Supplementation Strategies for Range Cattle in NM

Cow Requirements

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New Mexico State University
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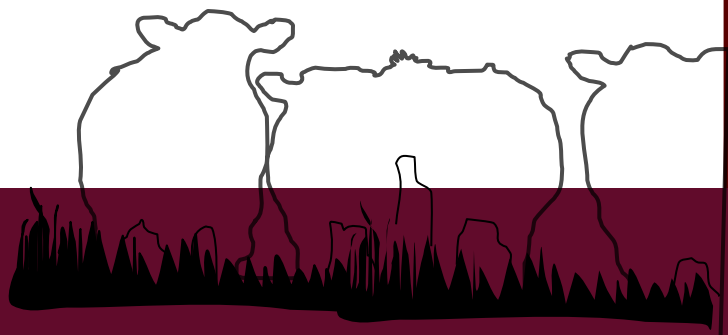
Importance of Minerals

Macro vs. Micro

- Micro minerals are present in small amounts in the body.
  - chromium, cobalt, copper, fluorine, iodine, iron, manganese, molybdenum, selenium, and zinc
- Macro minerals are present in large amounts in the body.
  - calcium, chlorine, magnesium, phosphorus, potassium, sodium, and sulfur

Minerals of concern and interactions

- Ca: Mn, Se, and Zn
  - 0.5% Ca reduced serum Zn (Perry et al., 1968)
- Fe: Cu and Mn
- Zn: Cu
- S: Cu and Se



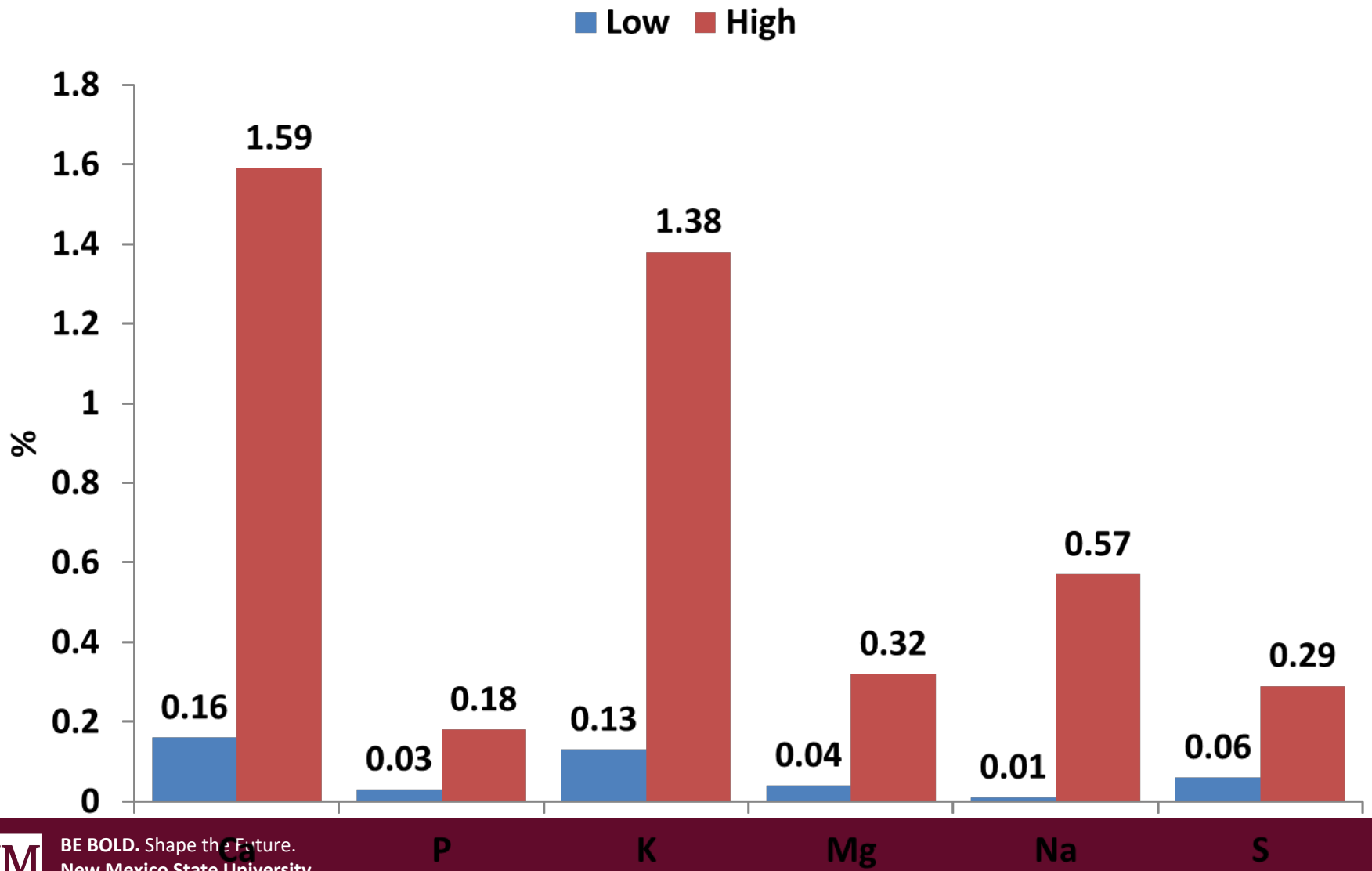
Mineral requirements based on stage of production, maximum tolerable levels and the greatest impact on performance in beef cattle. [a]

Mineral	Growing-Finishing BW 650 lbs	Gestating Dry Cows BW 1,250 lbs	Lactating Cows BW 1,200 lbs	Max. Tolerable	Performance Impacted
Ca, %	0.31	0.18	0.27	1.8	Growth
P, %	0.27	0.18	0.27	0.3	Growth
Na, %	0.07	0.07	0.10	4.0	Milk Prod.
Cl, %	—	—	—	4.0	Milk Prod.
Mg, %	0.10	0.12	0.20	0.40	Growth
S, %	0.15	0.15	0.15	0.40	Growth
K, %	0.60	0.60	0.70	3.0	Reprod.
Co, ppm	0.10	0.10	0.10	10.0	Growth
Cu, ppm	10.0	10.0	10.0	100.0	Growth
I, ppm	0.50	0.50	0.50	50.0	Milk Prod.
Mn, pm	20.0	40.0	40.0	1000.0	Reprod.
Se, pm	0.10	0.10	0.10	2.0	Immunity
Zn, ppm	30.0	30.0	30.0	500.0	Immunity

[a] Requirements based on values provided by NRC, 2000, and expressed in concentration (% or ppm).

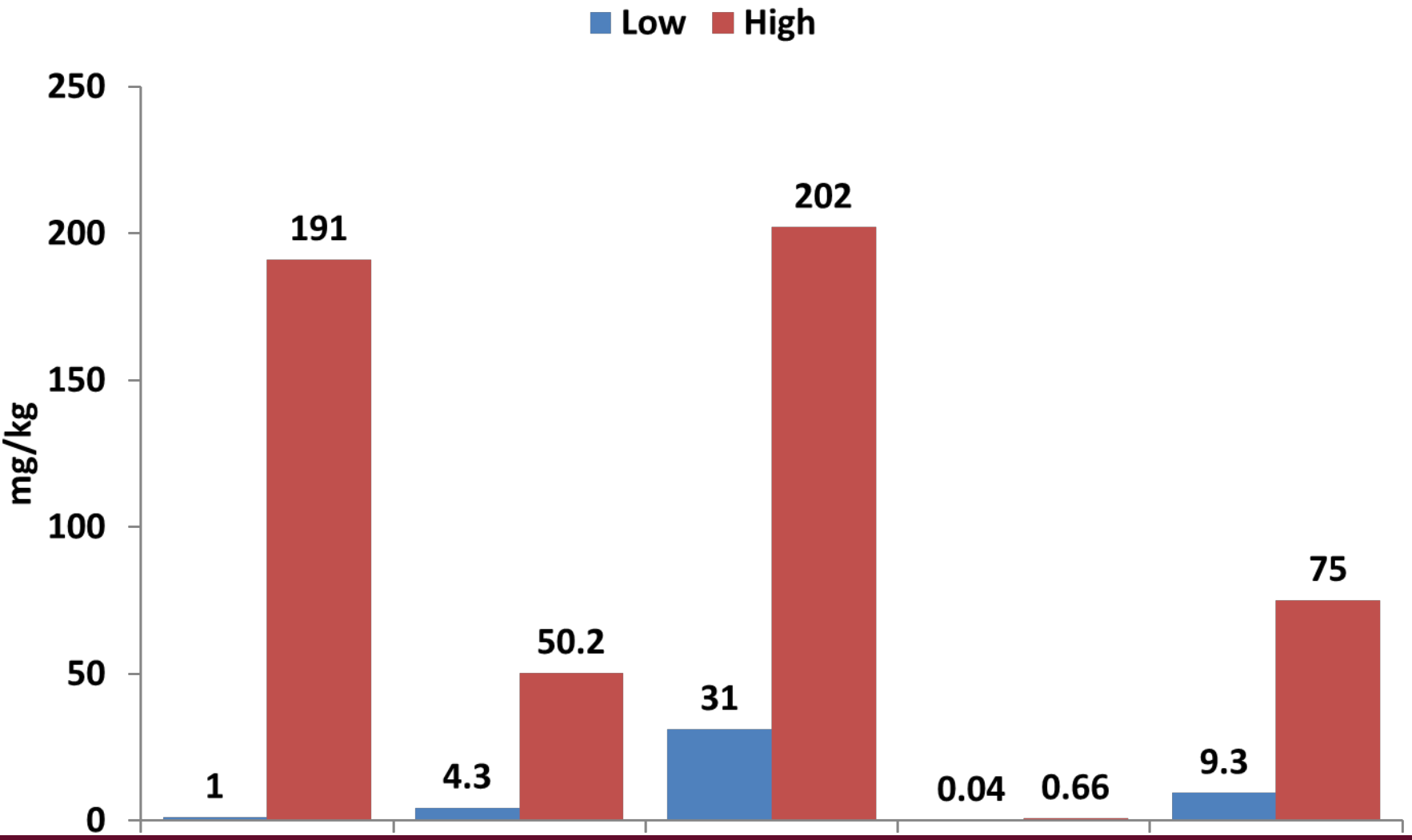
Ward and Lardy, 2005

NM forage macromineral content



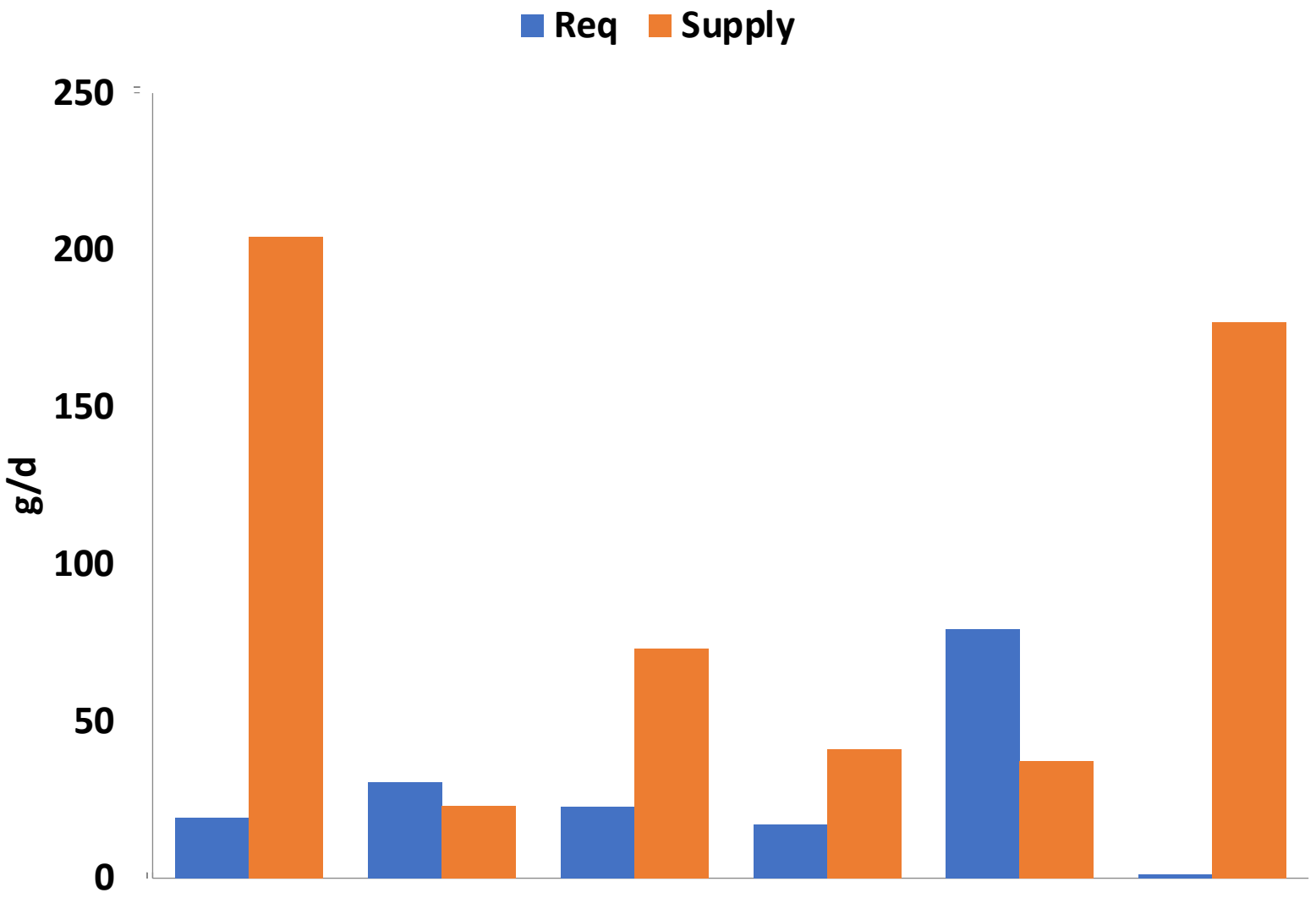
Mathis and Sawyer, 2004

NM forage micromineral content

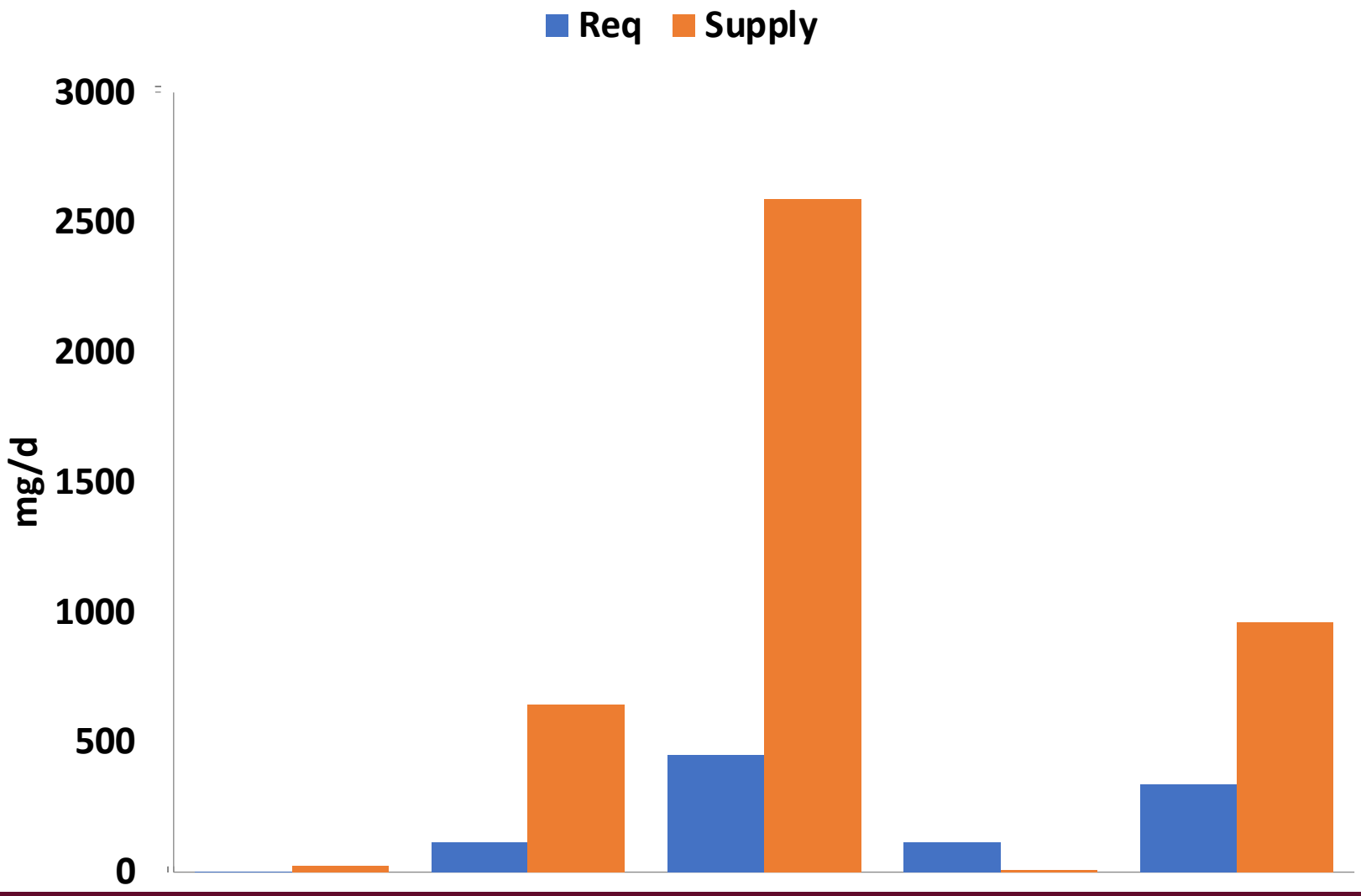


Mathis and Sawyer, 2004

Cow macromineral supply d 60 of gestation



Cow micromineral supply d 60 of gestation



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Minerals are deficient; now what?

Supplementation: Free Choice

- Blocks
  - Blue, red, white, yellow…

Supplementation: Free Choice

- Reputable bagged mineral

GUARANTEED ANALYSIS:

MINERAL / VITAMIN	LEVEL
Calcium (Ca), min	13.00%
Calcium (Ca), max	15.00%
Phosphorus (P), min	4.00%
Salt (NaCl), min	16.50%
Salt (NaCl), max	18.50%
Magnesium (Mg), min	10.00%
Potassium (K), min	0.10%
Zinc (Zn), min	3,600 PPM
Manganese (Mn), min	3,600 PPM
Copper (Cu), min	1,200 PPM
Cobalt (Co), min	12 PPM
Iodine (I), min	60 PPM
Selenium (Se), min	27 PPM
Vitamin A, min	75,000 IU/LB
Vitamin D, min	7,500 IU/LB
Vitamin E, min	75 IU/LB

Comparing

- PPM vs %
- 0.1% = 1000 ppm
- Example: Block Mg 2,400 ppm

  Bag Mg 10% = 100,000 ppm

Blocks are mostly salt

What About Organic?

- Mineral is chelated to increase availability
- “More digestible or absorbable”
- In general, unless you have a problem, you don’t need to spend the money

Injectable

- Bypasses digestive system so absorption is not an issue
- Good way to rapidly increase mineral status in deficient cattle
- Improve mineral status in cattle not supplemented or not eating mineral
- If cattle consuming good mineral?

General Guidelines

- Provide free choice bagged mineral
  - Tubs: mineral specific
- Provide near water supplies
- Monitor intake
- 50 pounds = 800 oz
  - 10 cows x 2 oz/day = 20 oz/day
  - For every 10 cows, 1 bag should last about 40 days

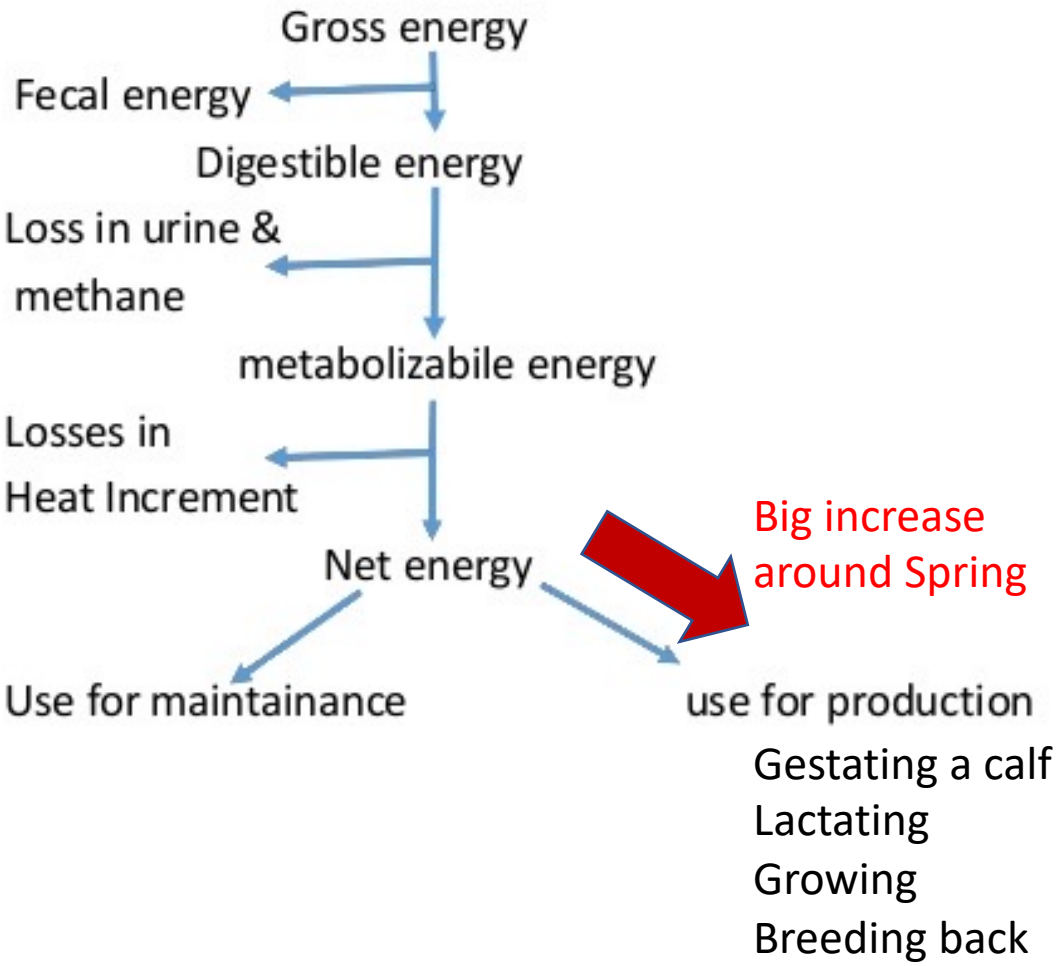
Nutritional Considerations

What do we need to know?

- When do we calve?
- When does breeding season start?
- When do we wean?
- Who are we feeding?
- What are their needs?

Major Considerations

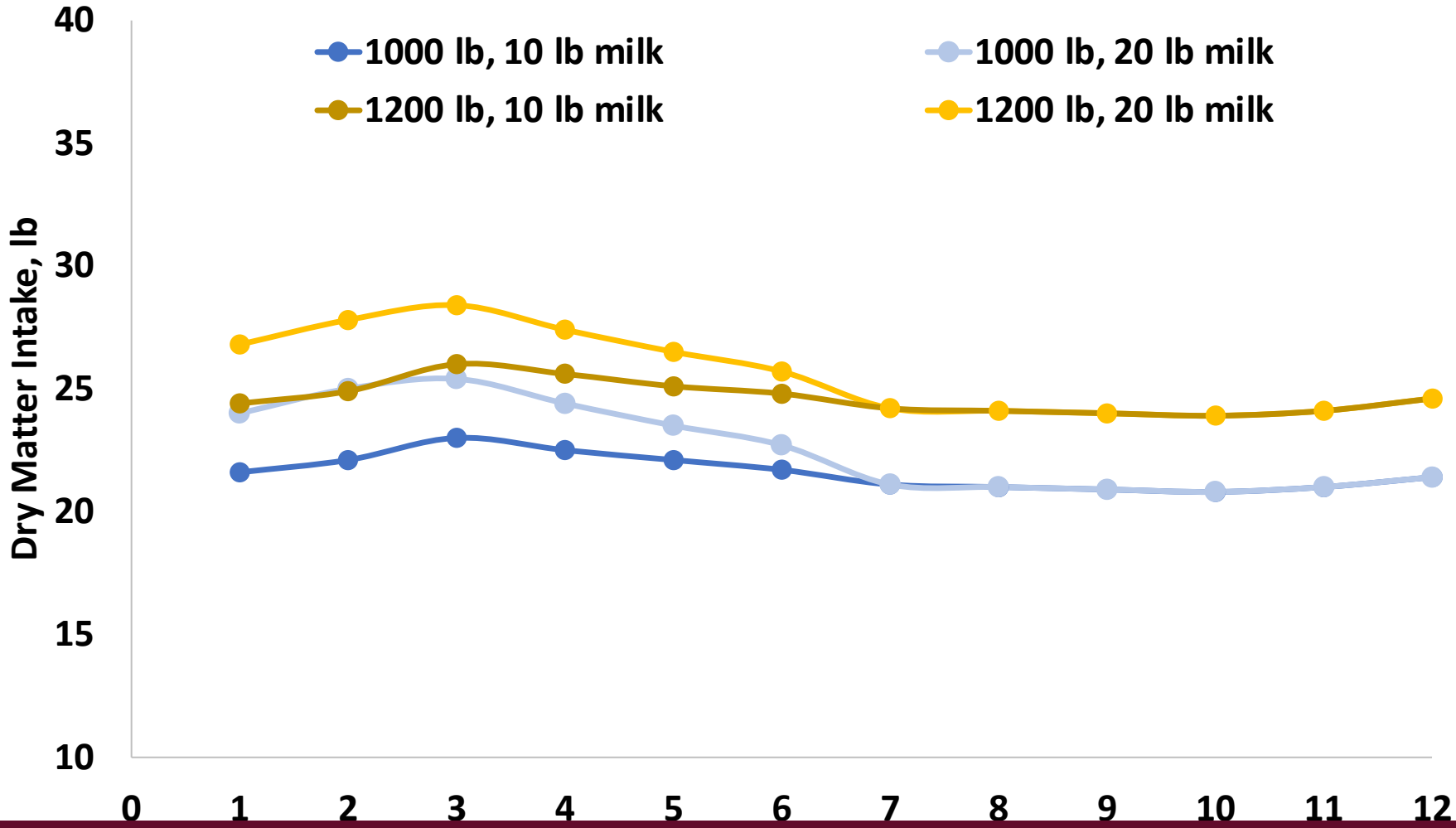
- Amount of feed available
- Crude protein (CP) content of diet
- Energy (TDN) available from the diet
- Current condition of the herd


Gross energy
Fecal energy
Digestible energy
Loss in urine &
methane
metabolizabile energy
Losses in
Heat Increment
Net energy
Big increase
around Spring
Use for maintainance
use for production
Gestating a calf
Lactating
Growing
Breeding back

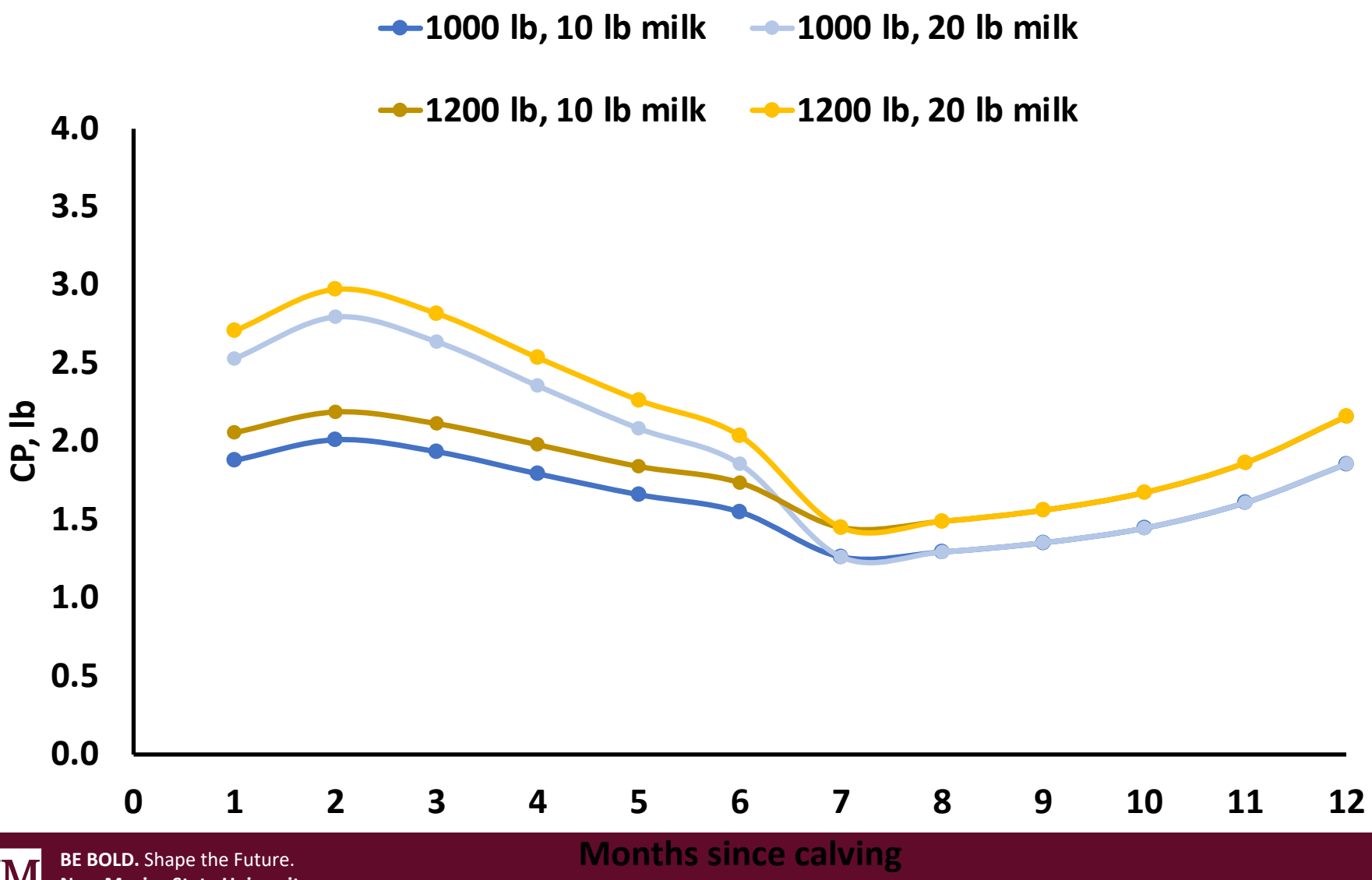
Requirements aren’t the same

- Heifers (growing and puberty)
- 2s and 3s (growing, gestating, and lactating, breed back)
- Middle-aged cows
- Old cows

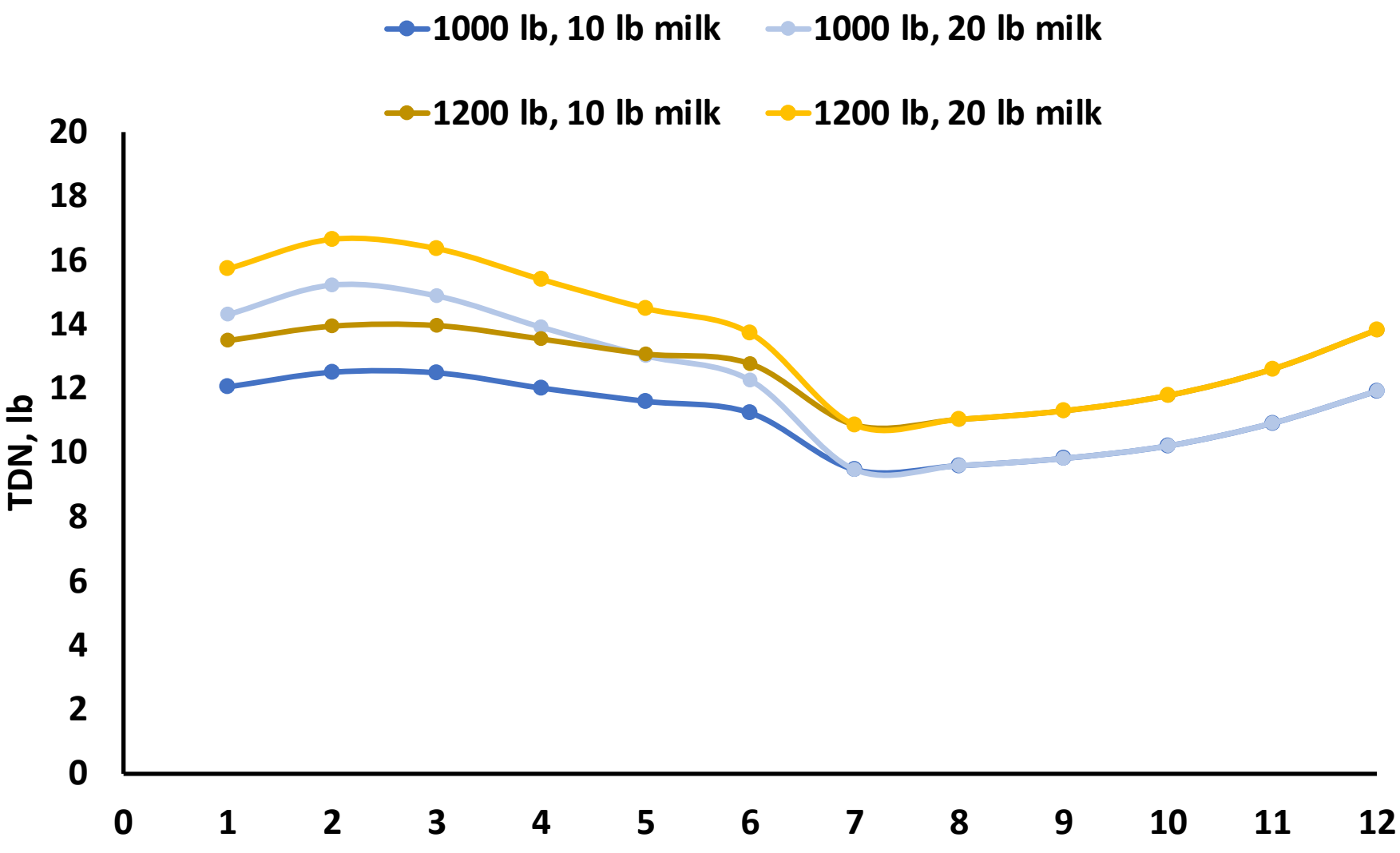
Cow Dry Matter Intake Requirements



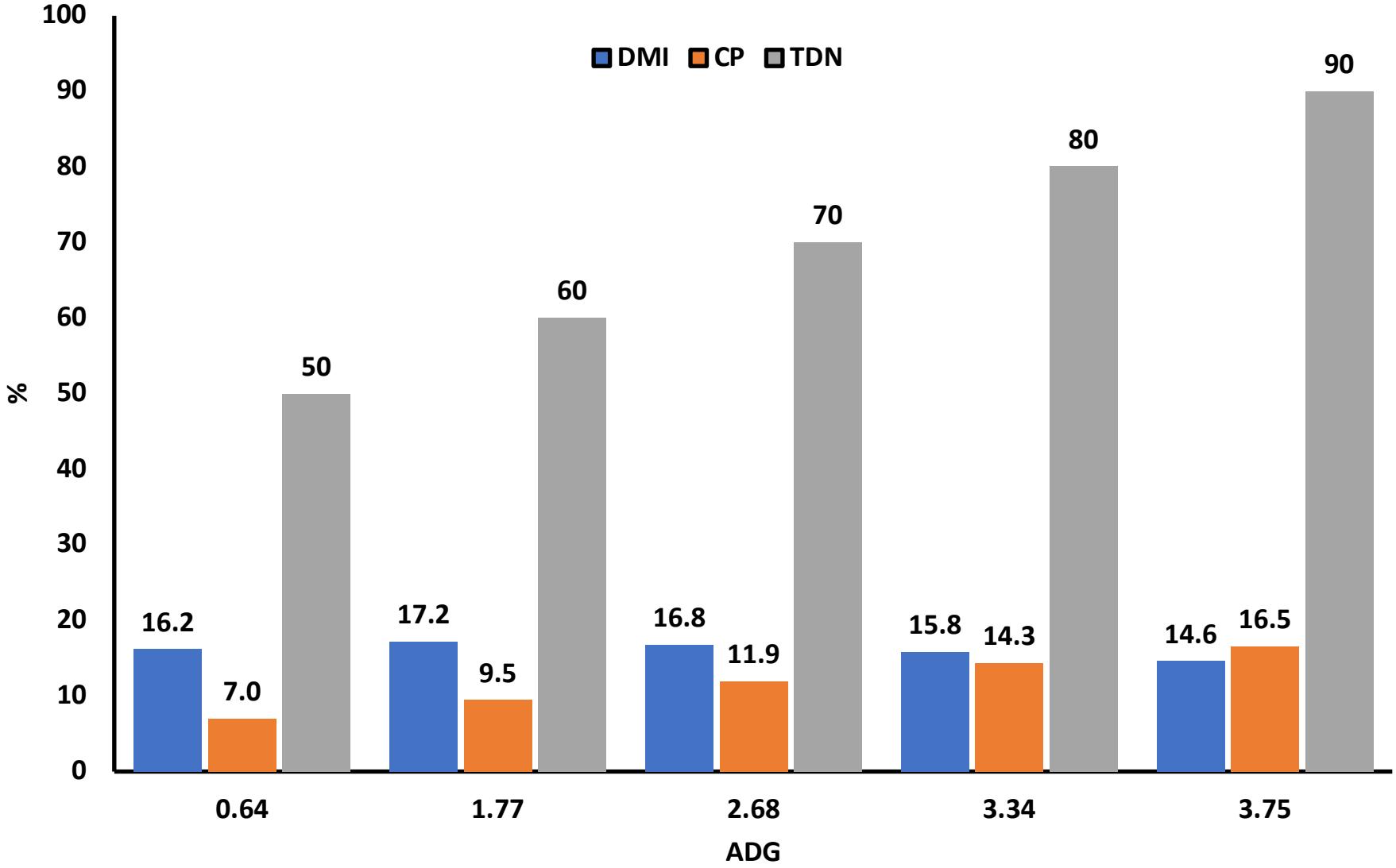
Cow CP Requirement



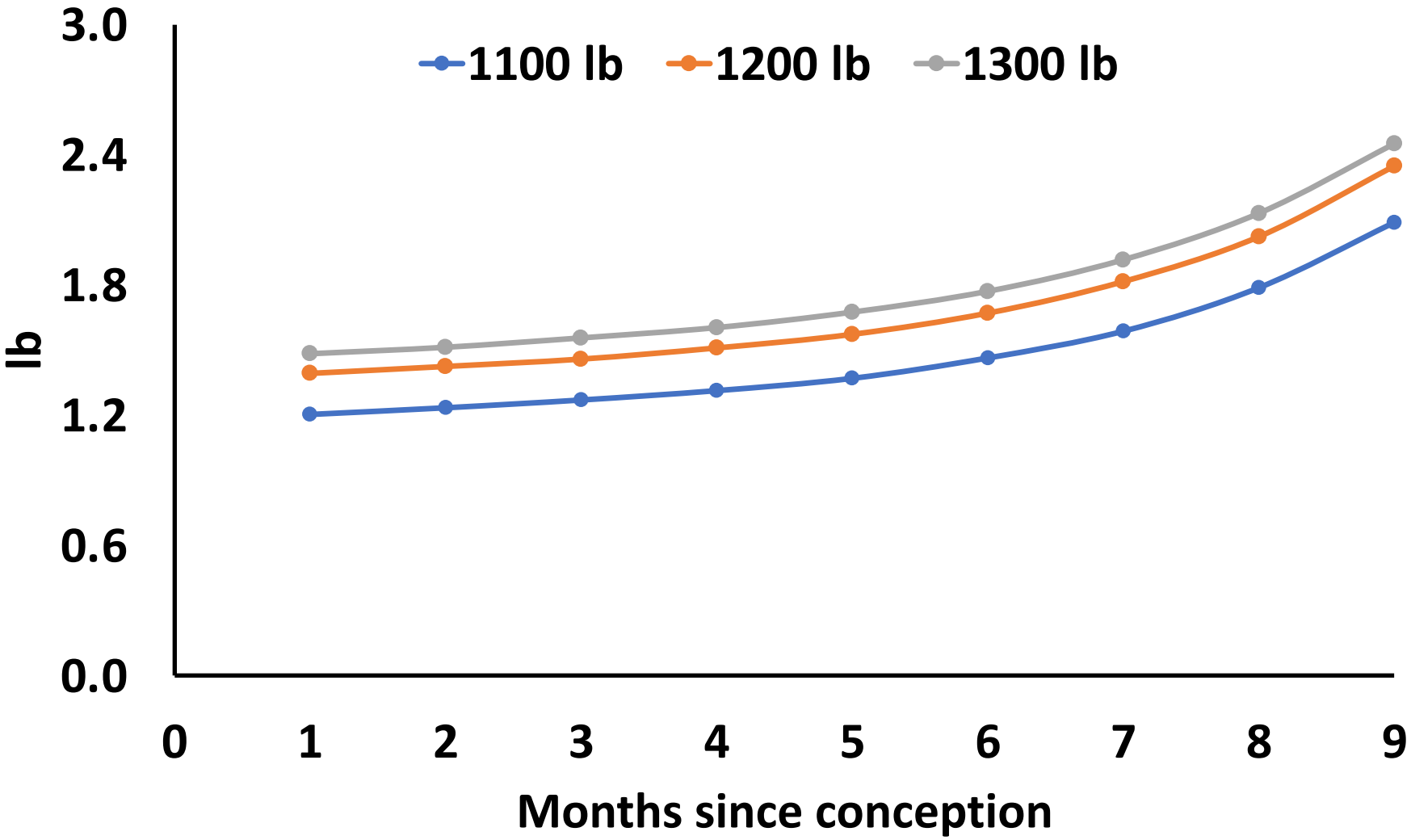
Cow TDN Requirement



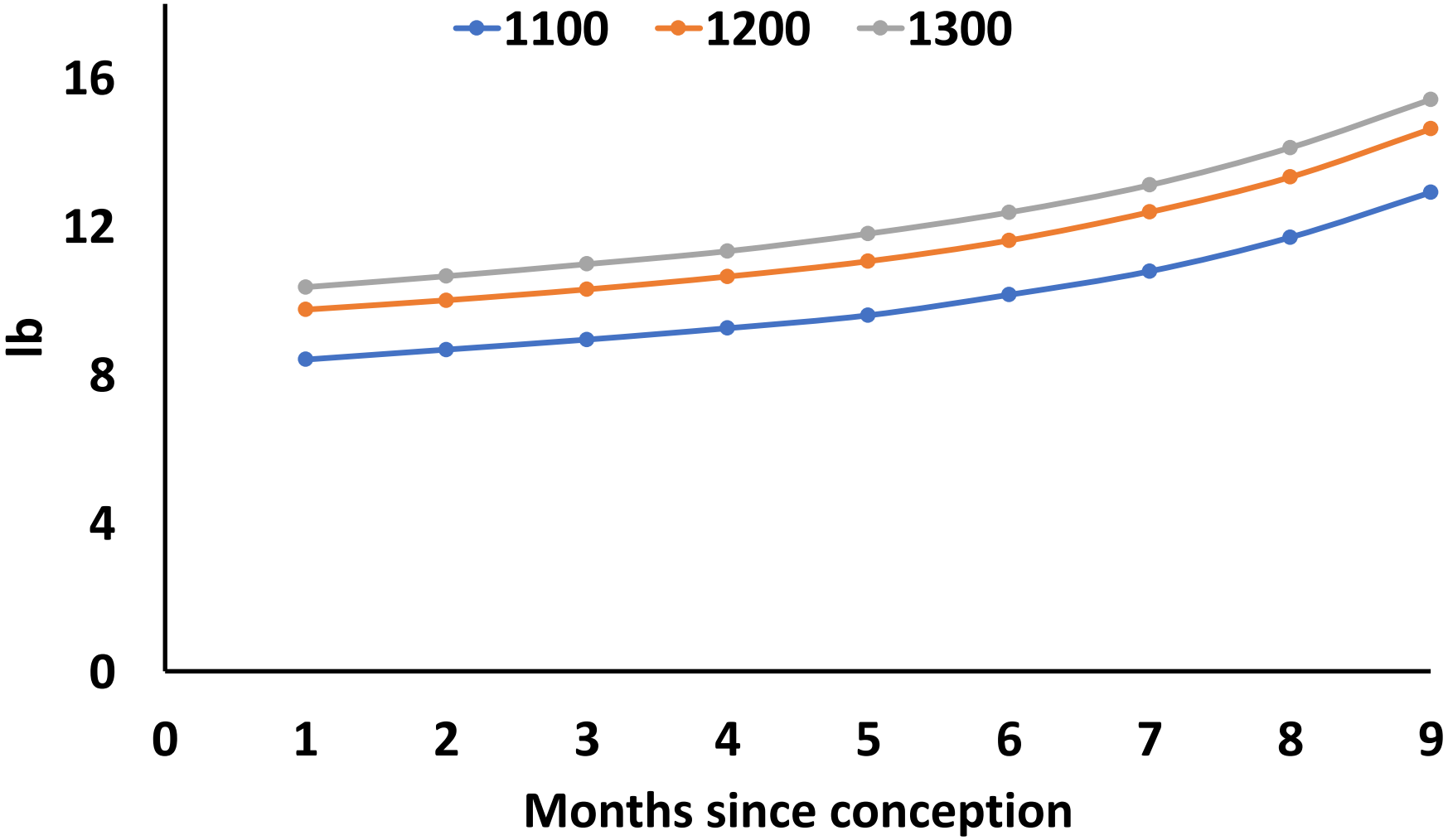
Nutrient requirements for 600 lb replacement heifer



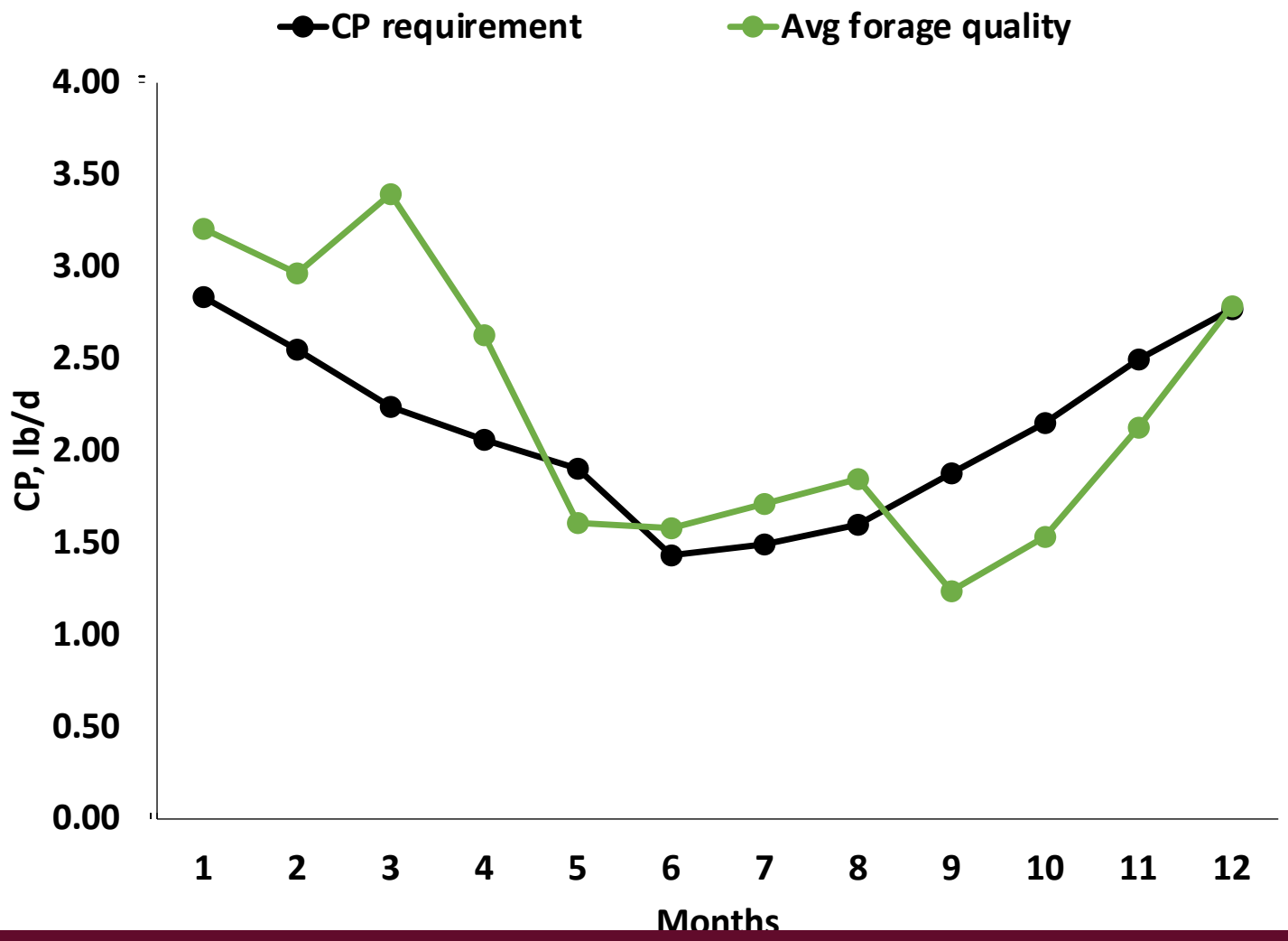
Pregnant Heifer CP requirements



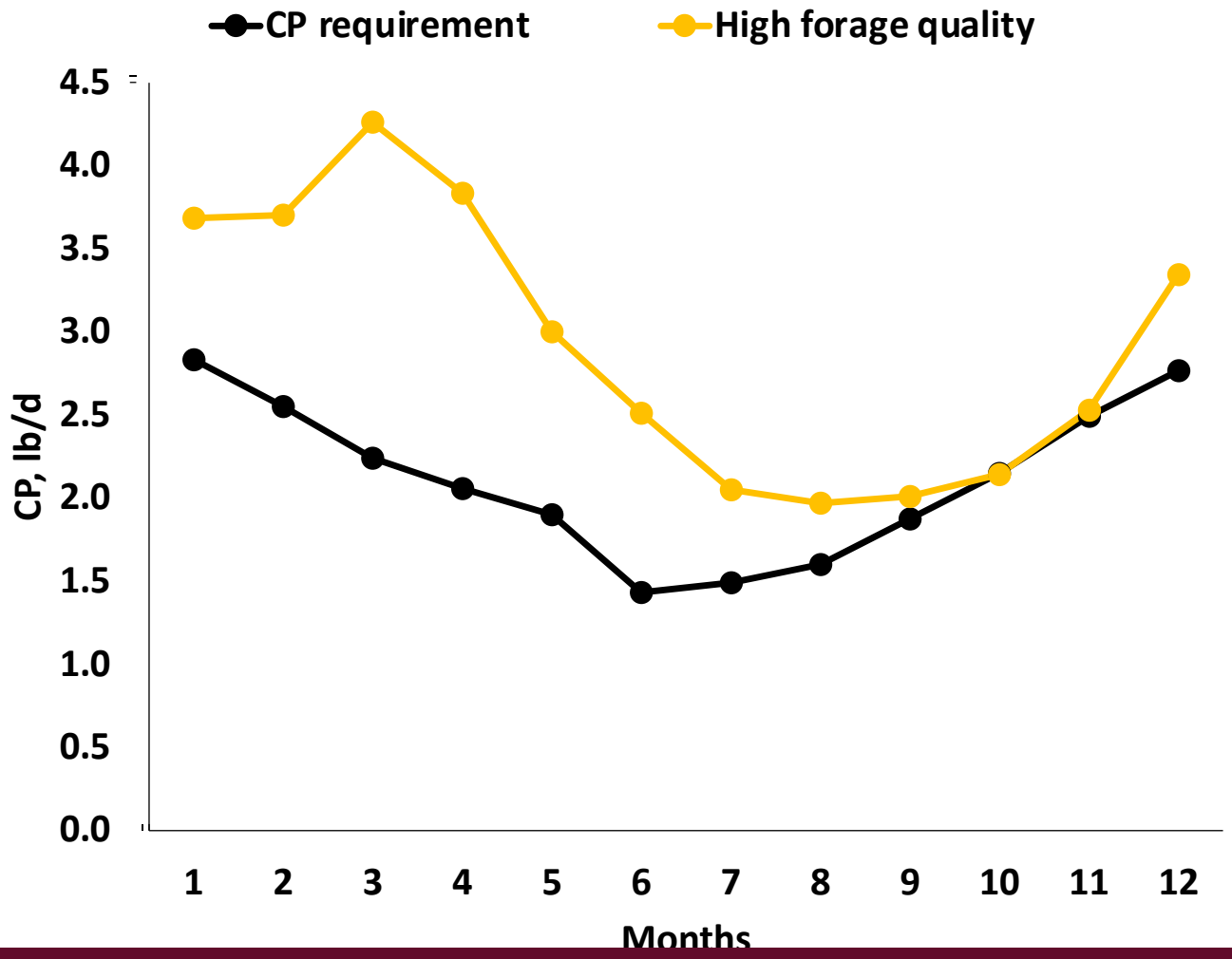
Pregnant Heifer TDN requirements



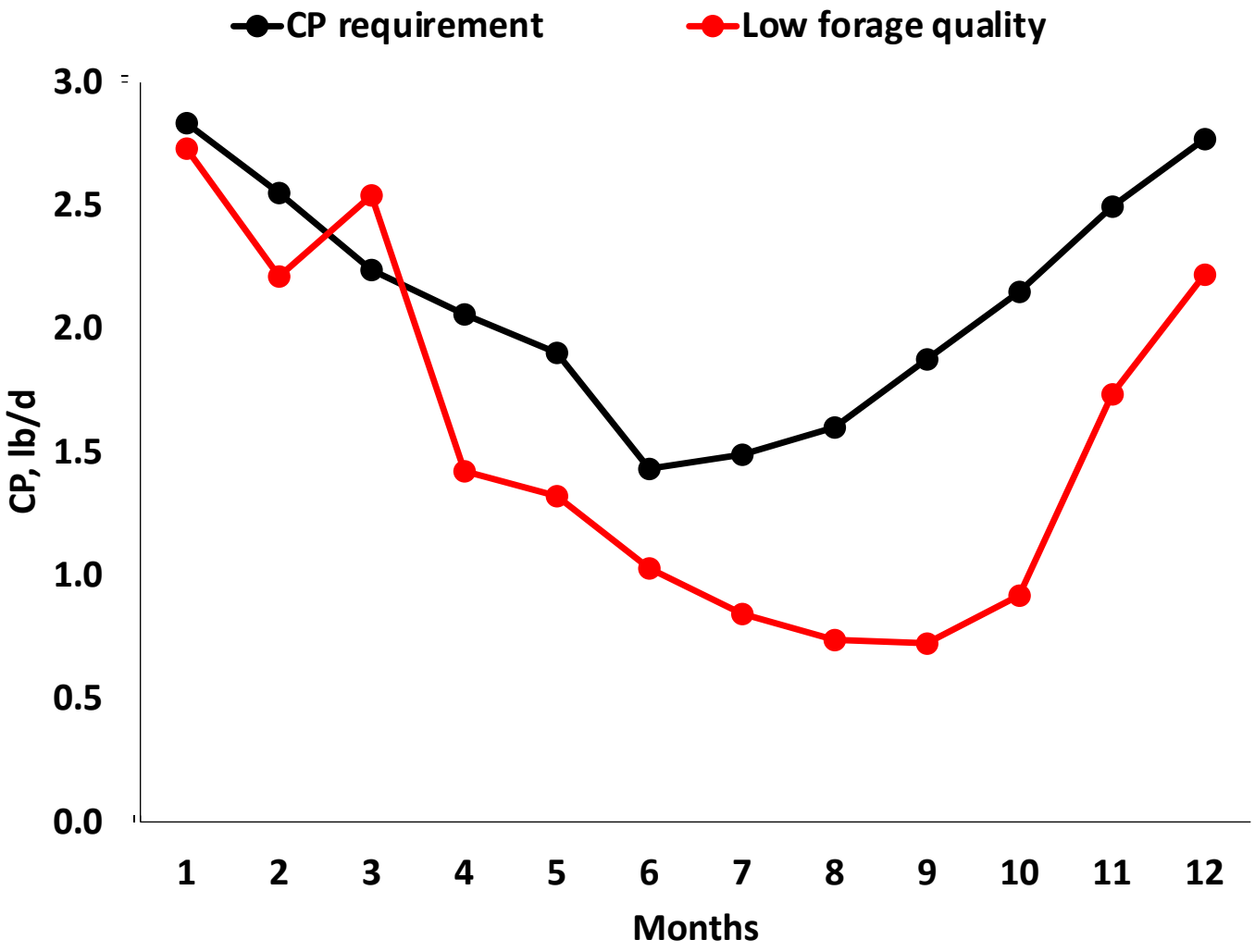
Cow CP Requirement and average forage quality



Cow CP Requirement and high-quality forage



CP requirement and low-quality forage



Lack of Protein

- Insufficient protein can also lead to reduced energy

- Remember, you are feeding microbes!

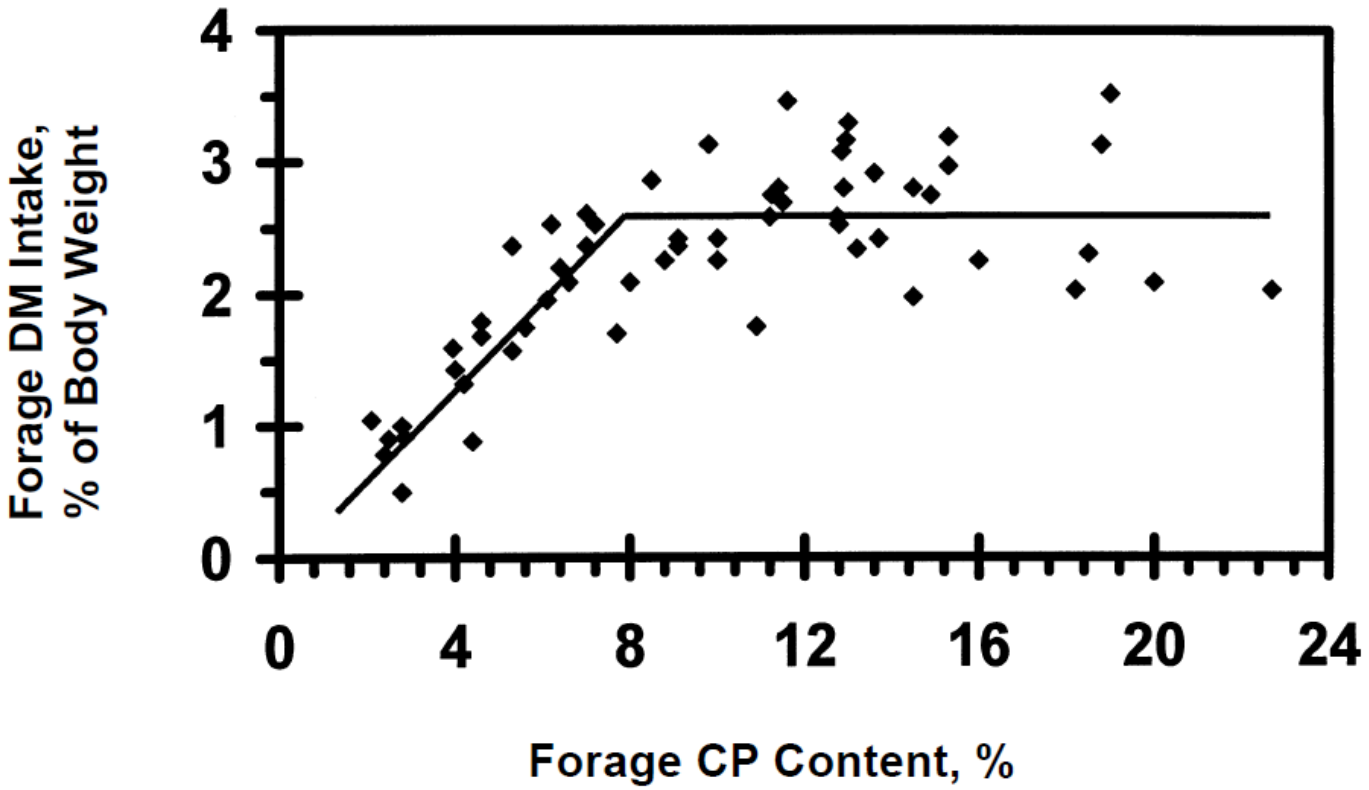
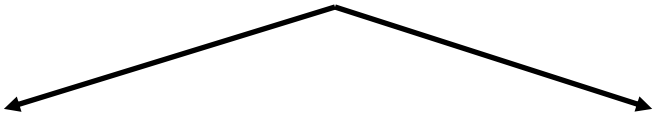


Figure 1. Forage dry matter (DM) intake relative to the forage crude protein (CP) content.

Mathis, 2003

Supplement decision guide

Does cow have all she can eat in pasture?



YES **NO**

Supplement decision guide

Does cow have all she can eat in pasture?

NO

- **Forage supply is inadequate; energy deficient**
- **Reduce the forage needs of herd by lowering stocking rate and/or feeding supplement**

Supplement decision guide

Does cow have all she can eat in pasture?

NO

What color is forage?

Brown

- **Supplement with 20-28% CP**
- **0.3 to 0.5% BW/day**
- **Energy is deficient**
- **Protein is likely <7%, limits digestion**
- **Consider $/lb CP and $/lb TDN**
- ***IF forage shortage is severe Supplement with <20%CP***
- **0.4 to 0.8% BW/day**
- **Price $/lb TDN**

Green

- **Supplement energy with < 20% CP**
- **0.4% to 0.8% BW/day**
- **Protein is sufficient**
- **Energy is deficient**
- **Price $/lb TDN**

Supplement decision guide

Does cow have all she can eat in pasture?

YES

What color is forage?

Brown

- **Protein is likely <7%, limits intake and digestion**

Green

- **No Supplement needed!!!!!**

Supplement decision guide

Does cow have all she can eat in pasture?

YES

What color is forage?

Brown

- **Protein is likely <7%, limits intake and digestion**

Are cows in adequate body condition (BCS >4.5)

Supplement decision guide

Does cow have all she can eat in pasture?

YES

What color is forage?

Brown

Are cows in adequate body condition (BCS >4.5)

YES

- **Supplement with > 32% CP**
- **0.1 to 0.3% BW/day**
- **Improves rumen efficiency**
- **Price $/lb CP**

NO

- **Supplement with 28 to 32% CP**
- **0.25 to 0.4% BW/day**
- **Improves rumen efficiency**
- **Provides extra energy**
- **Price $/lb CP and $/lb TDN**

Mineral requirements based on stage of production, maximum tolerable levels and the greatest impact on performance in beef cattle. [a]

Mineral	Growing-Finishing BW 650 lbs	Gestating Dry Cows BW 1,250 lbs	Lactating Cows BW 1,200 lbs	Max. Tolerable	Performance Impacted
Ca, %	0.31	0.18	0.27	1.8	Growth
P, %	0.27	0.18	0.27	0.3	Growth
Na, %	0.07	0.07	0.10	4.0	Milk Prod.
Cl, %	—	—	—	4.0	Milk Prod.
Mg, %	0.10	0.12	0.20	0.40	Growth
S, %	0.15	0.15	0.15	0.40	Growth
K, %	0.60	0.60	0.70	3.0	Reprod.
Co, ppm	0.10	0.10	0.10	10.0	Growth
Cu, ppm	10.0	10.0	10.0	100.0	Growth
I, ppm	0.50	0.50	0.50	50.0	Milk Prod.
Mn, pm	20.0	40.0	40.0	1000.0	Reprod.
Se, pm	0.10	0.10	0.10	2.0	Immunity
Zn, ppm	30.0	30.0	30.0	500.0	Immunity

[a] Requirements based on values provided by NRC, 2000, and expressed in concentration (% or ppm).

Ward and Lardy, 2005

LANTANA, MARCELL
P.O. BOX 1264
CROWNPOINT, NM 87313

ANALYSIS

	Dry Basis	As Received	
Moisture		6.34	%
Dry Matter		93.66	%
Protein, Crude	2.86	2.68	%
ADF-Acid Detergent Fiber	41.93	39.27	%
NEL: Net Energy-Lactation	0.46	0.43	Mcal/lb
NEG: Net Energy-Gain	0.13	0.12	Mcal/lb
NEM: Net Energy-Maintenance	0.37	0.35	Mcal/lb
TDN: Total Digestible Nutrients	45.94	43.03	%
Calcium	0.45	0.42	%
Phosphorus	Less than 0.01		%
Potassium	0.15	0.14	%
Magnesium	0.06	0.06	%
Sodium	Less than 0.01		%
Sulfur	0.10	0.09	%
Aluminum	1320.00	1236.31	ppm
Cobalt	2.04	1.91	ppm
Copper	7.40	6.93	ppm
Iron	784.00	734.29	ppm
Manganese	36.40	34.09	ppm
Molybdenum	2.85	2.67	ppm
Zinc	9.38	8.79	ppm

LANTANA, MIKELLE
P.O. BOX 1264
CROWNPOINT, NM 87313

ANALYSIS

	Dry Basis	As Received	
Moisture		7.07	%
Dry Matter		92.93	%
Protein, Crude	2.87	2.67	%
ADF-Acid Detergent Fiber	41.76	38.81	%
NEL: Net Energy-Lactation	0.46	0.43	Mcal/lb
NEG: Net Energy-Gain	0.13	0.12	Mcal/lb
NEM: Net Energy-Maintenance	0.38	0.35	Mcal/lb
TDN: Total Digestible Nutrients	46.17	42.91	%
Calcium	0.18	0.17	%
Phosphorus	Less than 0.01		%
Potassium	0.32	0.30	%
Magnesium	0.04	0.04	%
Sodium	0.02	0.02	%
Sulfur	0.06	0.06	%
Aluminum	250.00	232.33	ppm
Cobalt	0.78	0.72	ppm
Copper	4.61	4.28	ppm
Iron	190.00	176.57	ppm
Manganese	32.80	30.48	ppm
Molybdenum	1.37	1.27	ppm
Zinc	8.84	8.22	ppm

LANTANA, MIKELLE
P.O. BOX 1264
CROWNPOINT, NM 87313

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Potassium	0.32	0.30	%
Magnesium	0.04	0.04	%
Sodium	0.02	0.02	%
Sulfur	0.06	0.06	%
Aluminum	250.00	232.33	ppm
Cobalt	0.78	0.72	ppm
Copper	4.61	4.28	ppm
Iron	190.00	176.57	ppm
Manganese	32.80	30.48	ppm
Molybdenum	1.37	1.27	ppm
Zinc	8.84	8.22	ppm

Female Requirements, %

	DMI lb	CP %	TDN %	ME Mcal/d	NEm Mcal/d	Ca %	P %
HEIFER 1200 lb Mature BW 10 lb of milk							
First	19.8	7.2	50.6	0.46	0.21	7.19	0.18
Second	21.5	7.4	51.5	0.48	0.23	7.35	0.17
Third	23.7	8.7	56.6	0.56	0.30	8.68	0.22
COW 1200 lb mature BW 10 lb of milk							
First	25.2	7.4	52.2	0.87	0.49	7.35	0.17
Second	24.1	6.2	45.9	0.77	0.39	6.22	0.12
Third	24.2	7.8	52.6	0.88	0.49	7.84	0.16
Lactation/breeding	25.1	8.5	55.0	0.92	0.53	8.45	0.20
COW 1200 lb mature BW 20 lb of milk							
First	26.5	8.6	54.8	0.91	0.53	0.24	0.17
Second	24.1	6.2	45.9	0.77	0.39	0.15	0.12
Third	24.2	7.8	52.6	0.88	0.49	0.25	0.16
Lactation/breeding	27.7	10.2	58.7	0.98	0.59	0.3	0.20

Female Requirements, lb

	DMI lb/d	CP lb/d	TDN lb/d	ME Mcal/d	NEm Mcal/d	Ca lb/d	P lb/d
HEIFER 1200 lb mature BW 10 lb of milk							
First	19.8	1.42	10.01	9.11	4.16	0.045	0.036
Second	21.5	1.58	11.10	10.34	4.96	0.047	0.037
Third	23.7	2.06	13.44	13.22	7.21	0.073	0.053
COW 1200 lb mature BW 10 lb of milk							
First	25.2	1.85	13.13	21.90	12.33	0.050	0.036
Second	24.1	1.50	11.07	18.48	9.32	0.036	0.029
Third	24.2	1.90	12.74	21.23	11.95	0.061	0.039
Lactation/breeding	25.1	2.12	13.80	23.08	13.38	0.060	0.042
COW 1200 lb mature BW 20 lb of milk							
First	26.5	2.28	14.54	24.25	13.01	0.064	0.039
Second	24.1	1.50	11.07	18.48	9.32	0.036	0.032
Third	24.2	1.90	12.74	21.23	11.95	0.061	0.039
Lactation/breeding	27.7	2.83	16.25	27.11	14.75	0.082	0.054

Female Requirements, lb

	DMI lb/d	CP lb/d	20% feed lb/d	32% feed lb/d
HEIFER 1200 lb mature BW 10 lb of milk				
First	19.8	1.42	1.2	0.7
Second	21.5	1.58	2.0	1.3
Third	23.7	2.06	4.5	2.8
COW 1200 lb mature BW 10 lb of milk				
First	25.2	1.85	3.4	2.1
Second	24.1	1.50	1.6	1.0
Third	24.2	1.90	3.7	2.3
Lactation/breeding	25.1	2.12	4.8	3.0
COW 1200 lb mature BW 20 lb of milk				
First	26.5	2.28	5.7	3.6
Second	24.1	1.50	1.6	1.0
Third	24.2	1.90	3.7	2.3
Lactation/breeding	27.7	2.83	8.6	5.4

Assumptions:
1.2 lbs CP from forage
Cube is 95% DM

Female Requirements, lb

	DMI lb/d	CP lb/d	20% feed lb/d	32% feed lb/d
HEIFER 1200 lb mature BW 10 lb of milk				
First	19.8	1.42	4.3	2.8
Second	21.5	1.58	4.8	3.2
Third	23.7	2.06	6.9	4.6
COW 1200 lb mature BW 10 lb of milk				
First	25.2	1.85	5.6	3.8
Second	24.1	1.50	4.1	2.7
Third	24.2	1.90	6.0	4.0
Lactation/breeding	25.1	2.12	7.0	4.7
COW 1200 lb mature BW 20 lb of milk				
First	26.5	2.28	7.6	5.1
Second	24.1	1.50	4.1	2.7
Third	24.2	1.90	6.0	4.0
Lactation/breeding	27.7	2.83	10.2	6.8

Assumptions:
2.86% CP in Forage
Cube is 95% DM

Female Requirements, lb

Assumptions:
46% TDN

	DMI lb/d	CP lb/d	TDN lb/d	TDN Supplied lb/day
HEIFER 1200 lb mature BW 10 lb of milk				
First	19.8	1.42	10.01	9.1
Second	21.5	1.58	11.10	9.9
Third	23.7	2.06	13.44	10.9
COW 1200 lb mature BW 10 lb of milk				
First	25.2	1.85	13.13	11.6
Second	24.1	1.50	11.07	11.1
Third	24.2	1.90	12.74	11.1
Lactation/breeding	25.1	2.12	13.80	11.5
COW 1200 lb mature BW 20 lb of milk				
First	26.5	2.28	14.54	12.2
Second	24.1	1.50	11.07	11.1
Third	24.2	1.90	12.74	11.1
Lactation/breeding	27.7	2.83	16.25	12.7

Water Contributions

Suboptimal Water Intake

- We often think of lack of water as severe dehydration

- Try to think about water like other aspects of production. There is an optimum and intake that is less than optimum will result in varied physiological responses

- Relative to water, dry matter intake is significantly impacted by “water quality”

Water Quality and Intake

Table 2. Intake and performance of growing steers supplied water with various total dissolved solid and sulfate levels in western South Dakota (Least Squares Mean)[a]

	Total Dissolved Solid/Sulfate Level, ppm				
Item	1,226/441	2,933/1,725	4,720/2,919	7,268/4,654	SEM
Initial Weight, lb	642	640	640	639	2
Final Weight, lb[b]	827	812	794	710	5
ADG, lb/d[b]	1.78	1.65	1.48	0.61	0.11
DM Intake, lb/d[b]	20.79	20.62	18.95	13.18	0.95
Gain/Feed[b]	0.086	0.080	0.078	0.045	0.005
Water Intake, gallons/d[c]	15.04	13.43	11.97	9.53	0.62

[a]Cattle fed a consistent diet (0.97 Mcal/kg NEg) and provided various water for 104 days during the summer.
[b]Measurements declined quadratically with increasing total dissolved solids and with increasing sulfates ($P < 0.05$).
[c]Measurements declined linearly with increasing total dissolved solids and with increasing sulfates ($P < 0.01$).

Intake, ADG, and Gain/Feed declined with increasing TDS/Sulfate concentrations!

Patterson et al., 2004
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Management Considerations: Drought

- Water from forage
- Assume cow requires 24 lbs DM
  - 88% DM = consume 27 lbs forage = 3.34 lbs H2O (1/2 gallon)
  - 60% DM = consume 40 lbs forage = 16 lbs H20 (1.5-2.0 gallons)
- Cows grazing green forage can obtain up to 8 gallons water from grazing alone (Ted McCollum)

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Questions?

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