

COPPER LEVELS IN BOVINE SERUM

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Through the cooperation of USDA-APHIS inspectors in six slaughter plants, 723 serum-liver samples were collected from August through November of 1977. The average copper level in these serums was $0.64 \pm .27$ ppm. There were 211 cattle with less than 0.5 ppm copper and 67 with less than 0.25 ppm. Future supplementation trials and additional sampling are planned.

Copper was first shown to be a dietary essential in 1928 (1). Copper is required for normal red blood cell information, bone formation, aorta elastin formation, spinal cord myelin formation, hair pigmentation, and a number of enzymes (2, 3). In cases of copper deficiency, bone disorders, nerve problems, reproductive problems, poor growth, and scours are often observed (2, 3). In some cases chronic copper deficiency may be seen without any pronounced clinical signs (4).

The normal copper levels in bovine serum should be from 0.5 to 1.5 parts per million (ppm) (2). Serum copper levels consistently below 0.5 ppm are strongly correlated to liver copper levels of less than 40 ppm D.M. (8) and indicative of copper deficiency, simple or conditioned (2).

The first major work on copper deficiency in sheep and cattle was reported in New Zealand in 1946 (5). Recent work on copper deficiency in beef cattle was also done in South Dakota (6) and Manitoba (7). Data acquired from diagnostic specimens at North Dakota State University indicated that the copper nutrition of North Dakota cattle should also be investigated. A project to measure copper levels in cattle was developed in the Department of Veterinary Science and is now underway.

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Procedure

Through the cooperation of USDA-APHIS inspectors in six slaughter plants (see Figure 1), paired serum-liver samples were collected from August through November of 1977. The blood samples were centrifuged and the serum was separated before transportation to this laboratory. The serum and liver samples were frozen until they could be assayed. The serum was diluted eleven fold with 0.1% Triton X in 10 mM HNO₃. A 20 microliter sample of the diluted serum was then analyzed on a flameless atomic absorption spectrophotometer. The data was punched on computer cards for subsequent geographical and statistical tabulations.

Results and Discussion

From August to November of 1977 serum and liver samples were collected from 723 slaughter cattle. These cattle were from 280 North Dakota producers. The average copper level in these serums was 0.64 with a standard deviation of 0.27 ppm. There were 211 cattle with less than 0.5 ppm serum copper and 67 with less than 0.25 serum copper. The cattle with less than 0.5 ppm serum copper were from 99 herds throughout North Dakota. The number of samples was not sufficient to establish accurate county averages.

The data from this initial survey indicates that some North Dakota cattle, those with less than 0.5 ppm serum copper, may be deficient in copper. It is unknown whether or not copper supplementation will give beneficial responses to those cattle which have low serum copper levels. There are a number of factors (age, management, feed molybdenum levels, water sulfates) which can affect the response of these cattle to supplementation. Supplementation trials are planned for future experiments and an additional 12,000 to 15,000 samples will be assayed. Producers and veterinarians are encouraged to submit serum or plasma samples from cattle they suspect are deficient in copper.

Figure 1. Cooperating Slaughter Plants

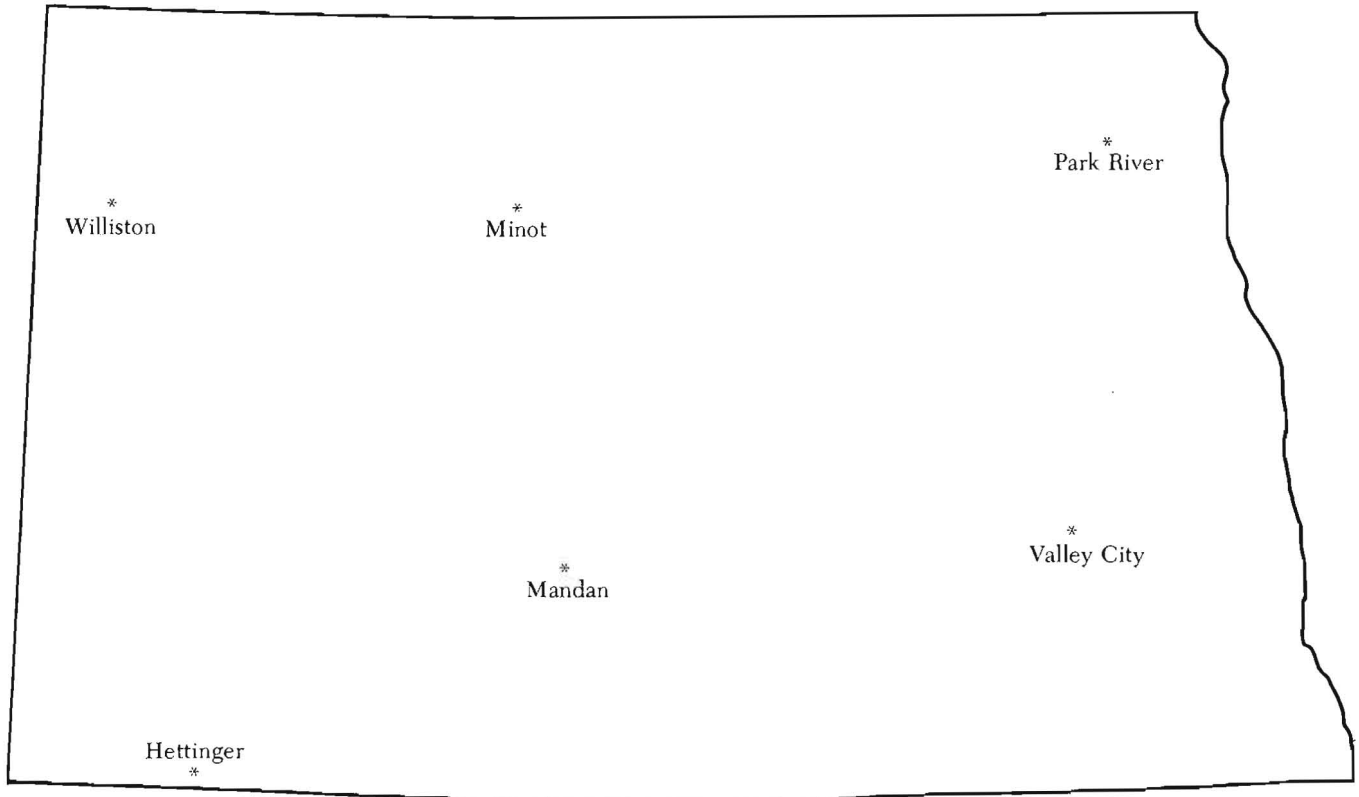


Figure 2. A view of the equipment used for the copper analysis.



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