

# Managing Macro and Micro Nutrients in Mineral



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# Outline

- Nutritional Management Goals
- Mineral Overview
- Minerals in the Diet
- Practical Mineral Feeding

# Nutritional Management Goals

- Cow-calf operations: produce pounds of weaned calf in an *efficient and economical* way
  - Meet the needs as closely as possible, rather than feeding in excess or having a deficiency
  - Growth and reproduction can be compromised without a good mineral program

# Minerals can be a complex topic...

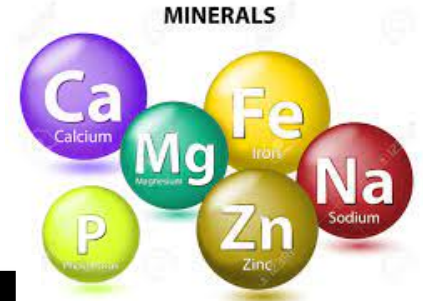
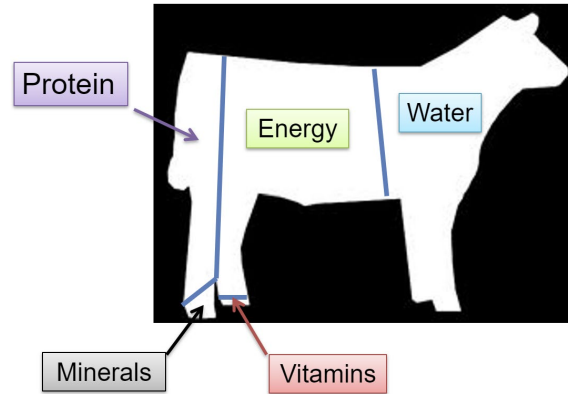
Mineral availability in pasture and hay forages fluctuates according to the **season, fertilizer application, weather conditions, forage species, and other factors.**

Cattle mineral requirements also fluctuate with **growth and stage of production.**



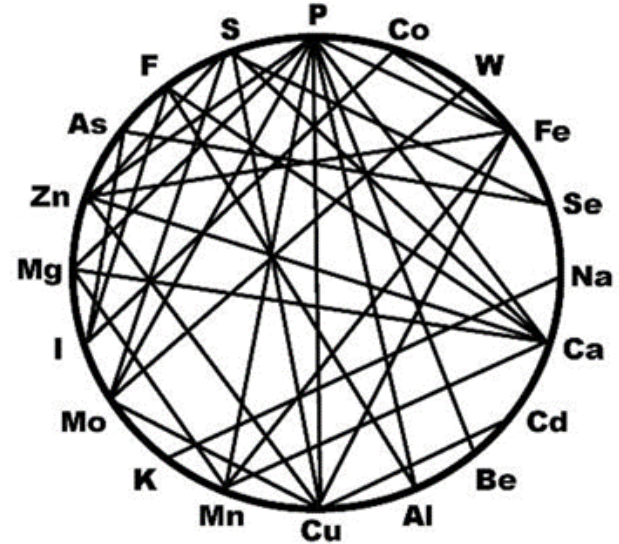
# What are Minerals?

- Naturally occurring, inorganic elements that are *essential* for proper animal function (bone development, immune function, muscle function, etc.)
- Cannot be synthesized by the body
- Make up 4% of total body weight of the animal



# Mineral Interactions

- Some minerals can “tie up” other minerals or make them unavailable for essential bodily functions
- Ca:P is a notable interaction



# Where do minerals come from in the diet?

Mineral	Most Significant Known Functions in Body	Source
<b>Macro Minerals (required in larger amounts)</b>		
Calcium	Bone & teeth formation, nerve & muscle function	Forages
Phosphorus	Reproduction, health of bones and teeth	Grains
Magnesium	Growth, reproduction, metabolic functions	Mineral supplement
Potassium	Metabolic functions	Forages
Sulfur	Metabolic functions, amino acid formation in rumen	Forages & grains
<b>Micro Minerals (required in smaller amounts)</b>		
Chromium	Immune response, glucose tolerance factor	Cereal grains
Cobalt	Component of Vitamin B12	Legumes
Copper	Hemoglobin formation, tissue metabolism	Forages & grains
Iodine	Production of thyroid hormones, energy metabolism	Forages
Manganese	Reproduction enzyme formation	Forages
Molybdenum	Enzyme activity	Forages
Selenium	Antioxidant, glutathione peroxidase	Grains & forages
Zinc	Enzyme activity	Legumes



# Macro vs. Micro

## Macrominerals

- Minerals required in larger amounts in the body (greater than 100 milligrams)
- Represented as a percentage of the diet

## Microminerals (Trace)

- Minerals required in smaller amounts in the body (less than 100 milligrams)
- Represented in parts per million or mg/kg



## Macrominerals

- Calcium (Ca)
- Phosphorus (P)
- Potassium (K)
- Sodium (Na)
- Magnesium (Mg)
- Sulfur (S)
- Chlorine (Cl)

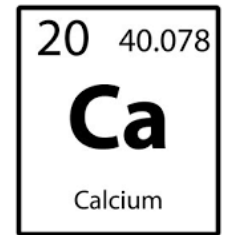
## Microminerals

- Copper (Cu)
- Iron (Fe)
- Manganese (Mn)
- Zinc (Zn)
- Cobalt (Co)
- Iodine (I)
- Selenium (Se)

# MACROMINERALS

# Calcium

- Most abundant mineral in the body
  - around 2% of total body weight
- 99% found in bones and teeth
- Multiple functions in body:
  - Bone formation, blood clotting, nerve transmission, muscle contraction, etc.
- Legumes > grasses > grain-based feeds



# Calcium (cont.)

## Calcium Deficiency

- Rickets – failure of bone mineralization in growing animals
- Osteomalacia – bone “softening” in adult animals
- Osteoporosis – loss of bone mineral
- Hypocalcemia or “milk fever” – sudden decrease in calcium serum in post-partum animals

## Calcium Toxicity

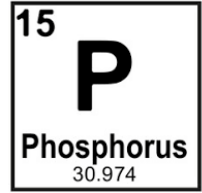
- Osteopetrosis or “marble bone disease” – overly dense bones that are susceptible to fracture
- Hypercalcemia – increase in calcium serum

# Calcium Sources

- Calcium carbonate, feed-grade limestone, dicalcium phosphate, defluorinated phosphate, monocalcium phosphate, and calcium sulfate

Feed-grade limestone	34% Ca
Dicalcium phosphate	22% Ca and 19.3% P

# Phosphorus



- 2<sup>nd</sup> most prevalent mineral in the body
- 80% found in bones and teeth
- Functions in the body:
  - Bone formation, muscle contraction, energy transformation, pH balance in blood, component of organic compounds and enzymes
- Excessive intake = increased output = environmental concern
- Cereal grains & oilseed meals > forages

# Phosphorus (cont.)

## Phosphorus Deficiency

- Similar to calcium
- Rickets, osteomalacia, osteoporosis
- Decreased fertility in cattle
- Slow growth
- Reduced feed intake
- Pica

## Phosphorus Toxicity

- Laxative effects – increased fecal loss of nutrients
- Lameness
- Increased risk of long bone fracture



# Ca:P Ratio

- Calcium concentration affects P absorption, bone growth, and mineralization
- 1:1 to 1.6:1 is ideal, and 1:1 to 4:1 is acceptable
- May be as high as 2:1 with some forages

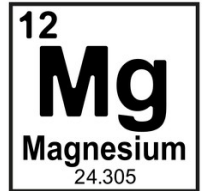
# Salt: Sodium and Chlorine

- Required for proper function of the nervous and muscular system
- Regulate pH and water retention
- There is little storage of these minerals in the body – provide daily
- Rule of thumb: cattle consume 0.005 to 0.01% of body weight in salt daily
  - E.g. 1200 lb cow would eat 1 to 1.9 oz per day

# Magnesium

- Bone: 65% of total body magnesium
- Functions in the body:
  - Enzyme cofactor, bone formation, muscle contraction
- Toxicity: Diarrhea, neuromuscular irritability, anesthetic properties

Muscle function is impaired when there is an excess or not enough Mg



# Grass Tetany



- Metabolic disorder as a result of low blood magnesium levels
- Caused by low Mg in diet, nutrient imbalances, and high levels of milk production
- Symptoms: excitability, muscular incoordination, grazing away from the herd, irritability, staggering, thrown-back head; death can result quickly

# Grass Tetany (cont.)

- Prevalent in spring when cool-season forages are rapidly growing and especially in animals in early lactation
- Older animals cannot mobilize Mg from bones as well as younger animals
- Focus on **prevention**

# FAQ: Should I feed hi-mag mineral?

- Regular mineral: 1 – 4% Mg
- Hi-mag: 12 – 14%
- Most common in min-Feb through mid-Apr
- Mg is not stored in the body so cattle must meet their intake requirements *daily*
- Mg intake at about 0.6 oz. per day
- **Magnesium oxide or sulfate**, not magnesite or dolomitic limestone
- Loose mixtures are preferred where there is high-risk for grass tetany

# Potassium

- Acid-base balance and water retention
- Grasses typically provide adequate amount
- Soluble – may leach out of stockpiled forage or rained-on hay



# Sulfur

- Part of essential amino acids → protein
- More likely to be in excess than deficient
- Can interfere with copper metabolism resulting in Cu deficiency
- Some by-products like distillers and corn gluten feed contain high sulfur concentrations and should be accounted for in rations

# MICROMINERALS

# Microminerals that are rarely deficient

- Cobalt – component of B-12 synthesized by rumen microbes
- Iodine – function of thyroid hormones
- Iron – formation of hemoglobin; iron oxide provides color, but is unavailable to the animal
- Manganese – reproduction, fetal and udder development

# Copper

- Most common deficiency in grazing cattle
- Deficiency signs include reduced fertility, depressed immunity, and reduced pigmentation of hair
- Most deficiencies caused by consumption of antagonists
- Should be supplemented as **copper sulfate**



# Selenium

- Deficiency causes white muscle disease in calves
- Very toxic and should only be used in a premixed form
- FDA regulation – should not exceed 0.3 ppm of total DM of diet

# Zinc

- Important for immunity, male reproduction, hoof and skin health
- Limited ability to store in the body
- Zinc absorption closely tied to Cu absorption – keep Zn:Cu ratio close to 3:1

# MINERALS IN THE DIET



# Mineral Form

- Sulfates are better than oxides
  - Copper and Zinc
- Oxides are okay
  - Magnesium
- Chelated or organic minerals
  - Usually more expensive
  - More available mineral
  - Beneficial for high producing cattle: seedstock, bull development, heavy milkers, newly received stocker calves

**Bioavailability:** The degree to which a mineral becomes available to the target tissue after administration

# FAQ: If I provide minerals separately, will the cows eat what they need?

- No – salt is needed to encourage consumption
- Other minerals are bitter, metallic, and unpalatable
- 15 – 25% of the mix is usually salt

# Selecting a Supplement

- Important points to consider
  - Ca:P ratio (2:1 – 4:1)
  - Salt level (15 – 25%)
  - Bioavailability, especially Cu
  - Level of trace minerals
  - Additives: ionophores, fly control, antibiotics

## Read the Label

Ensure adequate intake and intended use, especially in medicated products

## Example Mineral for Beef Cows on Fescue

Element	Intake/head/day	
	2 oz.	4 oz.
Ca	10 to 20%	5 to 10%
P	7 to 10%	3.5 to 5%
Mg	2%	1%
S	1%	0.5%
Mn	0.1% (1000 ppm)	0.05% (500 ppm)
Fe	0.1% (1000 ppm)	0.05% (500 ppm)
Cu	0.18% (1800 ppm)	0.09% (900 ppm)
Zn	0.5% (5000 ppm)	0.25% (2500 ppm)
Co	0.002% (20 ppm)	0.001% (10 ppm)
I	0.004% (40 ppm)	0.002% (20 ppm)
Se	0.0044% (44 ppm)	0.0022% (22 ppm)

# Considerations for Grain-based Diets

- Usually contain low Ca, so look for 25% Ca
- Supplemental salt at 1 to 1.9 oz per day
- Trace mineral salt at 0.5% of diet
- Selenium to maintain total diet concentration of 0.1 ppm
- Phosphorus supplementation rarely required

# PRACTICAL MINERAL FEEDING

# Practical Mineral Feeding

- One mineral feeder for every 30 to 50 cows
- Monitor feeders, make sure they are always full
- Wood, plastic, or fiberglass
- Place near water, loafing areas, or grazing areas to encourage cattle to go to the feeder



# Practical Mineral Feeding

- Commonly formulated for cattle to eat 2 – 4 oz per head per day
- Free-choice, blocks, and tubs (intake can vary)
- A good mineral program should cost \$10 - \$20 per cow per year



# Take Home Message

**Buy a complete mineral that fits your situation and  
keep it out at all times**

# Questions?

## Contact Information:

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