower in molybdenum than this tolerate lower levels of copper. Especially if the sheep are of British or Texel origin.

Copper toxicity can be of two types: chronic or acute. The acute form of copper toxicity occurs quickly, shortly after ingestion of high amounts of copper. The chronic form occurs when sheep are fed diets over a period of time that are marginally higher in copper content relative to level of copper antagonists in the diet. This could be over a period of weeks or months, depending on actual copper intake by the sheep. What happens is that sheep bind absorbed copper very tightly in the liver. Copper buildup in the liver occurs because sheep do not excrete copper from the body as efficiently as other animal species. When the liver becomes saturated with copper, tissue damage occurs in the liver and large amounts of copper are released into the bloodstream. This causes the death of red blood cells and subsequent tissue damage. Often, the first very noticeable sign of copper toxicity is dead sheep. This many times may follow some stressful event for the sheep.

Prevention of copper toxicity is the most practical method of dealing with this problem. There are a number of strategies that can be used to prevent copper problems. They entail trying to decrease intake or absorption of copper and include:

1. Do not feed swine or poultry feed to sheep. They contain high levels of copper by design.
2. Carefully investigate copper levels in beef or dairy products before feeding to sheep. Some of them will have high levels of copper, while others will not.

3. Communicate with feed company representatives or country elevators supplying feed. It is important that mixers are clean, augers clean, and feed delivery trucks clean before handling sheep feeds, especially if they mix and handle swine feeds.
4. Test feeds and forages for levels of copper, molybdenum and sulfur.
5. Avoid grazing sheep on pastures where swine or poultry waste is applied.
6. Consider adding molybdenum to the diet at a rate of 3 ppm.
7. Have post mortems done on dead animals. This is a good routine management practice.

Treatment of sheep with copper toxicity should be done under the advice of a veterinarian. The usual treatment consists of drenching or feeding ammonium molybdate, sodium sulfate and penicillamine over a period of weeks. Future performance of sheep that recover from copper toxicity is variable and not fully known. Prevention is the best course of action.

Sources of further reading:

Nutrient requirements of sheep, sixth revised edition, 1985,  
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