# Vitamin Nutrition: What do your cattle need?

ANIMAL NUTRITION AND HEALTH

- ESSENTIAL PRODUCTS
- PERFORMANCE SOLUTIONS + BIOMIN®
- PRECISION SERVICES

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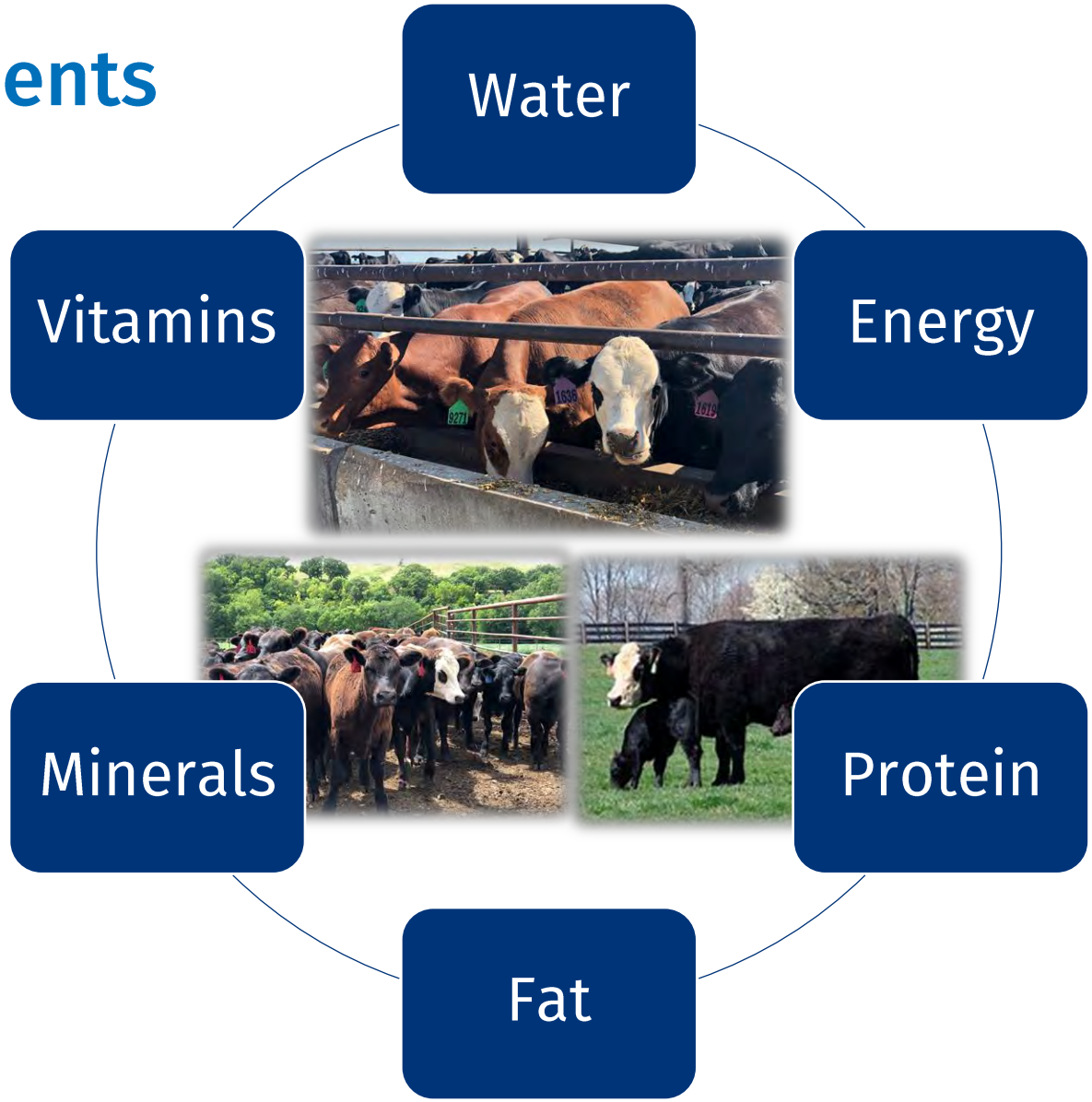
NBCA Learning Lounge
February 1, 2022

DSM
BRIGHT SCIENCE. BRIGHTER LIVING.

# Outline

- Introduction
- Basic nutrition
- Vitamins in cattle diets
  - Form and Function
  - Factors influencing vitamin levels in feed
- Optimum Vitamin Nutrition (OVN)
- Recommendations

# Essential Nutrients



# Essential Nutrients

**Water**
- Quality
- Availability

**Vitamins**
- Vit A, D, E, …
- Concentration
- Bioavailability
- Stability

**Energy**
- Complex carbohydrates
  - Roughages
  - Concentrates

**Minerals**
- Inorganic
- Hydroxy
- Organic

**Protein**
- Amino acids
- Protein solubility

**Fat**
- Omega 6: Omega 3
- Essential fatty acids

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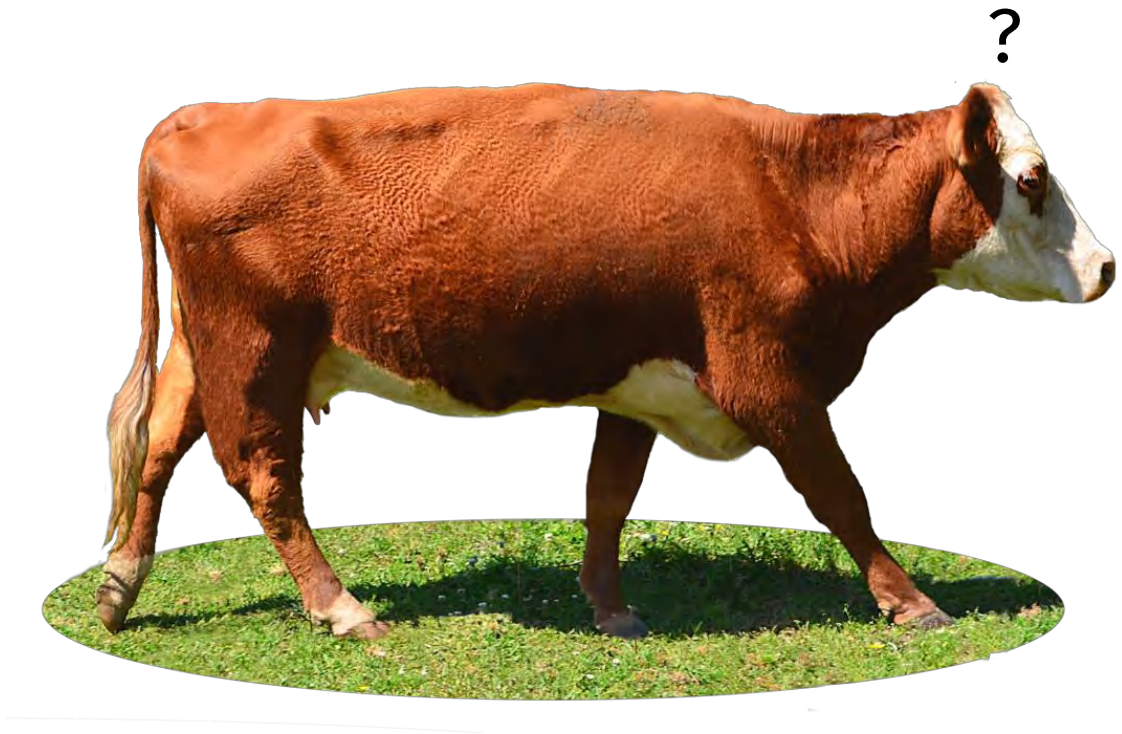
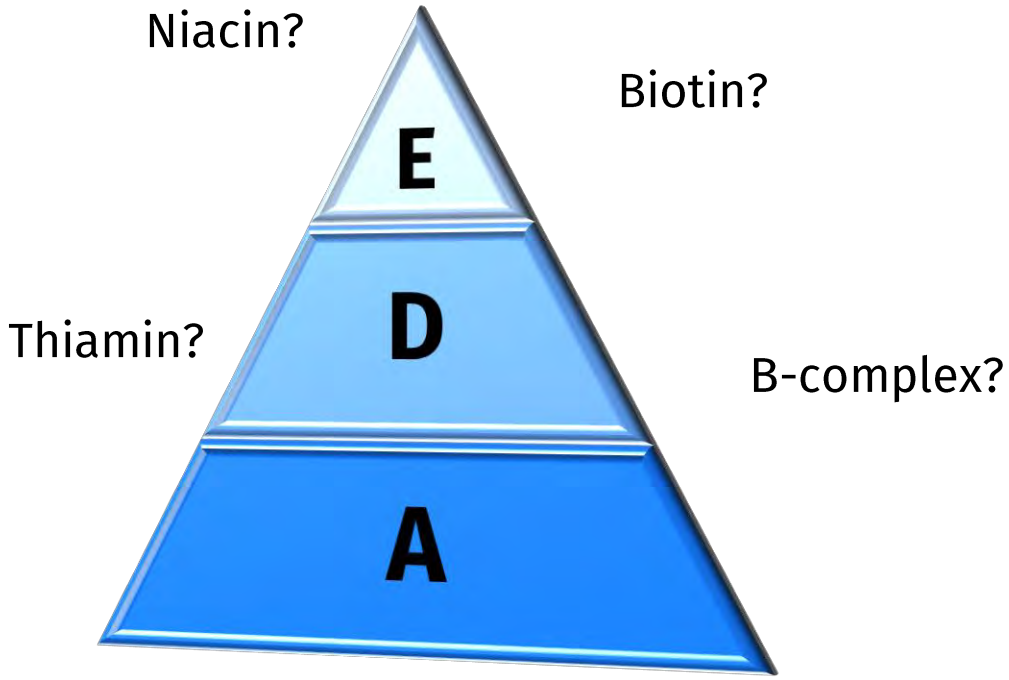
# What vitamins do your cattle need?



# Factors affecting vitamin needs

- Stage of production
- Diet
- DMI
- Stress
- Nutritional status
- Age
- Breed
- Time of year
- Geographical region
- Health
- Facilities

# Vitamins

*"Organic compounds required in very small amounts which are essential for normal development and functioning of the body."*

## Fat soluble vitamins:

1. **vitamin A (retinol)**
2. **vitamin D (calciferols)**
3. **vitamin E (tocopherols)**
4. **vitamin K (phylloquinone)**

## Water soluble vitamins*:

1. **vitamin $B_1$ (thiamin)**
2. **vitamin $B_2$ (riboflavin)**
3. **vitamin $B_6$ (pyridoxine)**
4. **vitamin $B_{12}$ (cobalamin)**
5. **niacin (vitamin PP or $B_3$)**
6. **pantothenic acid (vitamin $B_5$)**
7. **folic acid (vitamin M)**
8. **biotin (vitamin H)**
9. **vitamin C (ascorbic acid)**

Vitamin K, C, and B Vitamins are synthesized by rumen bacteria in healthy functioning ruminants. Preruminants need additional vitamin supplementation.

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8. biotin (vitamin H)
9. vitamin C (ascorbic acid)

# Vitamin A

**Derived from carotenoids found in plants**

**Function:**
Bone, teeth, and nervous tissue development
Reproduction
Growth
Immune function
Vision
Epithelial tissue
Kidney function
Skin integrity

# Vitamin A

**Deficiency effects:**

- Thickens tissue lining in the digestive, respiratory, and reproductive tract.
  - Reduced nutrient absorption
  - Increased susceptibility to infection
- Fetal development
  - Resorb or abort fetus
  - Reduced calf growth
  - Impaired spermatogenesis in bulls

4H Ranch

# Vitamin D

**Function:**

Regulates Ca and P balance in the body

Bone formation

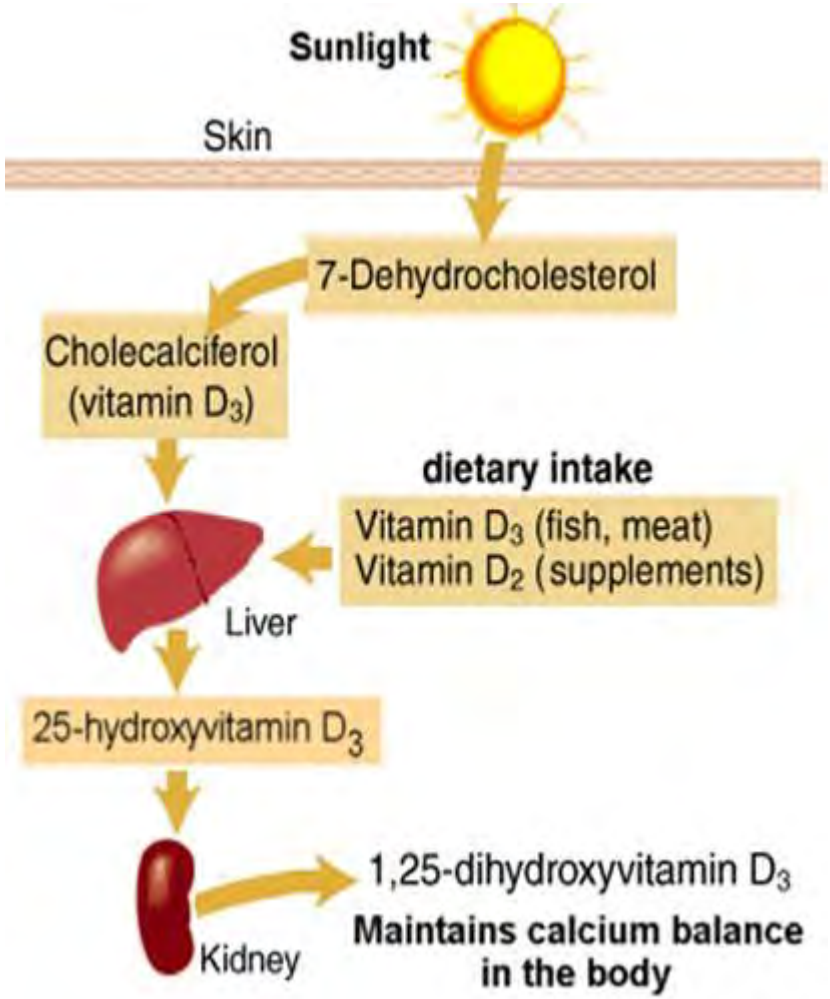
Dietary Ca absorption from small intestine

- Nerve cell transmission
- Muscle fiber contractions

Supports immune function

Insulin secretion

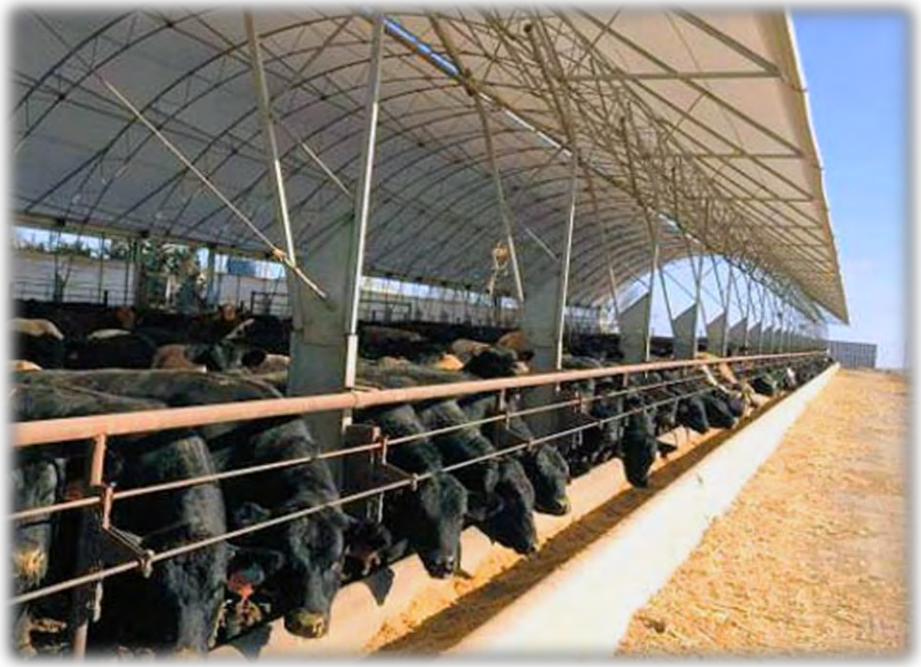
Reproduction




McDowell, UF

# Vitamin D

**Deficiency effects:**
Rickets in calves
Reduced feed intake
Tetany
Weak bones
Stiff joints



ASI, 2022

Gardenlux

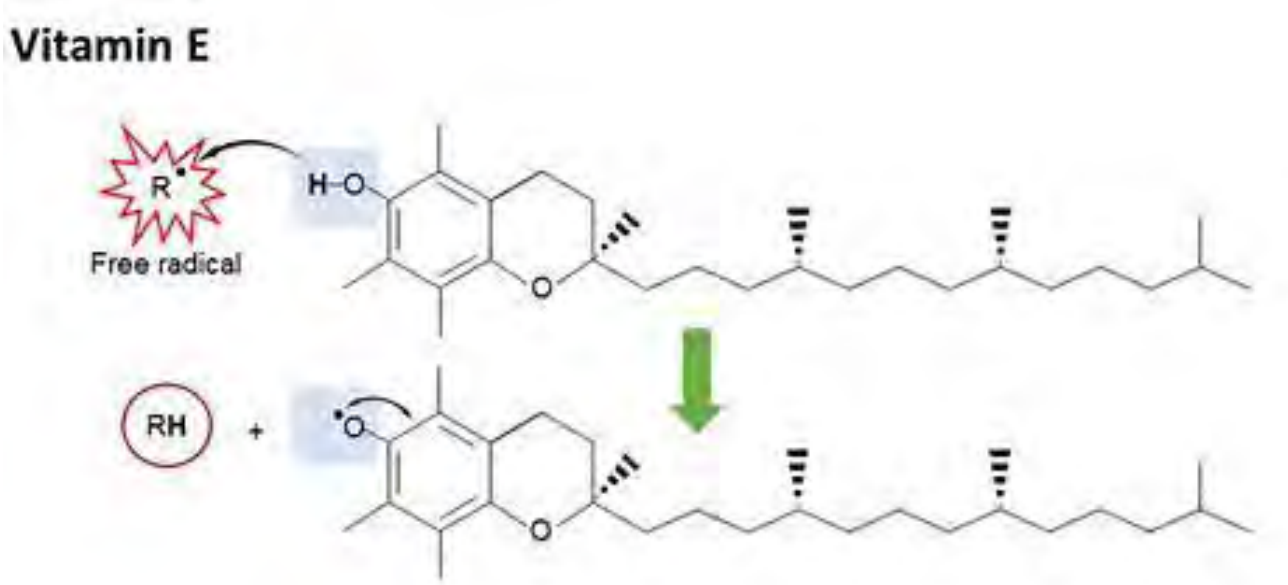
# Vitamin E

**Functions:**

- Antioxidant

  Reduced destruction of other vitamins and essential fatty acids during digestion and absorption

- Supports immune function, reproduction, and meat quality
- Functions with selenium



# Vitamin E

**Deficiency:**

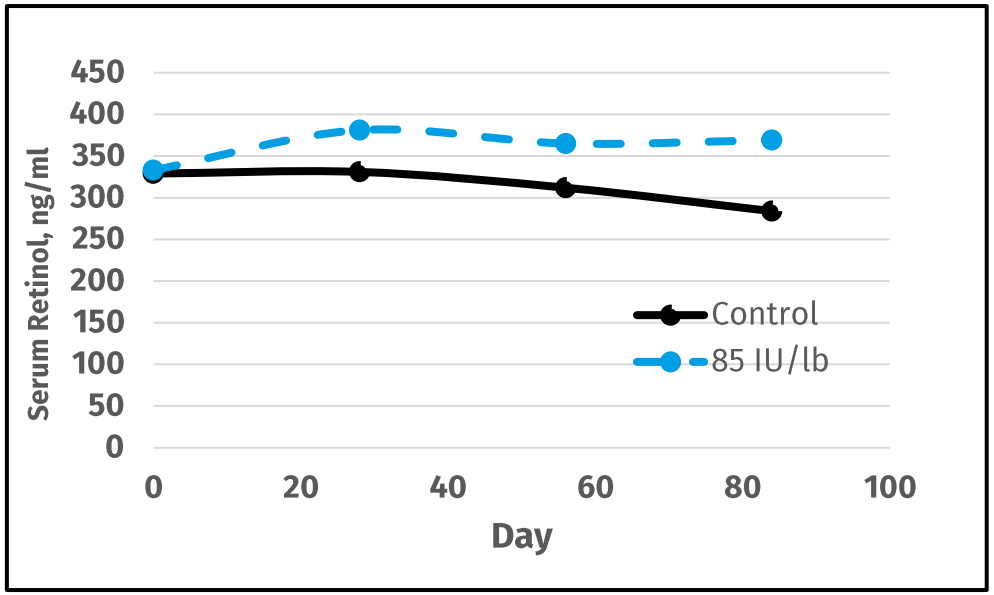
- White muscle disease
- Weak muscles
- Damage to cardiac and skeletal muscles
- Retained placenta
- Reduced reproduction
- Reduced disease resistance

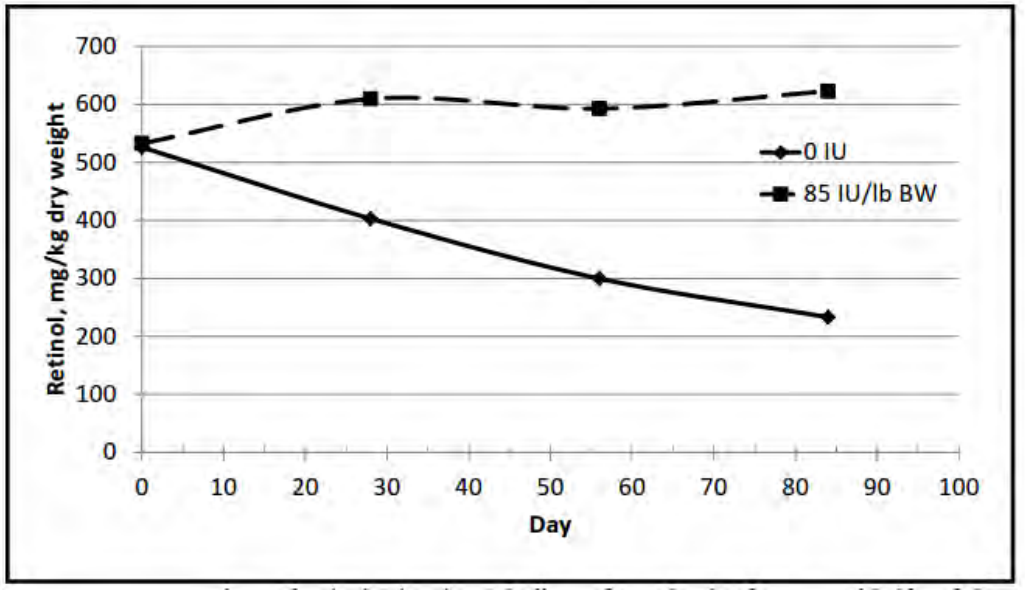
Kace, 2020

# Factors affecting vitamin level in feeds

- Forage species
- Stage of maturity
- Climate
- Harvest conditions
- Ensiling
- Composition of premix
- Pelleting
- Storage
- Weather

# Serum and liver stores of vitamin A




Alosilla et al, 2007 JAS

# Factors influencing vitamin stability

| Vitamin | Temp. | Humidity | Light | Oxygen | Acid pH | Alkaline pH |
|---|---|---|---|---|---|---|
| A | -- | - | -- | -- | - | + |
| D | - | - | - | -- | - | + |
| E | + | + | - | - | - | - |
| Niacin | + | + | + | + | + | + |
| Biotin | - | + | + | + | + | + |

+ Stable; - Sensitive; -- Very Sensitive

Adapted from Shurson et al. (2011)

# Do ruminants need B vitamins?

- Biotin (hoof health and milk production)
- Niacin (liver function, FA metabolism)
- Thiamine (assists in the adaptation to dietary changes)
- Full vitamin supplementation for milk-fed calves

# What levels should we be supplementing?

## What levels should we be supplementing?

Depends.

# Optimum Vitamin Nutrition (OVN)

## *Feeding animals with high quality vitamins*

Our Optimum Vitamin Nutrition (OVN™) concept is about feeding animals with high quality vitamins in the right amount, appropriate to their life stage and growing conditions. OVN™ is a cost-effective vitamin supplementation optimizing:

- Animal health and animal welfare
- Animal performance
- Quality and nutritional value of animal-origin foods
- Learn more about OVN™ in the video below and download the App!

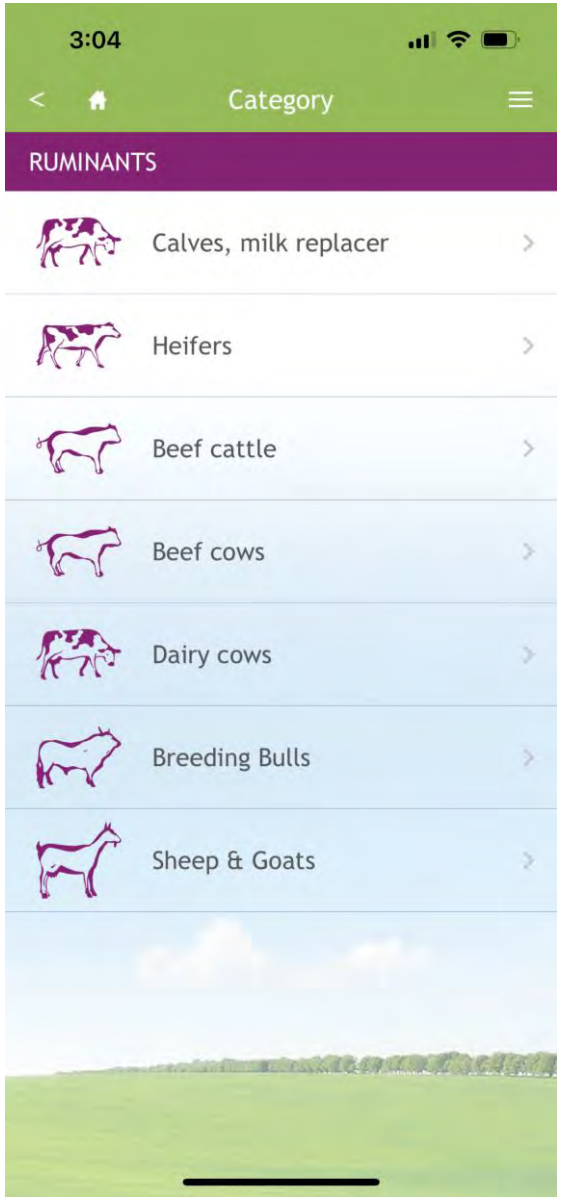
# OVN App

**Stay on top of your animals' nutrition with our Optimum Vitamin Nutrition App.**

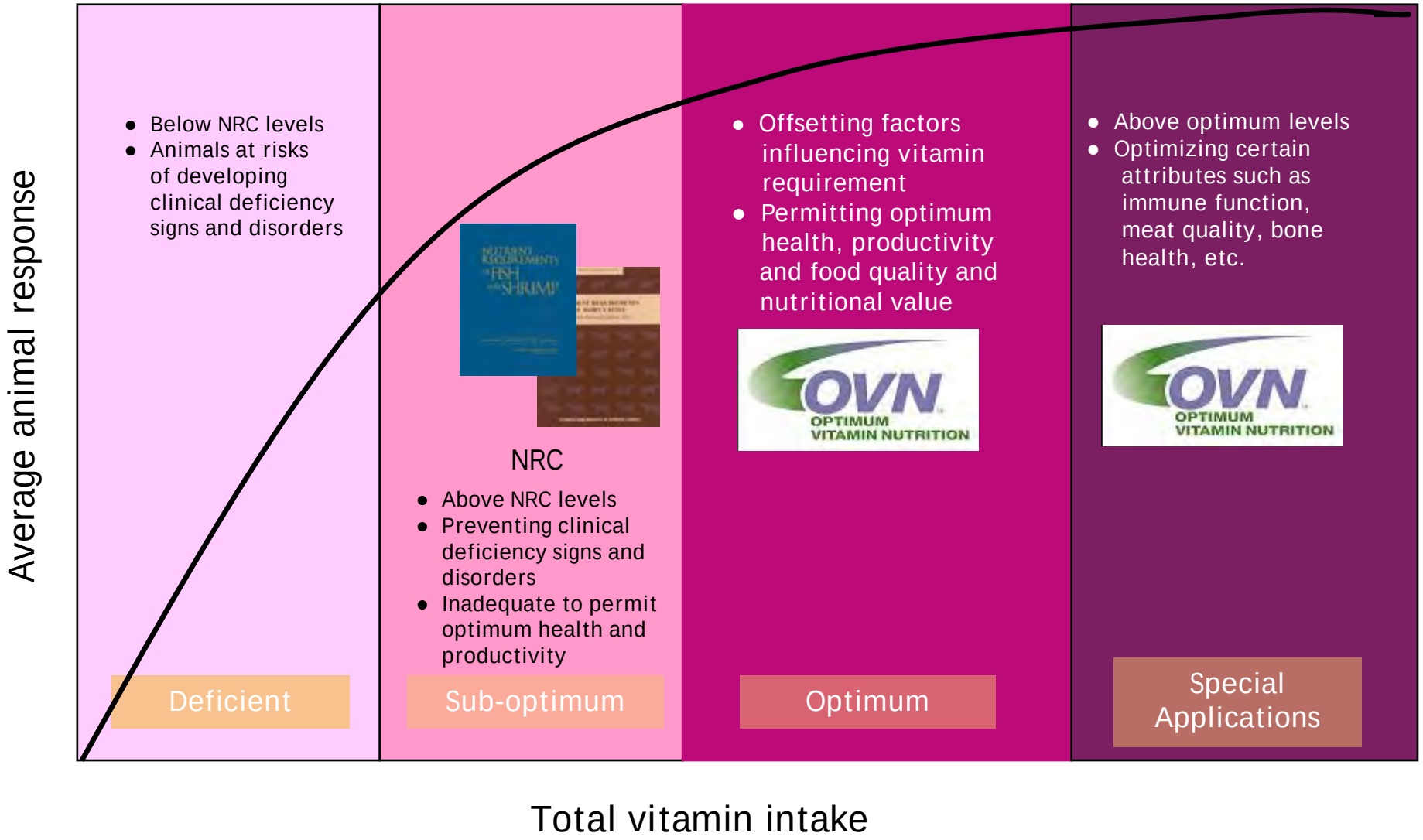
Download the latest vitamin supplementation guidelines for balanced animal nutrition.

Download on the App Store

GET IT ON Google Play




# Optimum Vitamin Nutrition Concept



# OVN Beef Cattle Recommendations

| Category/ Phase | Vit. A *IU/d* | Vit. $D_3$ *IU/d* | Vit. E[1] *IU/d* | Thiamin *mg* | Biotin *mg* | ß-carotene *mg* |
|---|---|---|---|---|---|---|
| **Beef cattle Growing** | 25,000-50,000 | 6,000-9,000 | 200-300 | 60-250[9] | 10-20[11] | |
| **Fattening & finishing** | 40,000-80,000 | 5,000-7,000 | 500-2,000[2] | 60-250[9] | 10-20[11] | |
| **Beef cows** | 40,000-70,000 | 5,000-10,000 | 300-500 | | 20[11] | 300-500[14] |
| **Breeding bulls** | 50,000-80,000 | 5,000-10,000 | 300-500 | | 20[11] | |

# Beef Cow-Calf & Bulls: OVN vs NRC 2017

| | Vitamin A IU/h/d | Vitamin D3 IU/h/d | Vitamin E IU/h/d | β-carotene mg/h/d | Biotin mg/h/d |
|---|---|---|---|---|---|
| **OVN** | 40,000-70,000 | 5,000-10,000 | 300-500 | 300-500 | 20 |
| **NRC** | 35,000-50,000 | 3,500 | 450 | - | - |
| Diff. | | ~2,700 | | | |
| Why? | Reproduction, immune system, colostrum quality | Immune system, calcium metabolism | Immune system, colostrum, calf health | Reproduction, colostrum quality | Hoof health |

# Feedlot Receiving Cattle (0-28 days): OVN vs NRC 2017

| | Vitamin A IU/h/d | Vitamin D3 IU/h/d | Vitamin E IU/h/d | Thiamin mg/h/d | Niacin g/h/d | Biotin mg/h/d |
|---|---|---|---|---|---|---|
| **OVN** | 25,000-50,000 | 6,000-9,000 | 500 | 60-250 | 1-2 | 10-20 |
| **NRC** | 22,000 | 3,300 | 400-500 | - | - | - |
| Diff. | ~3,000 | ~5,700 max | | | | |
| Why? | Prevent deficiency, immune system | Immune system, calcium metabolism | Immune system, health | Prevent PEM | Feed efficiency | Hoof health |

# Feedlot Finishing: OVN vs NRC 2017

| | Vitamin A IU/h/d | Vitamin D3 IU/h/d | Vitamin E IU/h/d | Thiamin mg/h/d | Niacin g/h/d | Biotin mg/h/d |
|---|---|---|---|---|---|---|
| **OVN** | 40,000-80,000 | 5,000-7,000 | 500-2,000[2] | 60-250 | 1-2 | 10-20 |
| **NRC** | 30,000 | 3,800 | 400-500 | - | - | - |
| Diff. | ~10,000 | ~3,200 max | | | | |
| Why? | Prevent deficiency, immune system | Immune system, calcium metabolism | Immune system, health | Prevent PEM | Feed efficiency | Hoof health |

# Feedlot survey

| Receiving diets, IU/kg | Mean | No. of responses | Min. | Max. | Mode |
|---|---|---|---|---|---|
| **Vit A** | 4,796 | 21 | 2,000 | 10,000 | 3,000 |
| **Vit E** | 29.8 | 21 | 0 | 100 | 20 |
| **Vit D** | 271 | 19 | 0 | 880 | 0 |
| **Finishing diets, IU/kg** | | | | | |
| **Vit A** | 4,715 | 21 | 700 | 25,000 | 2,000 |
| **Vit E** | 25.1 | 21 | 0 | 100 | 0 |
| **Vit D** | 142 | 18 | 0 | 440 | 0 |

- Vit A ~ 2.1x NRC levels; 1-2x OVN levels
- Vit E levels low in receiving calves
- Vit D low in in finishing diets
- Most nutritionists did not supplement Vit E and Vit D
- Did not account for injectable vitamins or time of year.

Samuelson et al., 2016

# Vitamin E benefits in feedlot diets

**Immune system:**

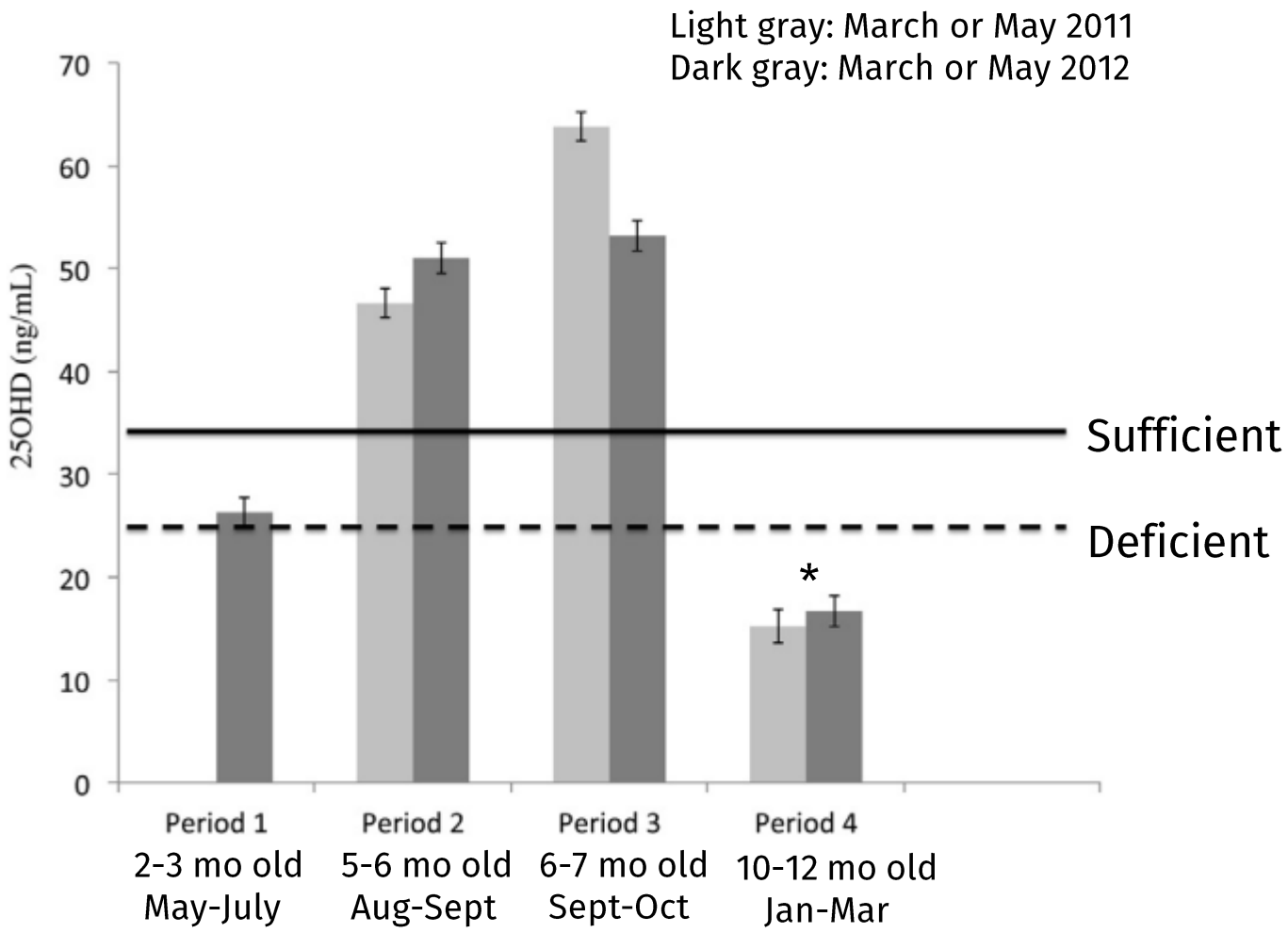
Supplementing >400 IU/d increased gain and reduced BRD in receiving diets (Gaylean et al., 1999)

**Improved shelf life:**

Improved oxidative stability of displayed beef cuts and decreasing economic losses during retail*

500 IU/d for 97 d to improve retail shelf life in diets including 35% distillers (Bloomberg et al., 2011)

# Vitamin D seasonal variation




Animals were fed to meet NRC recommendations

UVB too low to support cutaneously produced Vit D in light-skinned animals; estimated effect exacerbated 10 fold in dark skinned animals

“Current levels of supplementation of vitamin D fed during winter are inadequate to maintain proper immune function and Ca homeostasis and for black breeds such as Angus”

USDA NADC, 2015

# Cow/calf mineral

Vit. A = 100,000 IU/lb
Vit. D = 10,000 IU/lb
Vit. E = 100 IU/lb

4 oz intake = .25 lb/h/d

Vit A = 25,000 IU
Vit. D = 2,500 IU
Vit. E = 25 IU

Gestating cow: Vit A -15,000 IU; Vit D -800 IU; Vit E -275 IU
Lactating cow: Vit A. -25,000 IU; Vit D -1,000 IU; Vit E -423 IU

Risk of deficiency!

## Super Range Mineral

**PURPOSE**

A Mineral Supplement for Beef Cattle on Pasture

*** GUARANTEED ANALYSIS ***

| | |
|---|---|
| Calcium (Min) | 14.3% |
| Calcium (Max) | 17.1% |
| Phosphorus (Min) | 8.0% |
| Salt (Min) | 11.0% |
| Salt (Max) | 13.0% |
| Magnesium (Min) | 1.5% |
| Sulfur (Min) | .90% |
| Potassium (Min) | 1.0% |
| Cobalt (Min) | 35 ppm |
| Copper (Min) | 2,000 ppm |
| Iodine (Min) | 50 ppm |
| Iron (Min) | 1,500 ppm |
| Manganese (Min) | 2,200 ppm |
| Selenium (Min) | 25 ppm |
| Zinc (Min) | 4,000 ppm |
| Vitamin A (Min) | 100,000 IU |
| Vitamin D-3 (Min) | 10,000 IU |
| Vitamin E (Min) | 100 IU |

*** INGREDIENT STATEMENT ***

Monocalcium Phosphate, Dicalcium Phosphate, Salt, Processed Grain By-products, Calcium Carbonate, Molasses Products, Magnesium Oxide, Potassium Chloride, Zinc Sulfate, Copper Sulfate, Manganese Sulfate, Vitamin A Supplement, Cholecalciferol (D-Activated Animal Sterol - Source of Vitamin D-3), Vitamin E Supplement, Artificial Flavor, Ethylenediamine Dihydriodide, Sodium Selenite, Cobalt Carbonate, Natural and Artificial Flavors.

*** CAUTION ***

Follow feeding directions at all times. Provide free-choice to cattle on pasture. Consumption will vary depending on quality and quantity of available forage. Normal intake will range between 3 to 4 oz. per head per day. Provide plenty of fresh water and forage at all times.

Product contains added selenium. Intake of supplemental selenium should not exceed 0.3 parts per million on a complete diet basis or a total of 3 milligrams per animal per day.

**WARNING:** This product contains elevated copper levels. Do not feed to sheep or goats as this may result in copper toxicity.

Manufactured by
**Super Range Mineral Company, Inc.**
**Mineral Maker, TX**

**Net Wt. 50 lbs.**

# Cow/calf mineral

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4 oz intake = .25 lb/h/d

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Vit. A = 300,000 IU/lb
Vit. D = 30,000 IU/lb
Vit. E = 300 IU/lb

4 oz intake = .25 lb/h/d

Vit A = 75,000 IU ✓
Vit. D = 7,500 IU ✓
Vit. E = 75 IU -373 IU

Vit. E from other sources?

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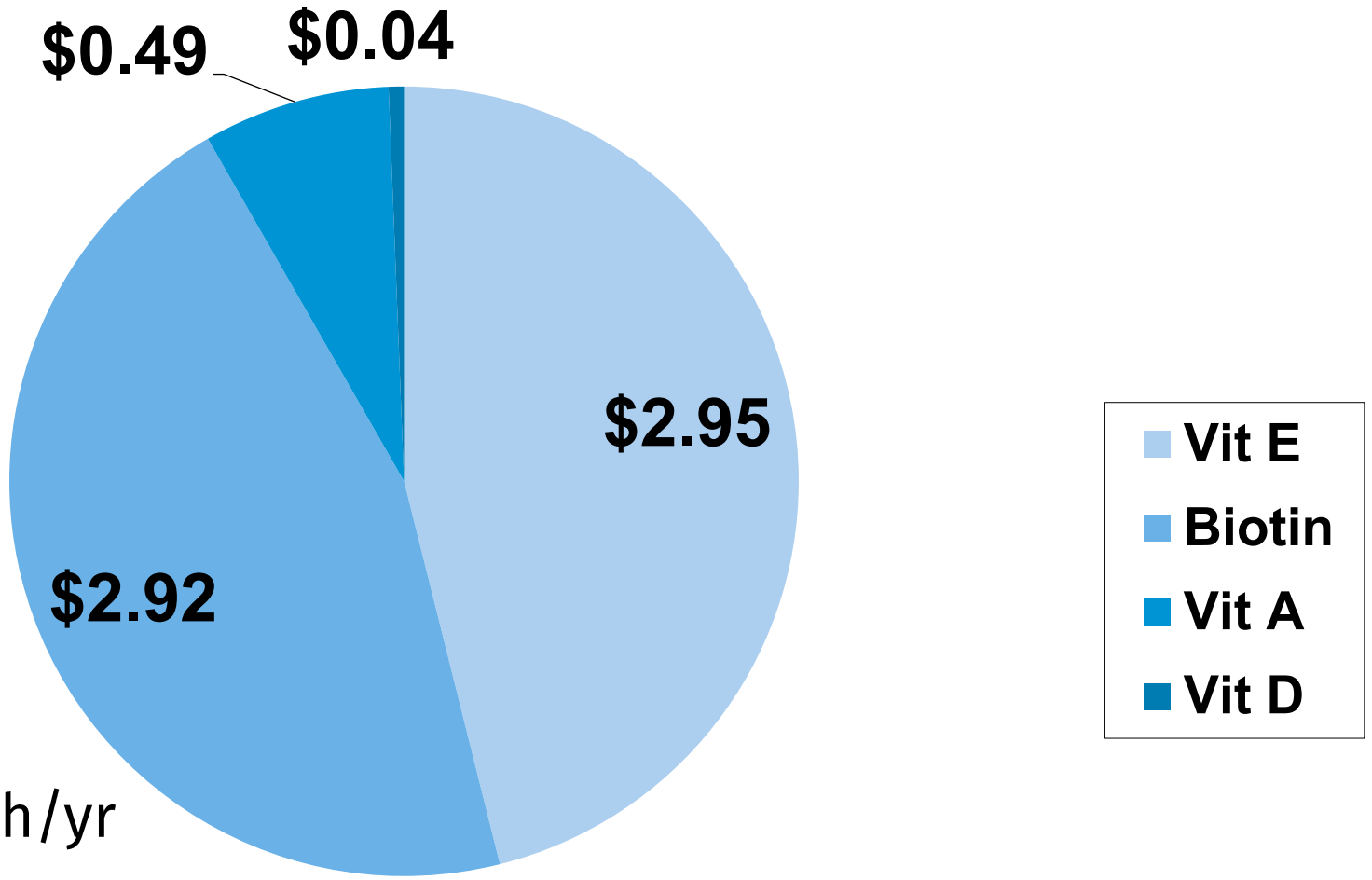
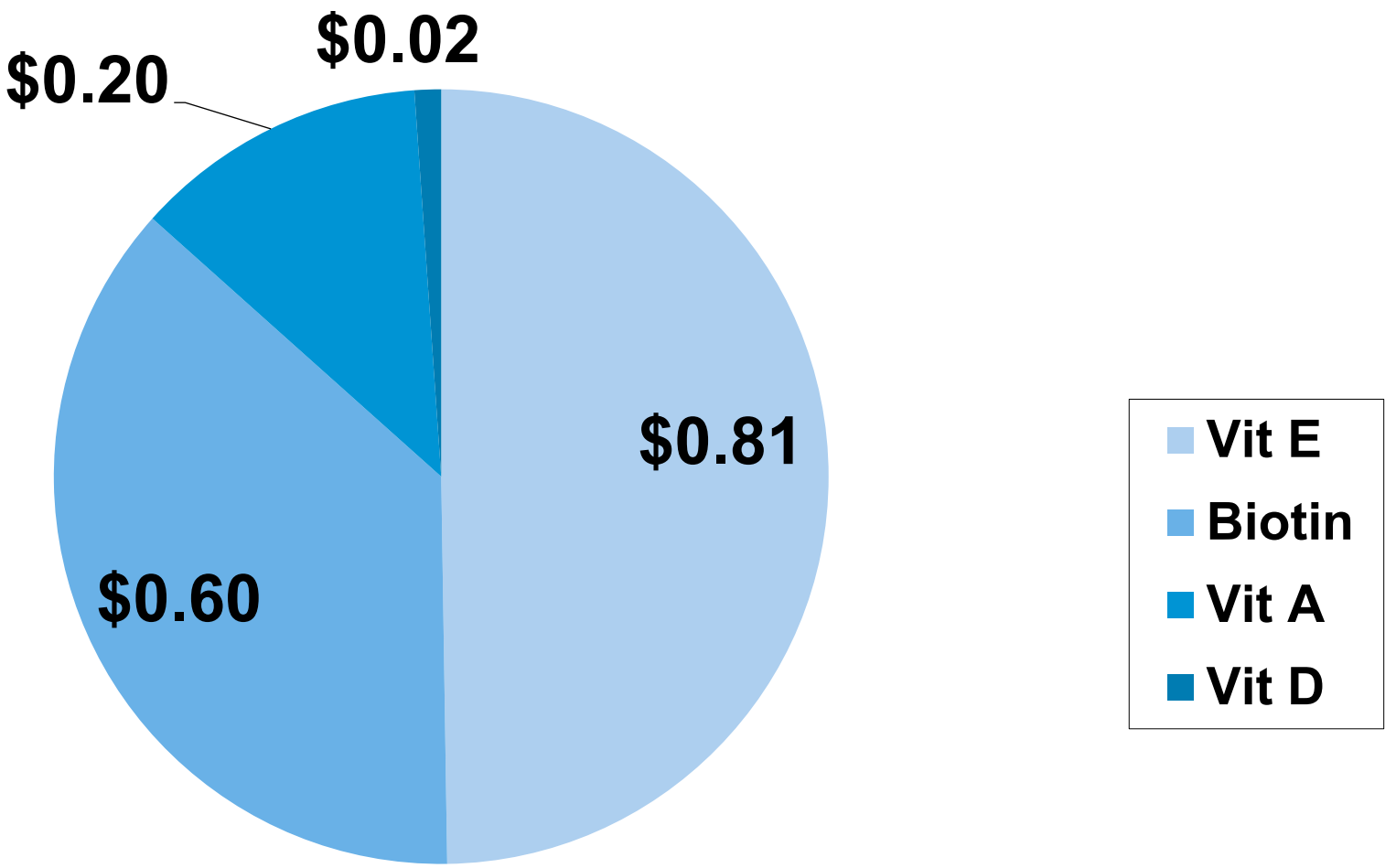
# Beef Cow Vitamin Cost (OVN Recommendations)




A, D, E only = $3.48/h/yr
Or ~$0.01/h/d

Total = $6.40/hd/yr

# Feedlot Vitamin Cost (OVN Recommendations)




A, D, E only = $1.03/h/cycle
Or ~$0.005/h/d

Total = $1.63/cycle

# Considerations for achieving proper vitamin nutrition

- Formulation
  - DMI
  - Body weight
  - Stage of production
  - Diet
  - Stress
  - Time of year
  - OVN recommendations
- Supplement intake
- Observe clinical signs

# Thank you!

**Booth #1305**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