

## COPPER STATUS OF EWES FED COPPER FROM OPTiMIN® COPPER OR COPPER SULFATE

A study was conducted at Texas A & M to determine the copper status of mature, hysterectomized, ewes (n=31) fed two dietary sources of Cu (Cu sulfate and Cu OPTiMIN®). On d 0, 28 and 73 plasma samples were collected to measure complete blood count and ceruloplasmin. Wool samples and wool length measurements were obtained on d 73. The Cu fed ewes had 19% more ( $P<.05$ ) white blood cells compared to those fed Cu sulfate. Ceruloplasmin activity was affected in ewes due to source and level of copper. Ewes fed Cu had higher ( $P<.05$ ) ceruloplasmin than those fed Cu sulfate (33.2 vs. 28.2 IU). There was a Cu level by source interaction ( $P<.05$ ) for wool growth. In ewes fed Cu, increasing dietary Cu increased wool growth, whereas, in ewes fed Cu sulfate, increasing dietary Cu decreased wool growth. These data support the hypothesis that Cu from Cu proteinate and Cu sulfate have different biological availabilities.

### KEY POINTS:

1. OPTiMIN® copper more bioavailable than copper sulfate.
2. While not our recommendation, study suggests higher levels of OPTiMIN® copper can be fed to sheep without toxic effects.
3. OPTiMIN® copper promotes wool production.

### SUMMARY:

OPTiMIN® copper is more bioavailable than copper sulfate as evidenced by higher ceruloplasmin, white blood cell, plasma copper, intestinal, and bile levels in ewes indicating greater amount of Cu available for wool growth. This study suggests OPTiMIN® copper and copper sulfate are utilized differently as indicated by liver and kidney tissue comparisons.

These data suggest that Cu proteinate will maintain higher liver Cu when fed at normal levels and if fed in excess amounts will result in less liver Cu compared to those fed Cu sulfate. However, as dietary Cu increased the rate of Cu accumulation in the liver decreased, which suggest to be a response from a mechanism used to the prevention of toxic Cu overloading.

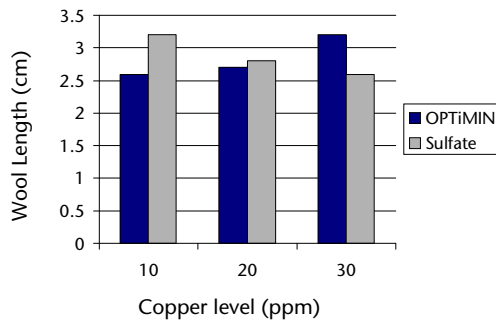
When the liver and kidney Cu concentrations of the ewes fed Cu sulfate are compared, an inverse relationship is noted. This indicates that Cu from Cu sulfate and Cu proteinate are utilized differently in the animal.

Copper proteinate fed ewes tended to have more ( $P<.10$ ) Cu in the small intestine tissue than those fed Cu sulfate. The Cu sulfate fed ewes had a mean bile Cu concentration of .68 ppm, and the Cu proteinate fed ewes had a mean bile Cu concentration of .85 ppm. Bile Cu from ewes fed

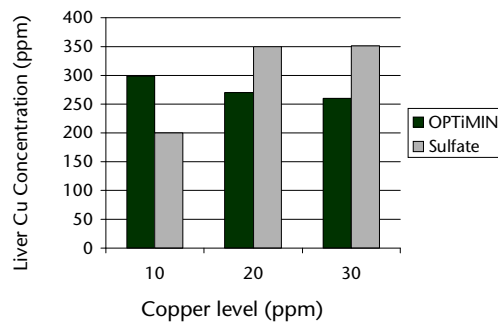
Cu proteinate tended to be found at a 20% greater rate in the bile as compared to those fed Cu sulfate.

An interaction ( $P < .05$ ) occurred between source and level of Cu for wool length. The wool length measurements show that generally among the three sample sites taken, as the dietary copper concentration increased in the copper sulfate fed ewes, the wool length decreased, while in the copper proteinate fed ewes wool length increased. This data tends to suggest that increased Cu availability may be linked to wool growth. The Cu proteinate fed ewes that had significantly greater wool growth as compared to the Cu sulfate fed ewes, also exhibited significantly greater ceruloplasmin levels. This greater amount of ceruloplasmin levels found in these ewes would indicate a greater amount of Cu available for wool growth.

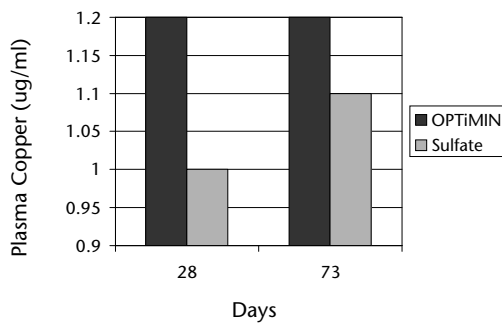
Effect of OPTiMIN® Copper on Wool Length



Effect of OPTiMIN® Copper on Liver Tissue Concentration



Effect of OPTiMIN® Copper on Plasma Copper Status



Effect of OPTiMIN® Copper on Small Intestine Copper Levels

