Utah State University Extension
electronic publishing

Animal Health Fact Sheet

COPPER DEFICIENCY IN UTAH

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July 1997 AH/Beef/11

Copper deficiency has been diagnosed in a number of Utah cattle herds, yet few producers use copper supplements. Cattle deficient in the element can suffer significant production losses.

Producers need to balance both the effects and the costs of copper supplements. Too much copper can cause copper toxicity or poisoning. And adding copper may not be economical if animals are only marginally deficient. Further, the deficiency may occur only on specific feeds or pastures, correcting itself when cattle are moved.

Clinical signs of deficiency include ill thrift and poor growth, rough haircoat, faded hair color, diarrhea, lameness, rickets-like condition, depraved appetite and infertility. However, specific signs depend on the cause of the deficiency, which contributes to confusion in diagnosis.

THESE ARE SOME OF THE SIGNS OF COPPER DEFICIENCY:

- Copper deficiency may be caused by a diet that is low in copper content or by interference with copper because of an excess of such elements as molybdenum, sulfate and iron.
- Livestock water that is high in sulfates can trigger copper deficiency.
- Growing plants, especially tall fescue and quackgrass, tend to tie up copper more than harvested feeds.
- Some breeds of cattle are more susceptible than others.
- Old lake-bottom soil, found in much of the Mountain West, and alkaline areas are prone to copper deficiency. It has been stated, apparently with considerable truth, that if you have 25 acres of swampland, even if you have 250 acres of good ground, you will have copper-deficient cattle.

Diagnosis of copper deficiency should be based on clinical signs, history, blood serum copper levels, and liver copper levels. Forage analysis for copper, molybdenum, iron and sulfate and water analysis for sulfate also help diagnose and plan supplementation.

The liver is the best measure of current copper status, except in the fetus or newborn. The fetus stores copper in its liver at the expense of the dam. In late pregnancy, it is normal for the cow's serum and liver copper levels to decline drastically.

Blood serum is a more reliable and consistent measure of copper status than is whole blood. But neither reflects dietary intake unless the liver is severely depleted of its copper stores.

Low serum copper indicates that almost all of the liver copper storage has been used. When the serum copper reaches normal levels, the only way to determine copper reserve status is by liver biopsy. Supplementing ruminants that have normal serum copper level could lead to toxicity. The supplemental copper could be removed until the level again becomes marginal.

The serum copper level may also be increased by infection, trauma and hemolysis of red blood cells.

Supplementation with selenium reduces the serum copper level, but actually increases the amount of copper available to the animal.

Guides for interpreting laboratory results are included in Tables 1 and 2.

Table 1. Tissue Copper Concentrations (1)

	Serum Copper (ppm)	Liver Copper (wet weight, ppm)
Clinical Signs	< 0.2	NA
Deficient	0.2–0.4	0.5–10.0
Marginal	0.4–0.7	5–25
Normal	0.7–1.1	25–550
Toxic	> 1.2	250–800

Table 2. Element Levels in Forages and Water (1,2,3)

	ppm Cu	ppm Mo	Cu:Mo Ratio	(S) Sulfate %	ppm Iron	ppm S in Water
Clinical Signs	< 2		< 2			
Deficient	< 3-5		< 2			
Marginal	< 10		< 3			
Adequate	10	> 3	6–10			
High	—			> 0.2%	> 300	> 500
Toxic	—	>10	> 12			

Several methods have been used to supplement copper, include feeding salt with 0.5-2.0% additional copper (as copper sulfate), injecting a commercial preparation of copper, dosing with gelatin capsules containing copper wires, adding copper tablets to water, and fertilizing pastures with copper.

Salt supplementation is not always successful because some grazing areas are high in salt, and cattle may not ingest enough free-choice salt to obtain the needed copper.

With financial help from the Utah Department of Agriculture, we conducted trials on several herds in Utah, supplementing with the products available. We concluded the following:

1. Blood serum analysis is a valuable tool for monitoring the copper status as well as the progress of copper supplementation. We recommend sampling 5-10 animals per herd or group to measure their status.
2. Injectable copper appeared to be of little value in correcting deficiencies.
3. The bolus brought a better response than injectable copper, but does not contain enough

copper to correct a severe deficiency. It could be administered to calves in the spring to carry them through the grazing period. But once given, it cannot be removed, so the producer has less dosage control than with a continuing supplement.

4. Salt is a good, economical means of supplementing copper, but it takes some planning and work. The rate can be controlled by offering cattle which eat more salt than expected, copper-free salt for a time. Correct low salt intake by adding cottonseed meal, ground barley, etc., to achieve the desired level.
5. Copper-supplemented pasture block also gives very good control but is more expensive than salt (see Table 3). Still, the cost per head is very reasonable compared to production losses which may be caused by copper deficiency.
6.

Table 3. Comparative Cost of Block and Salt for Copper Supplementation

	Cost Per Ton	Cost Per Pound	Cost Head Per Day
Block	$143.20	$0.072	$0.0741
Salt	$132.54	$0.0663	$0.0066

It should also be pointed out that copper deficiency occurs primarily in grazing animals. Cattle on harvested feeds are usually normal or only marginally deficient. Data were collected on four herds to show the relatively rapid change in serum copper from grazing (at weaning) to the feedlot (see Table 4).

Table 4. Comparison of Serum Cu Levels When Moved from Grazing Cond. (at Weaning) to Feedlot

Herd Location (Year)	Time Between Blood Samples (Months)	Serum Copper @ Weaning (ppm)	Serum Copper in Feedlot
Sevier County	2	0.52	0.72
Rich County	2 ¼	0.50	0.78
Cache County (1992)	2	0.29	0.79
Cache County (1993)	1 ¼	0.21	0.78

Copper supplementation is NOT a simple task, but it is manageable and can be applied to each ranch situation. Copper deficiency can be controlled using serum sample monitoring and copper-supplemented salt, pasture block or both.

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