

*Vitamin-Mineral Problems and their Diagnoses in Cattle*

Jeffery O. Hall, D.V.M, Ph.D., D.A.B.V.T.  
January 18, 2016

---

---

---

---

---

---

---

---

*Dairy-Vitamin/Minerals*

- Copper Excess (63%) Deficient (7%)
- Selenium Excess (69%) Deficient (6%)
- Manganese Low (40%)
- Zinc Low-deficient (26%)
- Vitamin E Deficiency
- Vitamin A Deficiency

---

---

---

---

---

---

---

---

*Beef-Vitamin/Minerals*

- Copper Deficiency (> 60 %)
- Selenium Deficiency (> 65 %)
- Vitamin E Deficiency
- Vitamin A Deficiency
- Rarer
  - Manganese (< 2%)
  - Zinc (2 - 10 %<sup>\*\*\*</sup>)
  - Cobalt (< 1%)

---

---

---

---

---

---

---

---

### *Dairy-Vitamin/Minerals*

- *Prior to 2008 saw RARE deficiencies except for low manganese*
- *Excesses in copper and selenium have been increasing in occurrence for 20 years*
- *After 2008, the numbers of deficiencies have been steadily increasing*

---

---

---

---

---

---

---

---

### *Vitamin/Mineral Deficiencies*

- *Why do we see more abnormalities?*
  - *Dairy-2008 - 2014 – Cost cutting*
  - *Dairy-Increased use of chelates*
  - *Dairy-Increased use of heifer raising facilities*
  - *Beef-Increased production*
  - *Beef-Altered Nature*
  - *Both -More common testing*

---

---

---

---

---

---

---

---

### *Copper Deficiency*

- *Deficiency in calves can cause*
  - *Poor Growth Rate*
  - *Poor Immune Function*
    - *Susceptible to various causes of diarrhea and pneumonia*
- *Calves should be born with higher body reserves than an adult*
- *Cows move copper to fetus during gestation*

---

---

---

---

---

---

---

---

## Copper Deficiency (cont.)

- Deficiency in a calf is caused by maternal deficiency
- Maternal deficiency due to inadequate intake or precipitated by high sulfur, iron, selenium, or molybdenum in the diet
- Maternal deficiencies associated with repeat breeders, poor conception rates, prolonged calving dates, non-breeders, poor immune function, poor hair coat color, and poor growth (hair coat color change)
- Sample of choice for testing is liver
  - Deficient Serum is accurate
  - Adequate serum is questionable

---

---

---

---

---

---

---

---

## Copper Excess

- Over-Supplementation
  - TMR does not allow for animal selection
  - Use of chelates at same content as inorganic
- Causes interference with iron, selenium, and zinc
- Can cause mild to severe functional liver changes

---

---

---

---

---

---

---

---

## Selenium Deficiency

- Deficiency in calves can cause:
  - Poor Growth Rate
  - Weak calves
  - Poor Immune Function
  - White Muscle Disease
  - Sudden Death

---

---

---

---

---

---

---

---

## Selenium Deficiency (cont.)

- Calves should be born with higher body reserves than an adult
- Cows move selenium to fetus during gestation
- Maternal deficiencies associated with repeat breeders, poor conception rates, prolonged calving dates, non-breeders, poor immune function and poor weight gain
- Maternal deficiency due to inadequate intake or precipitated by high sulfur, zinc, or iron
- Sample of choice is liver, serum, or whole blood
  - Serum is a good monitor of recent intake
  - Whole blood is a monitor of long term status

---

---

---

---

---

---

---

---

## Selenium Excess

- Over-Supplementation
  - TMR does not allow for animal selection
  - Use of chelates at same content as inorganic
- Causes interference with copper, iron, and zinc
- Can cause hoof growth abnormalities, lameness, and poorer reproductive performance

---

---

---

---

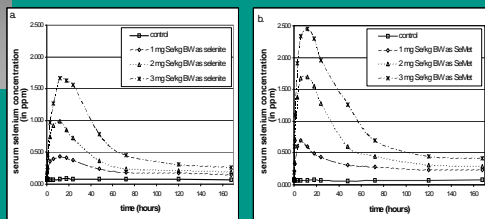
---

---

---

---

## Chemical Form of Supplements



---

---

---

---

---

---

---

---

### Vitamin E Deficiency

- Deficiency in calved can cause:
  - Poor Growth Rate
  - Weak calves
  - Poor Immune Function
  - White Muscle Disease
  - Sudden Death

---

---

---

---

---

---

---

---

### Vitamin E Deficiency (cont.)

- Vitamin E is a fat soluble vitamin that requires intake of green vegetation
- Drought conditions result in less accumulation of Vitamin E to sustain the cow through the winter and gestation
- Liver or serum are adequate for testing

---

---

---

---

---

---

---

---

### Vitamin A Deficiency

- Deficiency in calved can cause:
  - Poor Growth Rate
  - Weak calves
  - Poor Immune Function
  - Poor digestive tract integrity
  - High susceptibility to diarrhea
  - Deaths

---

---

---

---

---

---

---

---

### *Vitamin A Deficiency (cont.)*

- *Vitamin A is a fat soluble vitamin that requires intake of green vegetation*
- *Drought conditions result in less accumulation of Vitamin A to sustain the cow through the winter and gestation*
- *Liver or serum are adequate for testing*

---

---

---

---

---

---

---

---

### *Manganese Deficiency*

- *Rare in beef cows – more common in dairy*
- *Manganese necessary for bone and joint development and reproductive functions*
- *Deficiency associated with cystic ovaries, repeat breeding, and weak calves*

---

---

---

---

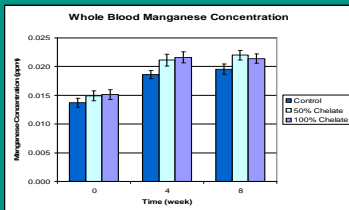
---

---

---

---

### *Supplement Type can make Differences*



---

---

---

---

---

---

---

---

### Effects on Immunity

- *Copper, Selenium, zinc, and Vitamin E are required for normal immunity*
- *With deficiencies*
  - *Direct immune compromise*
  - *Indirect immune compromise*
    - *Poor response to vaccinations (cow)*
    - *Poor colostrum*
- *Excess selenium (copper??) can harm immune function*

---

---

---

---

---

---

---

---

### Timing Supplementation

- *Vaccine Timing*
  - *Not wise to vaccinate when animals are in poor condition for vitamin/mineral balance*
- *Optimization of Calf Health*
- *Optimization of Reproductive Efficiency*

---

---

---

---

---

---

---

---

### Mineral Testing

- *Contact you state diagnostic laboratory to discuss capability.*
- *Biopsy samples should be frozen if not tested quickly*
  - *Refrigerate whole blood or serum*

---

---

---

---

---

---

---

---

## Vitamin A and E Testing

- Contact you state diagnostic laboratory to discuss capability.
- Samples should be frozen (serum and liver) if not tested quickly
  - Protect from sunlight

---

---

---

---

---

---

---

---

## Herd Testing

- Serum
  - Groups of samples required
  - 5-10 samples per group of similarly treated animals (dependent on group size)
  - Copper – questionable
  - Hemolysis can increase iron, potassium, zinc, magnesium, with lesser increases for selenium, manganese, etc.
- Liver
  - Saved samples from “normal animals”
  - Liver Biopsies

---

---

---

---

---

---

---

---

## Play with the numbers

- Serum:
  - Copper-0.75 ppm; selenium-0.13 ppm; manganese-0.004 ppm; zinc-2.35 ppm
- Liver:
  - Copper-43 ppm; selenium-0.38 ppm; manganese-1.08 ppm; zinc-186 ppm

---

---

---

---

---

---

---

---



## *Play with the numbers-2*

### ■ Serum:

- Copper-0.85 ppm; selenium-0.185 ppm; manganese-0.004 ppm; zinc-0.65 ppm

### ■ Liver:

- Copper-283 ppm; selenium-0.97 ppm; manganese-1.76 ppm; zinc-22 ppm

---

---

---

---

---

---

---

---

## ■ Questions

---

---

---

---

---

---

---

---