Value of Feeding Minerals to Beef Cattle

Logan Wallace
Livestock Specialist

UNIVERSITY OF MISSOURI Extension
Perceptions about Mineral Nutrition

• Depth of Knowledge
  – Know requirement of few minerals
  – Complexities with many interactions

• Nutritional Wisdom of Cattle
  – Palatability is key!!! (Salt Excluded)

• Reproductive Failure and Disease
  – Subtle changes before clinical signs
…Perceptions

• Required Mineral Elements
  – 16 minerals required
  – 6 macro and 10 micro
  – 3 monitored for interactions with Copper
    • Molybdenum, Iron, Sulfur

• Consistency of mineral intake
  – Want 2-4 oz/head/day
Macro Minerals Required

- Calcium – Bone, Nerve Function
- Phosphorus – Metabolism, Feed intake, Bone
- Sodium – Body fluid balance
- Potassium – Nerve function
- Magnesium – Metabolic functions
- Sulfur – Protein synthesis
Micro Minerals

- Copper – Red blood cells, hair coat pigmentation
- Selenium – Metabolism, works similar to Vitamin E
- Zinc – Enzyme Functions, Immune system, Skin and hair coat, hoof, bull fertility
Micro Minerals

- Iodine – Thyroid, metabolism
- Cobalt – Synthesis of B-12
- Iron – Red blood cell oxygen transport
- Manganese – bone formation, carbohydrate metabolism, central nervous system
Vitamins

• Vit. A: Epithelial tissue, skin, digestive tract
  – 250,000 IU
• Vit. D: Synthesized in skin when exposed to sunlight, Ca absorption
  – 25,000 IU
• Vit. E: Antioxidant, functions similar to Se
  – 100 IU
## Mineral requirements for beef cattle (adapted from NRC, 1996 and Greene, 2000)

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Units</th>
<th>Growing and Finishing Cattle</th>
<th>Gestating and Dry Cows</th>
<th>Lactating Cows</th>
<th>Maximum Tolerable Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>%</td>
<td>0.40 to 0.80</td>
<td>0.16 to 0.27</td>
<td>0.28 to 0.58</td>
<td>-</td>
</tr>
<tr>
<td>Chromium</td>
<td>ppm</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>1000.00</td>
</tr>
<tr>
<td>Cobalt</td>
<td>ppm</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>10.00</td>
</tr>
<tr>
<td>Copper</td>
<td>ppm</td>
<td>10.00</td>
<td>10.00</td>
<td>10.00</td>
<td>100.00</td>
</tr>
<tr>
<td>Iodine</td>
<td>ppm</td>
<td>0.50</td>
<td>0.50</td>
<td>0.50</td>
<td>50.00</td>
</tr>
<tr>
<td>Iron</td>
<td>ppm</td>
<td>50.00</td>
<td>50.00</td>
<td>50.00</td>
<td>1000.00</td>
</tr>
<tr>
<td>Magnesium</td>
<td>%</td>
<td>0.10</td>
<td>0.12</td>
<td>0.20</td>
<td>0.40</td>
</tr>
<tr>
<td>Manganese</td>
<td>ppm</td>
<td>20.00</td>
<td>40.00</td>
<td>40.00</td>
<td>1000.00</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>ppm</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>5.00</td>
</tr>
<tr>
<td>Nickel</td>
<td>ppm</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>50.00</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>%</td>
<td>0.22 to 0.50</td>
<td>0.17 to 0.22</td>
<td>0.22 to 0.39</td>
<td>--</td>
</tr>
<tr>
<td>Potassium</td>
<td>%</td>
<td>0.60</td>
<td>0.60</td>
<td>0.60</td>
<td>3.00</td>
</tr>
<tr>
<td>Selenium</td>
<td>ppm</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>2.00</td>
</tr>
<tr>
<td>Sodium</td>
<td>%</td>
<td>0.07</td>
<td>0.07</td>
<td>0.10</td>
<td>--</td>
</tr>
<tr>
<td>Sulfur</td>
<td>%</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
<td>0.40</td>
</tr>
<tr>
<td>Zinc</td>
<td>ppm</td>
<td>30.00</td>
<td>30.00</td>
<td>30.00</td>
<td>500.00</td>
</tr>
</tbody>
</table>
Micro Minerals

![Graph showing the relationship between trace mineral intake, subclinical and clinical stages, and various outcomes such as immunity, growth/fertility, and clinical signs over time.]

Deficiencies

- Mg: Grass Tetany
  - Lush spring growth high in K
- Se: White muscle disease, usually western
  - Most forages of area low in Se
  - May cause retained placentas
- Cu: Unthriftiness, bleaching of hair coat, anemia
Factors Affecting Mineral Content of Forages

- Plant Species
- Soil Characteristics
- Soil Fertility
- Stage of Plant Maturity
- Climatic Conditions
Ca in Tall Fescue

Late March: 0.22
April: 0.49
May: 0.4
June: 0.69
Early July: 0.66
Late July: 0.19
NRC - Gestating: 0.25
NRC - Lactating: 0.3

Southwest Center Dairy
P in Tall Fescue

% DM

- Late March: 0.27
- April: 0.51
- May: 0.3
- June: 0.47
- Early July: 0.41
- Late July: 0.26
- NRC - Gestating: 0.16
- NRC - Lactating: 0.2

Southwest Center Dairy
### Trace-mineral classification for 352 forage samples collected from 18 states

<table>
<thead>
<tr>
<th>Trace Element</th>
<th>Adequate</th>
<th>Deficient</th>
<th>Marginal</th>
<th>Very High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>36.0</td>
<td>14.2</td>
<td>49.7</td>
<td>--</td>
</tr>
<tr>
<td>Manganese</td>
<td>76.0</td>
<td>4.7</td>
<td>19.3</td>
<td>--</td>
</tr>
<tr>
<td>Zinc</td>
<td>2.5</td>
<td>63.4</td>
<td>34.1</td>
<td>--</td>
</tr>
<tr>
<td>Cobalt</td>
<td>34.1</td>
<td>48.6</td>
<td>17.3</td>
<td>--</td>
</tr>
<tr>
<td>Iron</td>
<td>62.8</td>
<td>8.4</td>
<td>17.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>11.7&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>42.2</td>
<td>--</td>
<td>48.6&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.2&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup> Causes interference with other elements

adapted from Corah et al., 1996
## Trace elements in tall fescue: 73 samples

<table>
<thead>
<tr>
<th></th>
<th>Copper (ppm)</th>
<th>Manganese (ppm)</th>
<th>Zinc (ppm)</th>
<th>Selenium (ppm)</th>
<th>Cu:Mo (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± S. E.</td>
<td>9.3 ± 0.5</td>
<td>151.8 ± 11.4</td>
<td>2.6 ± 1.1</td>
<td>0.08 ± 0.01</td>
<td>17.1 ± 1.9</td>
</tr>
</tbody>
</table>

### Classification

<table>
<thead>
<tr>
<th></th>
<th>MTL a (%)</th>
<th>Adequate (%)</th>
<th>Marginal (%)</th>
<th>Deficient (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTL a (%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Adequate (%)</td>
<td>26.0</td>
<td>97.3</td>
<td>15.1</td>
<td>4.1</td>
</tr>
<tr>
<td>Marginal (%)</td>
<td>72.6</td>
<td>2.7</td>
<td>46.6</td>
<td>17.8</td>
</tr>
<tr>
<td>Deficient (%)</td>
<td>1.4</td>
<td>0</td>
<td>38.4</td>
<td>78.1</td>
</tr>
</tbody>
</table>

### Copper Antagonists

<table>
<thead>
<tr>
<th></th>
<th>Mean ± S.E.</th>
<th>% Ideal</th>
<th>% Marginal</th>
<th>% High</th>
<th>% MTL a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron (ppm)</td>
<td>153.8 ± 21.7</td>
<td>82.2</td>
<td>6.9</td>
<td>5.5</td>
<td>1.4</td>
</tr>
<tr>
<td>Molybdenum (ppm)</td>
<td>1.1 ± 0.1</td>
<td>49.3</td>
<td>46.6</td>
<td>4.1</td>
<td>0</td>
</tr>
<tr>
<td>Sulfur (%)</td>
<td>0.2 ± 0.01</td>
<td>38.4</td>
<td>42.5</td>
<td>1.4</td>
<td>0</td>
</tr>
</tbody>
</table>

*a Maximum tolerable level*

adapted from Mortimer et al., 1999
Basic Mineral Guidelines

- Base of 15-30% salt
- Unfertilized grasses
  - 12 - 16% Ca, 8 - 12% P, and 2 - 4% Mg
- Fertilized warm season grass
  - 12 - 16% Ca, 4 - 8% P and 2 - 4% Mg
- Cool season lush growing grasses:
  - 12 - 16% Ca, 0-4% P, and 6 - 10% Mg
- Supplements provide at least 75% of trace minerals Co, Cu, I, Mn, and Se

Green, 2000
...Guidelines

• Always supplement salt
• Ca-to-P ratio of 2 : 1
  – When feeding byproducts mix may contain 18:1 or greater
• P is expensive, over supplementation has not shown performance benefits
• Use sources with high availability
  – Sulfates = Chlorides > Carbonates > Oxides
• Cu could be increased during the last third of pregnancy to .15 - .25%
...Guidelines

• Acceptable particle size – mix well
• Intake is variable: 2 - 4 oz on free choice mineral
• Palatable enough to eat required amount but not over eat
• Vitamins A/D/E when green forages are not available
How to Make a Cost Effective Mineral

• Test Forages
  – Spring
  – Summer
  – Fall
  – Hay
• Test supplemented feeds if no analysis given
• Watch for imbalances and antagonisms
Closing Thoughts

• Most nutrition issues are protein and energy
• Producer testimonials do not substitute for well designed research
• No single program works on every farm everywhere
• Any benefit must offset the cost of changes made
• Keep records of herd performance!
• Value is in herds optimum productivity level
Thank you!

Contact Info:
wallaceld@missouri.edu
417-256-2391