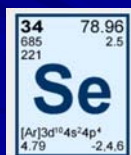


Selenium Nutrition of Grazing Beef Cattle in Florida

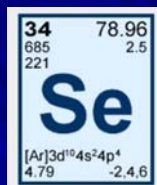
John Arthington, Professor and Center Director
 Juliana Ranches, PhD Student
 University of Florida / IFAS
 Range Cattle Research and Education Center, Ona



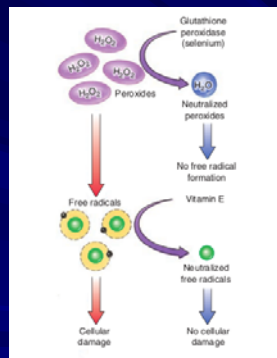
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Overview

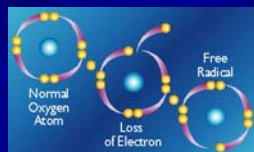
- Introduction
- Selenium functions
- Requirements & Toxicity
- Deficiency
 - Cow/Calf
 - Stocker/Feeder
- Florida selenium situation
- Supplementation systems



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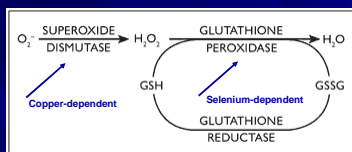


Selenium also cooperates with vitamin E to reduce **oxygen radicals** and protect against cell damage



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Cooperative Antioxidant Functions Copper and Selenium



Why are they important;

1. The two most limiting trace mineral in most forages and feedstuffs.
2. Both are strongly antagonized by sulfur.

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Selenium Requirements

- The Beef Cattle NRC (8th Rev, 2016 Update) suggests a requirement of 0.10 mg/kg.
- This requirement doesn't consider the influence of source.
- This requirement doesn't consider the influence of antagonists, such as sulfur.
- However, there is little evidence that dietary concentrations less than 0.10 mg/kg result in deficiency.

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Selenium Requirements

- The FDA regulates the addition of selenium to beef cattle diets;
 - 3 mg/head daily for supplements
 - 0.30 mg/kg of finished diets
- The selenium content of free-choice mineral supplements are regulated by the targeted intake.
 - 4.00 oz/head daily = maximum of 27 ppm Se
 - 1.75 oz/head daily = maximum of 60 ppm Se

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Selenium Toxicity

- Selenium is the most toxic of all essential minerals.
- Toxicity generally occurs from the careless or accidental formulation or supplementation.
- Some areas of the US are recognized as "seleniferous". Certain plants in these areas have evolved to accumulate selenium – called accumulators or converters.
- Toxicity can be both acute (accidental supplementation) or chronic (consumption of high-selenium forages).

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Cow/Calf Production

The physiological functions most impacted by selenium in cow/calf production systems, include;

- Cows: Retained placentas = lengthened anestrus period
- Weak calves = white muscle disease
- Impaired immunity = reduced vaccination response

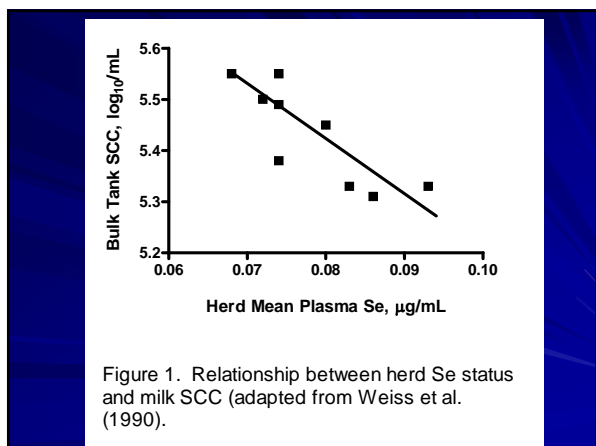
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White Muscle Disease

White Muscle Disease or Weak Calf Syndrome



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Liver trace mineral concentrations (m/kg DM)

Item	Se	Cu	Mn	Mo	Zn
Average	0.67	158	10.8	3.4	140
Deficient	< 0.50	< 75	< 8	-----	< 125
Prevalence	5 of 11	3 of 14	0 of 14	-----	0 of 14

Survey of 14 commercial cowherds in Florida (2014)

35% of surveyed cow/calf operations in the Southeast were Se deficient; Dargatz and Ross, 1996

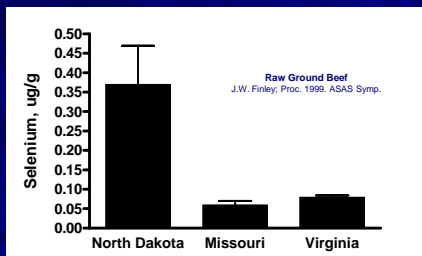
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United States Soil Selenium Concentrations

Check the soil selenium content of you county at:
<http://mrddata.usgs.gov/geochem/doc/averages/se/usa.htm>

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Effect of soil selenium distribution on selenium content of harvested beef



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Effect of soil selenium distribution on selenium content of harvested beef

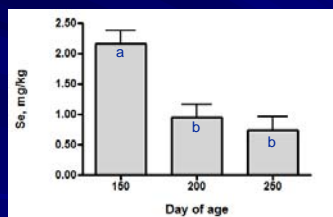
Tissue Se concentrations (mg/kg) from beef steers at slaughter¹

Tissue	High-Se Region	Low-Se Region
Sirloin	1.19 ± 0.05	0.40 ± 0.05
Liver	0.97 ± 0.14	0.89 ± 0.15

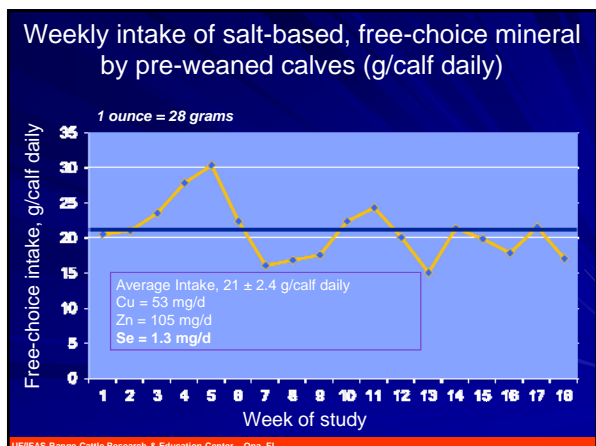
¹Steers were obtained from high- and low-Se regions of South and North Dakota, transferred to a feedlot and fed a common Se-adequate diet for 105 d. Initial muscle Se concentrations were 2.10 and 0.40 (± 0.10) for high- and low-Se regions, respectively.

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Decline in pre-weaned calf selenium status



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Selenium status of pre-weaned beef calves

1. Milk and forage are poor sources of selenium.
2. Calves often do not consume enough free-choice salt-based mineral to satisfy their selenium requirement.
3. Focus on selenium status of gestating cows to ensure adequate selenium stores in the calf until they begin consuming adequate amounts through supplements.

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Impact of supplement-derived dietary sulfur on selenium status of growing steers

- Previous research has shown that dietary sulfur may be responsible for altering selenium metabolism in ruminants:
 - Ivancic and Weiss, 2001 Dairy cows
 - Hintz and Hogue, 1964 Sheep
 - van Ryssen et al., 1998 Sheep
- Molasses feeding model
 - Does selenium react similarly to copper in our molasses feeding model?
 - What sources of selenium are available for use in these natural antagonism models?

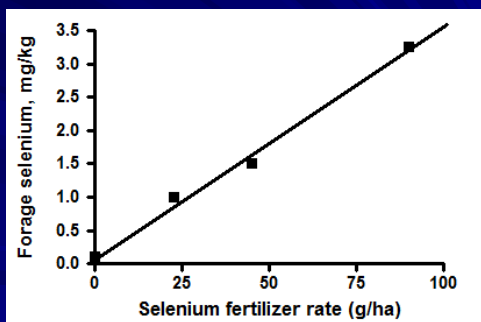
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Selenium biofortification

- Certain regions of the World have endemic selenium deficiency among people. Because cereal grains and meat are the primary source of dietary selenium, certain measure have been taken to fortify these food sources.
- In Finland, the addition of selenium to NPK fertilizers have increased the selenium content of cereal grains by 15X. As a result, meat and meat products have increased 2 to 6X since the implementation of biofortification.

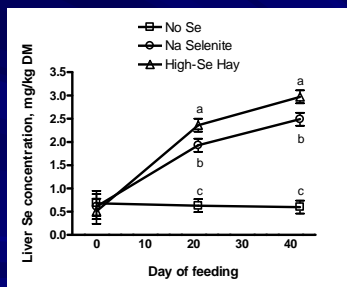
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Pasture fertilization with selenium (alfalfa hay)



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Feeding high-selenium hay to growing beef calves

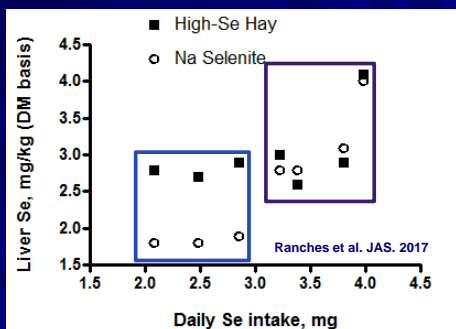


Weaned beef calves were pair-fed high-Selenium hay or Na selenite (or no selenium control) over a 42-day period.

Ranches et al. JAS. 2017

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Feeding high-selenium hay to growing beef calves



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Limit Creep Feeding

Increase calf mineral status prior to weaning

- Limit-fed, trace mineral-fortified creep feed prior to weaning.
 - Exposes calves to
 - Supplemental mineral
 - concentrated feed
 - human x feed interaction



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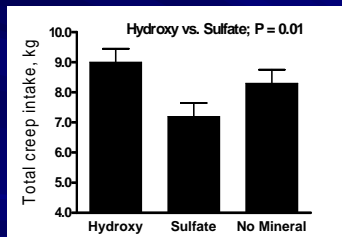
Limit Creep Feeding

- Two year study, 3 treatments;
 - No mineral
 - Hydroxychloride sources of Cu, Zn, and Mn
 - Sulfate sources of Cu, Zn, and Mn
- Offered in cow exclusion areas 3X weekly;
 - Maximum limited to 0.25 lb/d
 - Offered for 84 d prior to weaning

Caramalac et al. JAS. 2017

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Voluntary intake of mineral-fortified limit-fed creep feed



Hydroxy vs. Sulfate
26% increase in intake

Source	lb/d
Hydroxy	0.24
Sulfate	0.19
No Min.	0.22

Caramalac et al. JAS. 2017

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Limit Creep Feeding (calf mineral status)

Liver mineral concentration, mg/kg DM basis

Element	Mineral	No Mineral	SEM	P =
Co	0.23	0.09	0.032	0.003
Cu	186	129	35.7	0.07
Se	0.57	0.25	0.075	0.003

Caramalac et al. JAS. 2017


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Problem ??

Hand Feeding Creep



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Low Moisture Molasses Blocks

*Collaboration with Jim Drouillard
Kansas State University*

- Eliminates daily hand feedings
- Resistent to rain/weather
- Self limits intake to < 1.0 lb/d
- Delivers functional nutrients

Low-moisture, molasses blocks



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Limit Creep

mineral-fortified, low-moisture blocks

Access to blocks in cow excluded areas for 84 d prior to weaning

Item	Mineral	No Mineral	P =
Block intake, lb/d	0.60	0.86	0.05
Calf ADG, lb/d	1.44	1.45	0.97

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Limit Creep

mineral-fortified, low-moisture blocks

Mineral status measured at weaning (mg/kg DM)

Item	Mineral	No Mineral	P =
Selenium	1.19	0.49	0.001
Copper	169	86	<0.001
Zinc	146	127	0.020
Manganese	7.8	6.1	0.010

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Summary - Selenium

- As an essential trace element, selenium can be both deficient and toxic.
 - Likely one of the most impactful trace mineral deficiencies influencing cow/calf production and feeder calf health.
 - Regulated by FDA. Toxicity is typically due to formulation, production, or supplementation errors.
- Selenium impacts beef cattle health & performance through its function as an antioxidant.

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Summary - Selenium

- Cow/calf production is most impacted by;
 - Calf vigor
 - Anestrous interval
 - Response to vaccination
- Weaned calves in Florida (southeast) are commonly selenium deficient
 - Low selenium content in milk and forage
 - Inadequate free-choice mineral intake

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Summary - Selenium

- Forage selenium biofortification is effective to increase calf selenium status, but commercial products are lacking in availability.
- Limit creep feeding is effective in increasing calf selenium status at weaning, but;
 - Special consideration to formulation is essential
 - Hand-feeding is labor consuming
 - Difficult to realize ROI
- Current studies are revealing benefits of self-limited creep supplements

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Thank you for your attention

John D. Arthington
Professor and Center Director
Range Cattle Research and Education Center
University of Florida
(863) 735-1314; jarth@ufl.edu



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