Importance of Minerals

- Skeletal development
- Constituents of fat and protein that make up muscles
- Enzyme systems
- Maintaining osmotic pressure
Minerals most likely to be deficient in livestock rations

- Calcium
- Magnesium
- Sodium
- Phosphorous
Calcium - Ca

Interactions

- Ratio with P should be 1-2:1 of Ca:P
- Also related to Vitamin D because of absorption
- Excess Mg decreases absorption
Calcium Deficiency Symptoms

- **Rickets**
  - In young animals
  - Crooked legs
  - Enlarged joints

- **Osteoporosis**
  - In older animals
  - Brittle, weak bones

Photo courtesy of Irlbeck (CSU)
Calcium Deficiency Symptoms

- Thin shelled eggs
- Milk Fever in dairy cattle

Photo courtesy of Irlbeck (CSU)
Milk Fever Symptoms

- Hypocalcemia
  - Low blood calcium
- Very prevalent just prior to calving
- Loss of appetite
- Nervousness
- Loss of consciousness and collapse
- Head turned toward flank
Phosphorous - P

- More common in grazing species
  - Legumes are high in Ca and low in P
- Rocky Mt region is deficient in P
- Mineral most likely to be deficient in beef cattle (other than salt)
Phosphorous Interactions

- Should be in a 1:1 to 2:1 ratio with Calcium
- Excess Ca or Mg decreases absorption
Phosphorous Deficiencies

- Rickets
- Osteomalacia

Photo courtesy of Irlbeck (CSU)
Phosphorous Deficiencies

- **Pica**
  - Chewing bones, rocks, boards
- **Decreased reproduction and growth**
  - Can be severe

Photo courtesy of Irlbeck (CSU)
Phosphorous Toxicity

- Urinary calculi in male ruminants
  - “kidney stones”
  - Hard masses that can grow from crystals forming within the kidneys
NAACL - Salt

- Most widely fed mineral
- Requirements vary with specie
  - Swine .25 - .5 % of diet
  - Cattle - 20 pounds per year
  - Sheep
    - Lambs .5 pound per month
    - Ewes 1 pound per month
  - Horses lose 30 grains of salt for every pound of perspiration
NACL Deficiency Symptoms

- Craving for salt
- Emaciation, listlessness and general poor performance
NAACL Toxicity

- Occurs in non ruminants
  - If NA level above 8%

- Problems in poultry and swine
  - Usually related to high levels of alkali salts in water

- Symptoms
  - Staggering gait, blindness
Magnesium - Mg

**Interactions**

- Excess upsets Ca and P metabolism
- Reduces potassium retention
- Toxicity of Mg not likely
Magnesium Deficiency

Grass Tetany
Interactions

- Excess reduces Mg absorption
  - Mg deficiency reduces K retention that leads to K deficiency
Potassium Deficiency

- Forages have high concentrations of potassium
  - Therefore only a concern when high levels of grain being fed
- Lethargic condition with high incidence of coma and death
Supplemental S may be necessary when non-protein nitrogen sources are being utilized in high grain feedlot diets
Iron - Fe

**Interactions**

- Ca-P ratio influences absorption
- Copper required for proper metabolism
Iron Deficiency

- Always deficient in young pigs
  - Low body reserves of Fe
  - Milk is low in Fe
  - Anemia results
    - Insufficient hemoglobin in blood so animals can’t carry required amount of oxygen to body tissues
  - Always give baby pigs iron shot
Iron Toxicity

- Can build up over time if feeding rock phosphates or near processing mill

- Symptoms
  - Enlarged soft bones
  - Teeth that wear off rapidly
  - Difficulty walking
Copper - Cu

- **Interactions**
  - May be deficient because of excess amount of Mo or Sulfate
  - Required for Fe metabolism

Ghost eye calf caused by high Mo
Copper Deficiency

- Depigmentation of hair
  - Lighter than normal
- Loss of wool

Photo courtesy of Irlbeck (CSU)
Copper Deficiency

- Partial paralysis of rear quarters
- Impaired breeding performance

Photo courtesy of Irlbeck (CSU)
Copper Deficiency

- Nervous symptoms
- Lameness
- Staggered gait

Photo courtesy of Irlbeck (CSU)
Copper Toxicity

- Primarily in young animals that consume mineral supplements for other species
  - Or wrong supplement
  - If feed cattle salt block to sheep; it is toxic b/c too much copper for sheep
- Levels above 250 ppm with same symptoms as deficiency
Copper Toxicity

Symptoms

- Affects liver and can cause red blood cells to be destroyed
- Can have high death rates
Zinc - Zn

Interactions

- Excess Zn interferes with Cu metabolism and may cause anemia
Zinc Deficiency

- **Symptoms**
  - Parakeratosis in swine
    - Dermatitis of itching, scaly skin lesions

Photo courtesy of Irlbeck (CSU)
Zinc Deficiency Symptoms Con’t

- Poor hair or feathering
- Slipping of wool

Photo courtesy of Irlbeek (CSU)
Manganese - Mn

- Interactions
  - Excess Ca and P decreases absorption of Mn and thus increase requirements
  - Cereal grains (corn) are low in Mn
Mn Deficiency

Chickens and poultry mainly

- Perosis
  - Enlarged hock joint and bird has trouble moving

Photo courtesy of Irlbeck (CSU)
Mn Deficiency

- Impaired reproduction
  - Testicular degeneration in males; defective ovulation in females
- Weakness and poor balance in swine

Photo courtesy of Irlbeck (CSU)
Iodine - I

Deficiency symptoms

- Goiter (enlargement of the thyroid gland)
- Stillbirths
  - Hairless pigs
  - Wool less lambs at birth
Cobalt - Co

Interactions

• Component of Vit B12
  – Needed by rumen bacteria for growth and synthesis of B12
Cobalt Deficiency

- Anemia
  - Paleness of visible mucous membranes
- Causes deficiency of Vitamin B12
  - Retarded growth and listlessness

Photo courtesy of Irlbeck (CSU)
Selenium - Se

- Essential element for in all livestock rations but in excess it is toxic
- Depends on soil types and plants grown in low Se soils
- Strong relationship with Vitamin E
Selenium Deficiency

- **White muscle disease**
  - Nutritional muscular dystrophy
  - White muscle because of increase Ca-P salt deposits
  - Very difficult for animal to contract their muscles
  - High death rates in young animals
Selenium Toxicity

- **Symptoms**
  - Elongated hooves
Se Toxicity Symptoms Con’t

- Loss of tail and mane hair in horses
- Sloughing of hoof
- Difficulty walking