Supplementation Basics for Cow-Calf Operations

Jason Banta, Ph.D., PAS
Associate Professor and Extension Beef Cattle Specialist
Texas A&M AgriLife Extension Service
Texas A&M University
Overton, TX

Hay Feeding Scenarios

- cheap and easy
- easiest and least expensive
- frequent labor when needed, less expensive
- less consistent labor, more expensive

What 3 primary things affect supplementation of energy & protein?

- BCS
- forage & hay quality
- nutrient requirements

Performance Terminology

Growing Cattle: ADG  Cows: BCS

Areas to evaluate Body Condition

1. BACK  3. PINNIS  6. RIBS
2. TAIL HEAD  4. HOOKS  6. BRISKET
BCS of 9

<table>
<thead>
<tr>
<th>Not visible</th>
<th>Not visible</th>
<th>Not visible</th>
<th>Abundant fat</th>
<th>Abundant Fat</th>
<th>Full</th>
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<tbody>
<tr>
<td>Ribs</td>
<td>Spine</td>
<td>Hooks/Pins</td>
<td>Tailhead</td>
<td>Brisket</td>
<td>Muscling</td>
</tr>
</tbody>
</table>

% bred

**BCS Pattern: Spring Calving**

- Peak lactation
- Weaning

**Forage Quality and Forage Intake**

as forage quality declines forage intake decreases
- low quality forage = low intake
- high quality forage = higher intake

**Factors Affecting Forage Quality**

- maturity
- species
- temperature
- rained on hay
### Maturity

<table>
<thead>
<tr>
<th>Interval between cuttings</th>
<th>% TDN</th>
<th>Yield, tons/acre</th>
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<tbody>
<tr>
<td>3 weeks</td>
<td>65.2</td>
<td>7.9</td>
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<tr>
<td>4 weeks</td>
<td>61.9</td>
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<td>5 weeks</td>
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<td>6 weeks</td>
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<tr>
<td>8 weeks</td>
<td>54.1</td>
<td>10.2</td>
</tr>
<tr>
<td>12 weeks</td>
<td>51.0</td>
<td>10.4</td>
</tr>
</tbody>
</table>

- Coastal bermudagrass study in Georgia
- Glen Burton

### Species

**hybrid bermudagrass versus:**
- Tifton 85
- bahiagrass
- crabgrass
- johnsongrass
- native range
- winter annuals (i.e. ryegrass, rye, oats, etc.)

### Species

**cool season > warm season**

**annuals > perennials**

- winter annuals (i.e. ryegrass, rye, oats, etc.)
- crabgrass
- johnsongrass
- Tifton 85
- bahiagrass
- bermudagrass

### Time of year influences the quality of warm-season perennial grasses.

(Duble, 1970; pasture samples taken at Overton)

### Determining Forage Quality

- sample each cutting
- TDN (i.e. energy)
  - summative equations
  - NDF, ash, CP
  - NDF digestibility
crude protein
- cattle, horses, etc.

**Crude Protein**

approx. cost $50
Determining Forage Quality

**Pasture:**
- forage species
- growing conditions
- fecal consistency

Nutrient Requirements

<table>
<thead>
<tr>
<th>Cow Stage of Production*</th>
<th>CP, % of DM</th>
<th>TDN, % of DM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-yr-old lactating cow**</td>
<td>11</td>
<td>62</td>
</tr>
<tr>
<td>3-yr-old lactating cow**</td>
<td>11.5</td>
<td>63</td>
</tr>
<tr>
<td>Mature lactating cow**</td>
<td>11.5</td>
<td>63</td>
</tr>
</tbody>
</table>

*Estimated dietary requirements to maintain cow body condition for Brahman-influenced cows under typical production conditions (Beef Cattle NRC, 1996). These requirements will vary depending on numerous factors including animal weight, body condition, breed, environmental factors, and others.

**Requirements for lactating cows are at peak lactation.

Forage Testing Laboratories

**Dairy One Forage Lab**
Ithaca, NY; 800-344-2697
http://www.dairyone.com

- wet chemistry will always work
- NIR can be used if lab has forage specific database
but....what if the cows look like this?

<table>
<thead>
<tr>
<th>Components</th>
<th>As Fed</th>
<th>DM</th>
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</thead>
<tbody>
<tr>
<td>% Moisture</td>
<td>8.0</td>
<td></td>
</tr>
<tr>
<td>% Dry Matter</td>
<td>92.0</td>
<td></td>
</tr>
<tr>
<td>% Crude Protein</td>
<td>11.3</td>
<td>12.2</td>
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<tr>
<td>% Adjusted Crude Protein</td>
<td>11.3</td>
<td>12.2</td>
</tr>
<tr>
<td>% Acid Detergent Fiber</td>
<td>37.3</td>
<td>40.6</td>
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<tr>
<td>% Neutral Detergent Fiber</td>
<td>64.8</td>
<td>70.5</td>
</tr>
<tr>
<td>% NEC</td>
<td>11.6</td>
<td>12.6</td>
</tr>
<tr>
<td>% TDN</td>
<td>50</td>
<td>54</td>
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<tr>
<td>NEL, Mcal/Lb</td>
<td>.38</td>
<td>.41</td>
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<tr>
<td>NEM, Mcal/Lb</td>
<td>.42</td>
<td>.46</td>
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<tr>
<td>NEG, Mcal/Lb</td>
<td>.19</td>
<td>.21</td>
</tr>
</tbody>
</table>

Hay Feeding Scenarios

- cheap and easy
- easiest and least expensive
- less consistent labor, more expensive
- frequent labor when needed, less expensive
Easiest, Least Expensive

Frequent Labor When Needed, Less Expensive

When do we supplement?
for most beef cow-calf operations protein and/or energy supplementation is generally needed
- late summer when forage quality declines
- during the winter

What type of supplement is needed?
protein energy a combination of energy and protein
Prices quoted on: 9-9-15

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>$/50 lb</th>
<th>$/ton</th>
<th>% TDN, DMB</th>
<th>% CP, DMB</th>
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<tbody>
<tr>
<td>12% cube</td>
<td>$7.10</td>
<td>$284</td>
<td>81</td>
<td>13.6</td>
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<tr>
<td>20% cube</td>
<td>$7.80</td>
<td>$312</td>
<td>65</td>
<td>22.7</td>
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<tr>
<td>20% cube, breeder</td>
<td>$8.60</td>
<td>$344</td>
<td>77</td>
<td>22.7</td>
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<tr>
<td>38% cube</td>
<td>$10.60</td>
<td>$424</td>
<td>75</td>
<td>43.2</td>
</tr>
</tbody>
</table>

Energy Sources
- 12-14% cubes
- corn
- soybean hulls
- wheat midds
- rice bran
gradually increase levels in the diet

Energy and Protein Sources
- 20% cubes “breeder”
- 20% cubes
- corn gluten feed
- distillers grains
- winter pasture
- whole cottonseed (max. 25% of diet)
gradually increase levels in the diet

Protein Sources
- 40% cubes
- cottonseed meal
- soybean meal
- sunflower meal
- alfalfa hay
- winter pasture

Utilizing Cool-Season Annual Grasses (ryegrass, small grain-ryegrass mixtures)
Less Consistent Labor, More Expensive

20% cubes vs 20% tub

$10.60/50 lb sack
$424/ton

$98.95/225 lb tub
$880/ton

Generally, on all FS protein supplements one tub to 25 head will achieve a .5 to .75 of a pound per-head per-day consumption, which is all that cattle need.

Common floor stock formulations: 1 – 3 lbs of intake

Can Provide More Energy
Hay: 45% TDN, 5.0% CP

Dry cow
goal: maintain BCS
8 lbs of 20% cubes

Wet Cow
goal: control weight loss
11 lbs of 20% cubes

Hay: 50% TDN, 6.5% CP

Dry cow
goal: maintain BCS
4 lbs of 20% cubes

Wet Cow
goal: control weight loss
6 lbs of 40% cubes
**Hay: 55% TDN, 9.0% CP**

**Dry cow**
- goal: maintain BCS
  - hay only

**Wet Cow**
- goal: control weight loss
  - 2 lbs of 40% cubes

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**Monitor and adjust your supplementation program as performance dictates**

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**Pricing Supplements**

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**Need Protein**
- 20% CP cube (no NPN)
  - $10.30 per 50 lb sack
  - 10 lb CP per sack (50 x 0.20 = 10 lb of CP)
  - $1.03/lb of CP ($10.30 ÷ 10 = $1.03/lb)

- 38% CP cube
  - $13.55 per 50 lb sack
  - 19 lb CP per sack (50 x 0.38 = 19 lb of CP)
  - $0.71/lb of CP ($13.55 ÷ 19 = $0.71/lb)

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**Need Energy**
- 20% CP cube (high energy, 70% TDN, AFB)
  - $10.30 per sack
  - 35 lb of TDN per sack (50 x 0.70 = 35 lb)
  - $0.29/lb of TDN ($10.30 ÷ 35 = $0.294/lb)

- 38% CP cube (67% TDN, AFB)
  - $13.55 per 50 lb sack
  - 33.5 lb TDN per sack (50 x 0.67 = 33.5 lb)
  - $0.40/lb of TDN ($13.55 ÷ 33.5 = $0.404/lb)
**Supplementation Frequency**

**Protein Supplements**
- everyday
- 3 times/wk
- 2 times/wk
- 1 time/wk ??

**Energy Supplements**
- best to feed everyday
- if feeding small amounts, can feed every other day
- feeding at less frequent intervals can lead to big problems

Feeding 3 times a week reduced ADG by 10% compared with daily feeding (Loy et al., 2008)
- 3 supplements, 2 supplementation levels

**Additional Considerations**
- Subacute ruminal acidosis reduces sperm quality in beef bulls (Callaghan et al., 2016)
- Bulls were on free choice hay and 0.5% of BW concentrate for 125 days prior to challenge
- Challenged 1 day with rapidly fermentable CHO source
- Percent normal sperm reduced
- Percent normal sperm still lower at 88 days after challenge

**Disclaimers**
The information given herein is for educational purposes only.
Reference to trade name is made with the understanding that no discrimination is intended and no endorsement is implied by the Texas A&M AgriLife Extension Service.
Only a partial listing of available products and companies is included and no discrimination is intended by the omission of a product.

**Mineral Supplementation for Beef Cow-Calf Operations**

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Overton, TX
mineral nutrition impacts
- growth
- reproduction
- milk production
- health

PROFITABILITY

Components of a Complete Mineral Supplement

- salt
- macro minerals
- trace minerals (aka micro minerals)
- vitamins A, D, and E

Macro
- % of diet
  - calcium
  - phosphorus
  - potassium
  - magnesium
  - sodium
  - sulfur

Trace (micro)
- ppm or mg/kg
  - copper
  - zinc
  - manganese
  - selenium
  - iodine
  - cobalt
  - iron
  - others

Differences Between Companies

- formulation
- mineral source
- reputation
- palatability enhancers
- research programs
- targeted intake
- weatherization

Common Formulations

- higher-calcium, lower phosphorus
- similar Ca & P levels
- winter pasture (higher Mg)
3 basic formulas, common in Texas
• Texas All Season 7.5 Complete
• Texas All Season 12 Complete
• Hi-Magnesium Complete

Targeted Intake

2 or 4 oz.
- most are 4 oz.
- 2 oz. example: Moorman’s Range Minerals

target of 4 oz.
- average intake of 3 – 4 oz. would be acceptable

Se level
- 4 oz: commonly 25 - 27 mg

<table>
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<th>Emerald</th>
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<th>Gold</th>
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<tr>
<td>Vitamin D</td>
<td>-</td>
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<td>-</td>
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<tr>
<td>Vitamin E</td>
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<td>110</td>
<td>100</td>
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<table>
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<tr>
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<th>Texas All Season 7.5 Complete</th>
<th>Texas All Season 12 Complete</th>
<th>Hi-Magnesium Complete</th>
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<td>15</td>
<td>14</td>
<td>14</td>
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<tr>
<td>Phosphorus</td>
<td>7.5</td>
<td>12</td>
<td>4</td>
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<td>Salt</td>
<td>20</td>
<td>24</td>
<td>18</td>
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<td>10</td>
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<td>12</td>
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<td>Vitamin A</td>
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<td>75,000</td>
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<td>Vitamin D</td>
<td>15,000</td>
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<td>7,500</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>150</td>
<td>150</td>
<td>75</td>
</tr>
</tbody>
</table>

Additive Options
Additives researched
- IGR
- CTC
- bovatec
- rumensin

- bovatec is not labeled for cows

- Texas All Season 7.5 Complete
- Texas All Season 7.5 Complete AU5600
- Texas All Season 7.5 Complete ALT
- Texas All Season 7.5 Complete AU5600-ALT

Additives researched
- IGR
- CTC
- bovatec
- rumensin

not well researched or limited/no benefits
- there is a long list of these
- be cautious of claims
- be aware of selectively reporting research
- many would not justify the added cost

Geographic & Forage System Considerations

Native Range

dormant forages
- most mineral concentrations decrease with time especially P & K

protein and energy supplement can greatly impact the Ca:P ratio of the mineral needed

consider K level in protein and energy supplements

<table>
<thead>
<tr>
<th>product</th>
<th>intake, lbs</th>
<th>% P</th>
<th>gm P supplied</th>
</tr>
</thead>
<tbody>
<tr>
<td>15:4 mineral</td>
<td>0.25</td>
<td>4</td>
<td>4.5</td>
</tr>
<tr>
<td>12:9 mineral</td>
<td>0.25</td>
<td>9</td>
<td>10.2</td>
</tr>
<tr>
<td>12:9 mineral</td>
<td>0.125</td>
<td>9</td>
<td>5.1</td>
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<tr>
<td>cottonseed meal</td>
<td>2</td>
<td>1.1</td>
<td>10.0</td>
</tr>
<tr>
<td>DDGS</td>
<td>2</td>
<td>0.7</td>
<td>6.4</td>
</tr>
</tbody>
</table>
Native Range

Calcium content of the soil
- just because the soil is high in Ca or is sitting on a limestone base doesn’t mean the plant will take up more Ca

- bermudagrass average Ca: 0.43%
- native forages average Ca: 0.48%

Coastal Regions

mineral intake can be challenging
- try low salt formulations
- ADM AMPT-T Low Salt
- Purina Coastal Cattle Mineral
- molasses based mineral tub
- some work from Florida would suggest we could put the mineral supplement in a cube and feed 1 time per week

Winter Pasture

grass tetany concern for cows
- need consistent intake of Mg
  - 5% or greater Mg level
- salt is important for absorption of Mg

- milk fever and grass tetany may both be involved in some cows
  - want higher Ca, lower P level

Poultry Litter

- inverted Ca:P ratio in forage
- milk fever and grass tetany concerns
- may need P free mineral

Trace Mineral Considerations

- copper
- zinc
- manganese
- selenium
- iodine
- cobalt
**Cu, Zn, and Mn**

- **the copper race**
  - many products have way more copper than needed
  - a few are at levels that are concerning

- **desirable ratios**
  - 1:4 or 1:3 for Cu:Zn
  - 1:2 for Cu:Mn is probably sufficient

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**Copper**
- female: no effect
- male: probably no effect

**Zinc**
- female: very little data in cattle, but important in ovarian remodeling and CL production
- male: impacts testicular growth

**Manganese**
- female: possible estrous effect
- male: no claims

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**Selenium**

- **requirement**
  - 1.30 mg/d for 1250 lb cow

- **legal limit**
  - 3 mg/d
  - that is 2.31 times requirement

- Se has the smallest safety margin of any trace mineral; toxicity could be a concern if getting more Se from other sources

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**Iodine**

- **preferred forms**
  - calcium iodate
  - EDDI (organic form)

- **don’t want**
  - potassium or sodium iodide
  - less stable

- too much calcium iodate has been reported to reduce weight gain and feed intake

---

**Sources of Trace Minerals**

- **inorganic**
  - ionic bond
  - copper sulfate, zinc oxide, sodium selenite, etc.

- **organic**
  - covalent bond to carbon-containing ligand
  - mineral bonded to: amino acid, protein, or CHO
  - zinc methionine, copper amino acid complex, cobalt glucoheptonate, etc.

- **hydroxy**
  - covalent bond to a hydroxy (OH) group
  - zinc hydroxychloride, basic copper chloride, manganese hydroxychloride
inorganic vs. organic vs. hydroxy

research is inconsistent on animal growth, reproduction, and health

organic and hydroxy sources are likely safer for vitamins added to mineral supplements

availability of copper oxide is extremely low

Things to consider if you choose to feed a mineral with organic sources of trace minerals.

- What trace minerals are supplied by organic sources?
- How much of the trace mineral is supplied by an organic source?

How Much of the: Cu, Zn, Mn, & Co comes from an organic source?

INGREDIENTS
Molasses products, monocalcium phosphate, dicalcium phosphate, magnesium oxide, dehydrated seaweed meal, hydrolyzed vegetable oil, calcium carbonate, manganese oxide, manganese sulfate, manganese amino acid complex, zinc oxide, zinc sulfate, zinc amino acid complex, copper sulfate, copper chloride, copper amino acid complex, ethylenediamine dihydroiodide, calcium iodate, cobalt glucoheptonate, cobalt carbonate, sodium selenite, vitamin A acetate, vitamin D-3 supplement, vitamin E supplement, thiamine mononitrate, menadione sodium bisulfite complex, riboflavin supplement, calcium pantothenate, niacin supplement, vitamin B-12 supplement, choline chloride.
Thoughts
- most need separate source of salt
- most have a similar Ca:P ratio
- most have less Ca then loose supplements

<table>
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<tr>
<th></th>
<th>mineral-lyx</th>
<th>IGR max</th>
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<tbody>
<tr>
<td>Calcium</td>
<td>3.5 - 4.5</td>
<td>5 - 6</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>4</td>
<td>5</td>
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<tr>
<td>Salt</td>
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<td>none</td>
</tr>
<tr>
<td>Magnesium</td>
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<tr>
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<td>8.8</td>
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<tr>
<td>Iodine</td>
<td>25</td>
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<td>Vitamin A</td>
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<td>Vitamin D</td>
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</tr>
<tr>
<td>Vitamin E</td>
<td>100</td>
<td>200</td>
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</tbody>
</table>

recommended intake mineral-lyx: 4.8 to 12 oz.
IGR max: 4 oz.

<table>
<thead>
<tr>
<th></th>
<th>As 4 CP add Zn &amp; Cu</th>
<th>MAG Mineral Tub</th>
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</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>4.5</td>
<td>5.5</td>
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<tr>
<td>Phosphorus</td>
<td>4</td>
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<td>Selenium</td>
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<tr>
<td>Iodine</td>
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</tr>
<tr>
<td>Cobalt</td>
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recommended intake 4 to 8 oz.
need to put salt out with the “MAG” tub

<table>
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<tr>
<th></th>
<th>Big 6</th>
<th>Se-90</th>
<th>Iodised</th>
<th>Sulfur</th>
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<tr>
<td>Calcium</td>
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<td>Phosphorus</td>
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<tr>
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<td>96 - 99</td>
<td>95 - 98.5</td>
<td>97 - 99.7</td>
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<td>Magnesium</td>
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<tr>
<td>Potassium</td>
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<tr>
<td>Copper</td>
<td>260 - 380</td>
<td>280 - 420</td>
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<tr>
<td>Vitamin E</td>
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</table>
Things That Don’t Make Sense To Me

- having more P than Ca in the mineral
- not having any Ca in the mineral
- putting sodium bicarbonate in a mineral
- adding sulfur to the mineral
Mineral Feeders

Mineral Intake
what minerals do I need today?

• 2 or 4 oz. average consumption

• intake varies over time

• lactation may increase intake, 2 to 2.5x

Mineral Consumption by Cow Herd

[Graph showing mineral consumption over time with a peak of 3.6 ounce avg.]

3.6 ounce avg.

(Mason, 2005)

• if intake is to high
  - provide free choice salt
  - check location of mineral feeder
  - reduce amount of mineral fed

• if intake is low
  - determine if cattle are receiving salt from another source
  - check location of mineral feeder

• salt
  - initially encourages intake
  - as salt consumption increases mineral intake is reduce

• phosphorus
  - generally decreases intake

• magnesium
  - generally decreases intake
additives that stimulate intake
- molasses, yeast, other flavoring agents
- mineral oil and weatherization products

Calculating Mineral Intake
- 35 cows
- put 50 lbs of mineral in an empty feeder
- mineral lasts for 6 days
- $50 \text{ lbs} \div 6 \text{ days} = 8.33 \text{ lbs per day for the herd}$
- $8.33 \text{ lbs per day} \div 35 \text{ hd} = 0.24 \text{ lbs/hd/d}$
- $16 \text{ oz.} \times 0.24 \text{ lbs} = 3.8 \text{ oz./hd/d}$

Horn Fly Control: Feed Additives
Insect Growth Regulators (IGR)
methoprene (ex. Altosid)
- dosage $0.8$ – $1.5 \text{ mg/100 lbs}$
- $1300 \text{ cow: } 10.4$ – $19.5 \text{ mg/d}$

4 oz. intake
- $80 \text{ gm/ton} = 10 \text{ mg/d}$
- $120 \text{ gm/ton} = 15 \text{ mg/d}$
- $160 \text{ gm/ton} = 20 \text{ mg/d}$

When and What Do I Feed

Reputable Company with a Nutritionist on Staff
Consider Flexibility

**When should I feed a cow-calf mineral?**

- year round is best
  - last 3, first 3
  - provide salt at other times

**introduced pasture and hay**
- higher Ca, lower P

**winter pasture**
- higher Ca, lower P
- 5% or more Mg, make sure intake is good

**growing native range**
- higher Ca, lower P

**dormant native range (with protein/energy supplement that has some P)**
- higher Ca, lower P
- if possible get protein/energy supplement with added K

**dormant native range (no protein/energy supplement)**
- similar Ca & P levels
- make sure intake is adequate