Refining Our Nutrition Program to Meet the Mineral and Vitamin Needs of Our Sheep Flocks

Presenter:
Dr. Dan Morrical
Professor of Animal Science
Iowa State University

Host/Moderator: Jay Parsons
July 19, 2016

This webinar is made possible with funding support from the Let’s Grow Committee of the American Sheep Industry Association.
Refining our Nutrition Program

Dr. Dan Morrical
ISU Sheep Specialist
515-294-2904
morrical@iastate.edu
Objective of Supplementation

Provide for animal needs

Low cost

Livestock do not read the labels
Types of Minerals

Macro
Ca, P, K, Mg, S
Required in %
.1 to .7%

Micro
Zn, Se, Co, Cu,
Mn, I, Fe
PPM or mg/kg
Do I have a problem?

Figure 1. Schematic depiction of the relationship between nutrient status and presence of subclinical or clinical disease manifestations. (Redrawn from S. Wikse, 1992, Texas A&M University Beef Cattle Short Course).
Mineral Interactions
<table>
<thead>
<tr>
<th>Copper Antagonist</th>
<th>Deficient</th>
<th>Ideal</th>
<th>Antagonistic Level**</th>
<th>Marginal</th>
<th>High</th>
<th>MTC*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron (ppm)</td>
<td>below 50</td>
<td>50-200</td>
<td>&gt;200-400</td>
<td>&gt;400</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Molybdenum (ppm)</td>
<td>---</td>
<td>below 1</td>
<td>1-3</td>
<td>above 3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Sulfur (% DM)</td>
<td>below .10</td>
<td>.15-.20</td>
<td>&gt;.20-.30</td>
<td>&gt;.30</td>
<td>.40</td>
<td></td>
</tr>
</tbody>
</table>

*Maximum Tolerable Concentration

**Levels above these can potentially adversely affect copper availability
## Iowa Beef Center Forage Survey 2010

<table>
<thead>
<tr>
<th>Type</th>
<th>Region</th>
<th>Mn</th>
<th>SD</th>
<th>Zinc</th>
<th>SD</th>
<th>Copper</th>
<th>SD</th>
<th>Iron</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass</td>
<td>1</td>
<td>77.7</td>
<td>53.3</td>
<td>31.5</td>
<td>6.4</td>
<td>8.6</td>
<td>2.3</td>
<td>312.7</td>
<td>242.1</td>
</tr>
<tr>
<td>Grass</td>
<td>2</td>
<td>77.1</td>
<td>21.1</td>
<td>27.1</td>
<td>5.7</td>
<td>9.8</td>
<td>2.4</td>
<td>532.2</td>
<td>297.0</td>
</tr>
<tr>
<td>Grass</td>
<td>3</td>
<td>108.6</td>
<td>53.8</td>
<td>30.3</td>
<td>10.4</td>
<td>9.8</td>
<td>2.0</td>
<td>304.0</td>
<td>103.1</td>
</tr>
<tr>
<td>Grass/Legume</td>
<td>1</td>
<td>45.9</td>
<td>6.8</td>
<td>27.7</td>
<td>2.2</td>
<td>14.8</td>
<td>10.6</td>
<td>492.8</td>
<td>137.5</td>
</tr>
<tr>
<td>Grass/Legume</td>
<td>2</td>
<td>70.7</td>
<td>23.6</td>
<td>28.7</td>
<td>5.0</td>
<td>10.5</td>
<td>2.7</td>
<td>299.0</td>
<td>126.8</td>
</tr>
<tr>
<td>Grass/Legume</td>
<td>3</td>
<td>115.3</td>
<td>58.0</td>
<td>49.5</td>
<td>67.4</td>
<td>9.3</td>
<td>2.0</td>
<td>551.4</td>
<td>414.1</td>
</tr>
<tr>
<td>Legume</td>
<td>1</td>
<td>34.1</td>
<td>2.0</td>
<td>31.1</td>
<td>4.9</td>
<td>16.3</td>
<td>9.2</td>
<td>241.1</td>
<td>104.7</td>
</tr>
<tr>
<td>Legume</td>
<td>2</td>
<td>45.4</td>
<td>17.5</td>
<td>28.6</td>
<td>5.8</td>
<td>8.8</td>
<td>0.9</td>
<td>444.7</td>
<td>296.6</td>
</tr>
<tr>
<td>Legume</td>
<td>3</td>
<td>65.5</td>
<td>17.0</td>
<td>28.9</td>
<td>1.1</td>
<td>9.3</td>
<td>0.8</td>
<td>551.2</td>
<td>181.3</td>
</tr>
</tbody>
</table>

Region 1: north of I-80; Region 2: southwest IA; Region 3: southeast IA
n = 3 per type per region

- Mod. def: Moderate definition
- Mod. to high antagonism: Moderate to high antagonism
Biologically Critical Times for Trace Minerals

**Stress** increases urinary excretion of Cu, Zn
Weaning, transport/shipping, parasitism and lactation

**Reproduction** (conception and fetal development, including fetal liver mineral storage)

**Immune response** (vaccination titer response, neutrophil function, other mechanisms?)
Animal Needs

Stage of production
Other mineral levels
Age
Level of production
# Ewe Lambs vs Ewes

<table>
<thead>
<tr>
<th></th>
<th>Lambs</th>
<th>Ewes</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Lactation Ca</td>
<td>8.6g</td>
<td>12g</td>
</tr>
<tr>
<td>E. Lactation P</td>
<td>7.9g</td>
<td>11g</td>
</tr>
</tbody>
</table>

DGM:ISU:2016
Doing the math

Lactating ewes
4.5 lbs alfalfa hay and 2 lbs corn

4.5 X 0.24% P = 0.01 lb P

2.0 corn X 0.35% P = 0.007 lb P

0.017 lb P X 454 g/lb = 7.7g provided vs 11g req.
Meeting animal needs

Mineral Consumption
Salt driven
grain byproducts
molasses
Mineral Density
Se 10-90 PPM
controlled by FDA .69mg intake/d

DGM:ISU:2016
Mineral Sources

Feedstuffs

ex. alfalfa hay high calcium

Sheep Mineral contains

macro and micro minerals

10-12% calcium

6-10% phosphorous

10-35% salt

expensive $20-50 per bag
# Sheep Mineral, Kansas

## Guaranteed Analysis

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Percentage or PPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>7%</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>5%</td>
</tr>
<tr>
<td>Salt</td>
<td>45%</td>
</tr>
<tr>
<td>Sulfur</td>
<td>1%</td>
</tr>
<tr>
<td>Magnesium</td>
<td>1%</td>
</tr>
<tr>
<td>Zinc</td>
<td>150 PPM short</td>
</tr>
<tr>
<td>Iodine</td>
<td>125 PPM okay</td>
</tr>
<tr>
<td>Cobalt</td>
<td>150 PPM okay</td>
</tr>
<tr>
<td>Selenium</td>
<td>10 PPM super, super short</td>
</tr>
</tbody>
</table>

**Better mineral**
- Calcium not needed with legumes
- Phosphorous not needed with corn?
- High salt equals lower intake levels ++

DGM:ISU:2016

**Iowa State University**
University Extension
Mineral sources

**Trace mineral salt**
- 95-98% salt
- only micro minerals
- lower intake required
- lower cost
  - approx. half price w/ lower intake (mostly salt)
  - total cost of mineral supp. 25%

Water also may provide minerals

DGM:ISU:2016
Big Gain T.M. SALT w/ Selenium

T.M. Salt for sheep

GUARANTEED ANALYSIS

- Salt, min: 94.00%
- Salt, max: 95.00%
- Zinc, min: 0.60% (6000 PPM)
- Magnesium, min: 0.52% (5200 PPM)
- Manganese, min: 0.25% (2500 PPM)
- Iron, min: 0.25% (2500 PPM)
- Iodine, min: 0.01% (100 PPM - short)
- Cobalt, min: 0.003% (30 PPM)
- Selenium: 90 PPM (.009% - max.)

PPM = mg/kg
INGREDIENTS

Salt, Vegetable Oil, Calcium Sulfate, Magnesium Oxide, Zinc Oxide, Ferrous Sulfate, Manganese Sulfate, Sodium Selenite, Cobalt Carbonate, Ethylenediamine Dihydroiodide, Sodium Molybdate.
FEEDING DIRECTIONS

Feed BG Sheep Trace Mineral Salt on a free choice basis to sheep. **Do not** permit excessive consumption. Intake of supplement trace mineral salt mixture should not exceed 0.3 PPM on a complete ration basis, or 0.69 milligrams per head per day. An intake of $\frac{1}{4}$ oz. of this mineral per head daily will supply 0.63 milligrams.
What should You do?

Test forages

Macro minerals

Monitor mineral intake

put out set amounts, ex. Week’s supply

monitor how long it lasts
Selenium Deficiency

Reproductive failure
Embryonic mortality (wks 3-4)
White muscle disease
Poor suckling reflex
Indirectly hypothermia/ goiter
  Deiodinase enzyme
    I4 to I3 which is the biologically active form
    BAT activity
Reduced growth
Reduced disease resistance
BMP Selenium

Read mineral tag
Monitor mineral intake
Add to grain mix and force feed
Eliminates animal to animal variation

Needed year round

Pre-caution, some is good more may not be better.
Toxic at 2 ppm

High S decrease absorption (DDGS)
also heavy metals
Iodine

Lactation Ration = .8 ppm or mg/kg

Most mineral mixtures are short
needs to be 140 ppm mineral
with .5 oz intake

Solution free choice iodized salt in LG
Copper Toxicosis

Breed Susceptibility
Mineral interactions-Mo & Su,
along with high Zn & Ca
Normal copper, low molybdenum
Copper Toxicosis...continued

Prevention

Sheep specific feeds
No additional copper
Feed some Mo

CU & MO are both toxic

CU:MO ratio range 6-1 up to 10-1
Vitamins

**Fat Soluble**

A, night blindness, green feeds
D, rickets, sunshine
E, white muscle, immune issues
K, blood clotting, body synthesis

**B vitamins and C**

No concern with healthy rumen
C is synthesized by the sheep
Vitamins in mineral sources

Vitamins are inactivated during storage

Half life 14-21 days

Do not count on them to help.

EX. 10 IU E per pound of mineral

DGM:ISU:2016
Critical Nutrient, Vitamin E

White muscle disease
Interacts with Selenium
Oxidative stress and free radicals

Cellular level metabolism
Free radicals are a product of energy metabolism
Accumulation creates cell/muscle damage
ex. White muscle disease
Late gestation

Stressful which leads to reduced immunity

Cold stress

Milk fever

- inadequate calcium or too much other minerals
- cation-anion imbalance, see Dairy Nutritionist

occurs in late, late gestation mostly

Reduced immunity leads to more health issues,
(mastitis, respiratory, uterine infections)

Reallocation of nutrients
ISU Results - Serum E levels in ewes  
ISU, 900 IU injected weekly

<table>
<thead>
<tr>
<th></th>
<th>Con</th>
<th>E-G</th>
<th>E-L</th>
<th>E-GL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretreatment</td>
<td>1.27</td>
<td>1.26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-lambing</td>
<td>1.51&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.91&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-lambing&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.93&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.13&lt;sup&gt;b&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid-lactation</td>
<td>.97&lt;sup&gt;a&lt;/sup&gt;</td>
<td>.95&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.28&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.37&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Milk e at 3 days</td>
<td>10.8</td>
<td>15.1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a,b</sup> Row means with different superscripts differ (p<.05).

Base ration was excellent alfalfa hay and corn
## Results - Serum E lambs

<table>
<thead>
<tr>
<th>Age</th>
<th>Con</th>
<th>E-G</th>
<th>E-L</th>
<th>E-GL</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 days</td>
<td>1.08</td>
<td>1.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28 days</td>
<td>.41</td>
<td>.38</td>
<td>1.33</td>
<td>1.33</td>
</tr>
</tbody>
</table>
BMP Vitamin E

Feed ewes >100 IU/ hd/ d
  late gestation and lactation
Creep feed minimum 40K IU/ ton
  Up to 100K IU per ton
Do not count on E in mineral
  Concentration is way too low.
Grazing on green grass no problem

DGM:ISU:2016
What should You do?

Harvest kidney and liver from deads.
Sample forages
Trace minerals are around $35-50 per sample
Read mineral tags
Monitor mineral intake
Plain salt is not enough
Sheep have zero nutritional wisdom
Consult a nutritionist

DGM:ISU:2016
On farm vitamin fortification

50 ewes free choice mineral with .5 ounce intake

ADE premix 2 million A, .5 million D and 4000 E / lb

Vitamin E 20,000 iu/lb

Ewes need 3500 IU A and 150-300 IU E

DGM:ISU:2016
Mineral recipe

.5 oz X 50 head X 7 days / 16oz = 10.9 lbs
add
.7 pounds Kent ADE Premix (storage)
2.5 pounds Vitamin E (20K IU/lb)

Provides ewes 3800 IU A, 960 D and 138 E

Cost per week $3.00 or $3.00 per ewe per year

DGM:ISU:2016
Good Scales
Questions?