

Assessing Beef Ranch Trace Mineral Status

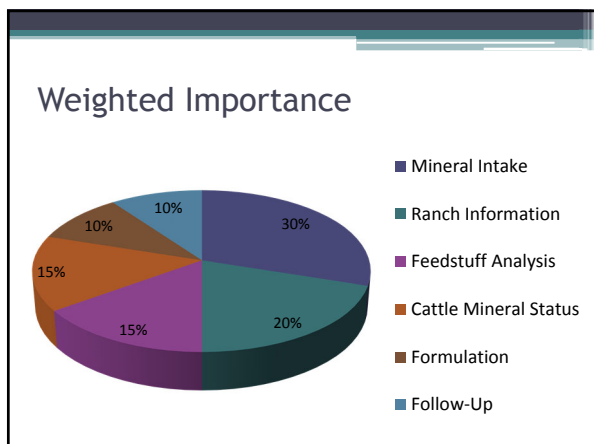
John Arthington
Professor and Center Director
University of Florida – IFAS
Range Cattle Research and Education Center

Overview

- Technical sales/service individuals involved in mineral products used by cow/calf producers often have a need to evaluate the trace mineral nutrition of a cowherd.
- Two common situations;
 - Owner/Mgr. perceives a trace mineral problem due to loss in production, or
 - Trace mineral assessment is provided as a service to the owner/Mgr.

Order of Assessment

1. Ranch / Farm Information
2. Feedstuff Analysis
3. Mineral Intake Management
4. Mineral Formulation and Analysis
5. Cattle Mineral Status
6. Communication / Follow-Up



1. Ranch/Farm Information

1. Information gathering process;
 - a) What are the goals and expectations?
 - b) How will success be measured?
2. What factors could be responsible? Start by ruling out more directly contributing factors.
 - a) Are energy and protein adequate (cow body condition)?
 - b) Are production losses well defined?
 - c) What are the sources of supplemental trace minerals?
 - d) Have there been recent changes in management?

2. Feedstuff Analysis

1. Trace mineral intake is a summation of multiple sources;
 - a) Forage (grazed and harvested)
 - b) Supplement
 - c) Water
2. Grazing cattle selectively consume forage with 1/3 greater crude protein, Ca, and P than had clipped samples of the same pasture.

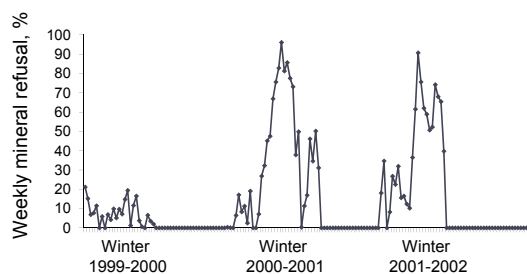
2. Feedstuff Analysis, cont.

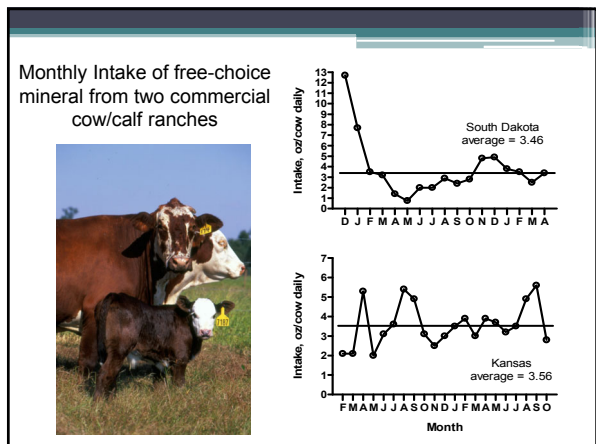
- 3. Trace mineral antagonists should be considered;
 - a) Sulfur is the most impactful of all trace mineral antagonists. Sources include, (1) fertilizer, (2) water, and (3) supplements.
 - b) Molybdenum is an antagonist of copper and is catalyzed by high-sulfur. Alone, molybdenum may impact estrogen metabolism resulting in impaired reproduction.
 - c) Iron may antagonize several minerals, but concentrations must be quite high.

3. Mineral Intake Management

- 1. Properly formulated free-choice minerals assume an average daily intake. Achieving this intake goal is the most influential factor impacting cowherd trace mineral status.
- 2. Variation in intake is due to seasonal and production status impacts on salt craving.
 - a) Temperature and humidity
 - b) Forage DM
 - c) Lactation
- 3. Changes in salt craving are not always linked to sodium requirement.

Intake Refusal of Free-Choice Trace Mineral





4. Mineral Formulation / Analysis

1. Too often, this step in the process is assessed first. This is usually the result of the owner/Mgr. impressions derived from advertisement or consultation by others.
2. The technician may or may not be familiar with the product currently being used. If not familiar;
 - a) Examine ingredients, concentration, and ratios.
 1. Is the zinc : copper at least 2:1?
 2. Is selenium provided at approximately 3 mg/d given the level of desired intake?
3. When testing the nutrient composition of trace minerals, collect at least 3 hand grab samples pulled from 3 random bags of product.



5. Cattle Mineral Status

1. Usually, a reasonable plan of action can be devised from the outcomes of steps 1 to 4; however, assessment of cow status is certainly an opportunity to learn more about the trace mineral status of the herd.
2. Selecting the proper sampling depot is essential and the **liver** remains the most suitable for copper and selenium. In addition, copper and selenium are usually the most commonly deficient trace minerals in grazing cattle and often considered "sentinels" for the overall trace mineral status of the herd

5. Cattle Mineral Status, cont.

3. Blood is an unreliable indicator of trace mineral status, with the possible exception of blood selenium.
4. Select cows that represent the herd average. Avoid selecting cows that the producer identifies as "poor doers" or as having poor production.
5. Non-pregnant cows are the best candidates. Attempt to target the early post-partum period.

Plasma x Serum Copper Correlation

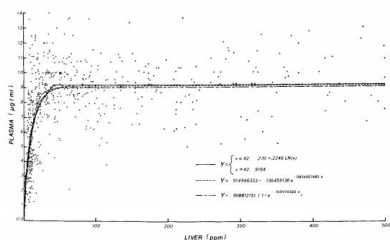


Figure 1. Relationship between blood plasma copper and liver copper and best fit curves generated by linear and nonlinear procedures.

Claypool, et al. Journal of Animal Science. 1975. 41(3):911-914

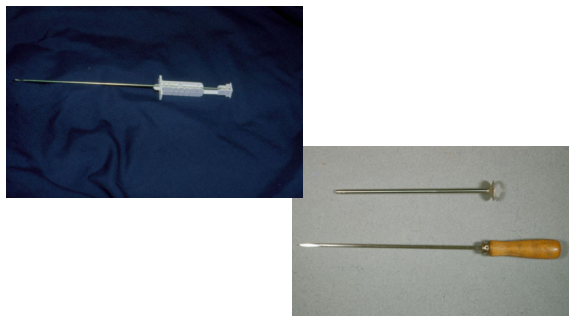
5. Cattle Mineral Status, cont.

- 6. Typically, 10 to 15 cows in a single herd is sufficient to characterize copper and selenium status.
- 7. Small sample size (approx. 300 mg) is adequate for trace mineral analyses using ICP.
- 8. Attempt to collect the sample from the same area of the liver (see figure).
- 9. Only use labs that report their results on a **DM basis**.

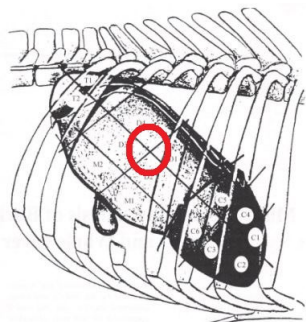
Liver biopsy for trace mineral assessment



16 ga, Tru Cut, Biopsy Needle



Target the same site for multiple biopsies



Video Segment

Please don't send your liver biopsy samples to a laboratory that reports results on a **wet weight basis!**



Analyze liver biopsy tissues on a DM basis (dry matter)



- Liver tissue is estimated to be 72% moisture (Herdt and Hoff, 2011).
- There is no way to control moisture loss (dehydration) from small tissue samples collected by traditional biopsy technique.
- Samples must be dried before analysis and reported on a DM basis. Liver biopsy results, reported on a wet weight (as received) basis are unreliable.

Erroneous results from wet weight reporting of results (WW or as received)

Dehydration, % ¹	Dry matter basis, ppm Cu	Wet weight basis, ppm Cu
0	75	21
5	75	24
10	75	26
15	75	29
20	75	32
25	75	35

¹Loss of moisture from the time of sample collection until analysis.

6. Follow Up

1. This last step in the process is often overlooked, but essential to the overall effort.
2. Did the owner/Mgr. measure, record, or notice the intended outcome.
3. Records of the Herd Assessment, such as, (1) forage mineral results, (2) free-choice mineral intake, and (3) cow mineral status can provide a valuable historic reference for future evaluations.

Thank you for your attention

John D. Arthington
Professor and Center Director
Range Cattle Research and Education Center
University of Florida
Institute of Food and Agricultural Sciences
(863) 735-1314
jarth@ufl.edu