TEXAS A&M AGRILIFE EXTENSION

Supplementation Basics for Cow-Calf Operations

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Hay Feeding Scenarios

- ~~cheap and easy~~
- easiest and least expensive
- frequent labor when needed, less expensive
- less consistent labor, more expensive

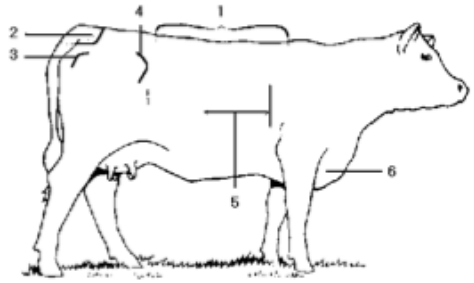
What 3 primary things affect supplementation of energy & protein?

BCS
forage & hay quality
nutrient requirements

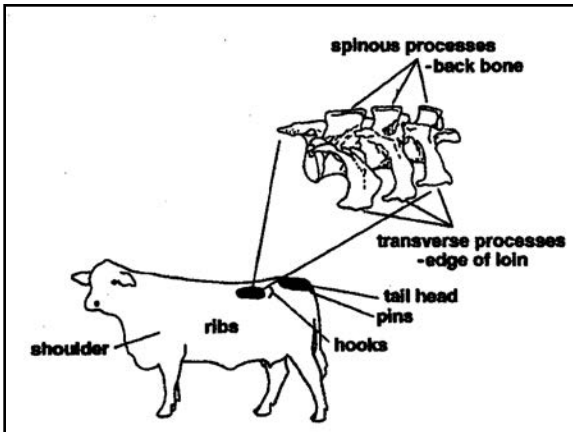
Performance Terminology

Growing Cattle: ADG Cows: BCS

Areas to evaluate Body Condition



1. BACK 3. PINS 5. RIBS
2. TAIL HEAD 4. HOOKS 6. BRISKET



BCS of 3

Visible	Visible	Visible	No fat	No fat	None
Ribs	Spine	Hooks/Pins	Tailhead	Brisket	Muscling

BCS of 4

Foreribs visible	Slightly visible	Visible	No fat	No fat	Some
Ribs	Spine	Hooks/Pins	Tailhead	Brisket	Muscling

BCS of 5

1 or 2 may be visible	Not visible	Visible	No fat	No fat	Full
Ribs	Spine	Hooks/Pins	Tailhead	Brisket	Muscling

BCS of 6

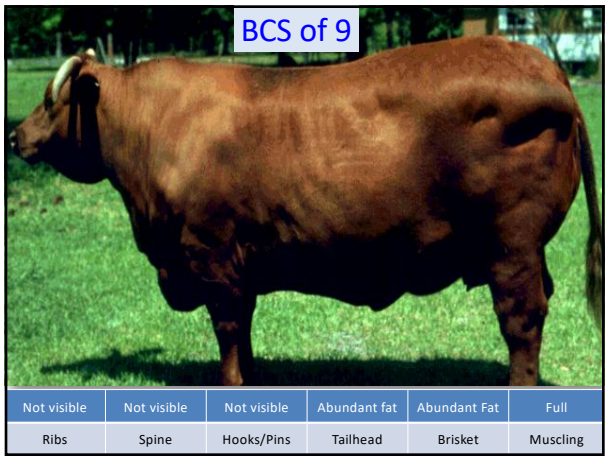
Not visible	Not visible	Visible	Some fat	Some fat	Full
Ribs	Spine	Hooks/Pins	Tailhead	Brisket	Muscling

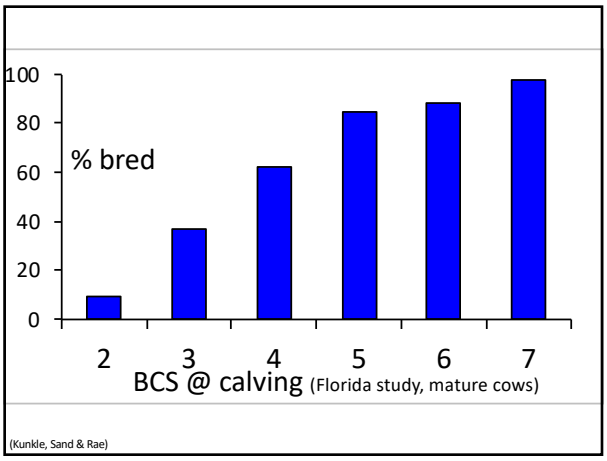
BCS of 7

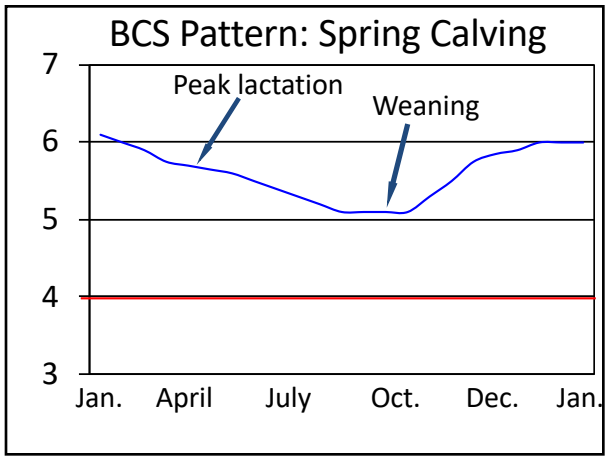
Not visible	Not visible	Slightly visible	Some fat	Fat	Full
Ribs	Spine	Hooks/Pins	Tailhead	Brisket	Muscling

BCS of 8

Not visible	Not visible	Not visible	Abundant fat	Abundant Fat	Full
Ribs	Spine	Hooks/Pins	Tailhead	Brisket	Muscling







Forage Quality and Forage Intake

as forage quality declines forage intake decreases

- low quality forage = low intake
- high quality forage = higher intake

Factors Affecting Forage Quality

- maturity
- species
- temperature
- rained on hay

Maturity

Interval between cuttings	% TDN	Yield, tons/acre
3 weeks	65.2	7.9
4 weeks	61.9	8.4
5 weeks	59.3	9.2
6 weeks	58.0	10.3
8 weeks	54.1	10.2
12 weeks	51.0	10.4

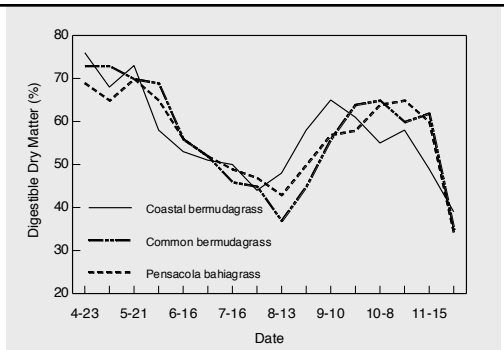
- Coastal bermudagrass study in Georgia
- Glen Burton

Species

cool season > warm season

annuals > perennials

- winter annuals (i.e. ryegrass, rye, oats, etc.)
- crabgrass
- johnsongrass
- Tifton 85
- bahiagrass
- bermudagrass



Time of year influences the quality of warm-season perennial grasses.

(Duble, 1970; pasture samples taken at Overton)

Determining Forage Quality

sample each cutting

TDN (i.e. energy)

- summative equations
- NDF, ash, CP
- NDF digestibility
- cattle, horses, etc.

Crude Protein

approx. cost $50

Components	As Fed	DM
% Moisture	9.1	
% Dry Matter	90.9	
% Crude Protein	6.2	6.8
% Adjusted Crude Protein	6.2	6.8
% Acid Detergent Fiber	45.3	49.8
% Neutral Detergent Fiber	56.1	61.8
% NFC	22.3	24.5
% TDN	52	57
NEL, Mcal/Lb	.46	.51
NEM, Mcal/Lb	.46	.51
NEG, Mcal/Lb	[illegible]	.26
IVTD 48hr, % of DM	[illegible]	69
NDFD 48hr, % of NDF	[illegible]	50

57% TDN

Components	As Fed	DM
% Moisture		
% Dry Matter		
% Crude Protein	6.2	6.8
% Adjusted Crude Protein	6.2	6.8
% Acid Detergent Fiber	45.3	49.8
% Neutral Detergent Fiber	56.1	61.8
% NFC	11.8	13.0
% Ash	16.55	18.21
% TDN	42	46
NEL, Mcal/Lb	.37	.41
NEM, Mcal/Lb	.31	.34
NEG, Mcal/Lb	.[illegible]	.09
IVTD 48hr, % of DM		69
NDFD 48hr, % of NDF		50

18.21% Ash

46% TDN

Forage Testing Laboratories

Dairy One Forage Lab

Ithaca, NY; 800-344-2697

http://www.dairyone.com

- wet chemistry will always work
- NIR can be used if lab has forage specific database

Determining Forage Quality

Pasture:

forage species

growing conditions

fecal consistency

Nutrient Requirements

Cow Stage of Production*	CP, % of DM	TDN, % of DM
2-yr-old lactating cow**	11	62
3-yr-old lactating cow**	11.5	63
mature lactating cow**	11.5	63

*Estimated dietary requirements to maintain cow body condition for Brahman influenced cows under typical production conditions (Beef Cattle NRC, 1996). These requirements will vary depending on numerous factors including animal weight, body condition, breed, environmental factors, and others.
**Requirements for lactating cows are at peak lactation.

Cow Stage of Production*	CP, % of DM	TDN, % of DM
2-yr-old lactating cow**	11	62
3-yr-old lactating cow**	11.5	63
mature lactating cow**	11.5	63
3-yr-old dry cow, 270 d pregnant	9	58
mature dry cow, 270 d pregnant	8	55
mature dry cow, 180 d pregnant	7	49

*Estimated dietary requirements to maintain cow body condition for Brahman influenced cows under typical production conditions (Beef Cattle NRC, 1996). These requirements will vary depending on numerous factors including animal weight, body condition, breed, environmental factors, and others.
**Requirements for lactating cows are at peak lactation.

Cow Stage of Production	CP, % of DM	TDN, % of DM
2-yr-old lactating cow	11	62
3-yr-old lactating cow	11.5	63
mature lactating cow, 25 lbs of milk	11.5	63
mature lactating cow, 15 lbs of milk	10	60
3-yr-old dry cow, 270 d pregnant	9	58
mature dry cow, 270 d pregnant	8	55
mature dry cow, 180 d pregnant	7	49

*Estimated dietary requirements to maintain cow body condition for Brahman influenced cows under typical production conditions (Beef Cattle NRC, 1996). These requirements will vary depending on numerous factors including animal weight, body condition, breed, environmental factors, and others.

but….what if the cows look like this?

Components	As Fed	DM
% Moisture	8.0	
% Dry Matter	92.0	
% Crude Protein	11.3	12.2
% Adjusted Crude Protein	11.3	12.2
% Acid Detergent Fiber	37.3	40.6
% Neutral Detergent Fiber	64.8	70.5
% NFC	11.6	12.6
% TDN	50	54
NEL, Mcal/Lb	.38	.41
NEM, Mcal/Lb	.42	.46
NEG, Mcal/Lb	.19	.21

Hay Feeding Scenarios

- ~~cheap and easy~~
- easiest and least expensive
- less consistent labor, more expensive
- frequent labor when needed, less expensive

Easiest,
Least Expensive

Frequent Labor When Needed,
Less Expensive

When do we supplement?

for most beef cow-calf operations protein and/or energy supplementation is generally needed

- late summer when forage quality declines
- during the winter

What type of supplement is needed?

protein energy

a combination of energy and protein

Prices quoted on: 9-9-15

Ingredient	$/50 lb	$/ton	% TDN, DMB	% CP, DMB
12% cube	$7.10	$284	81	13.6
20% cube	$7.80	$312	65	22.7
20% cube, breeder	$8.60	$344	77	22.7
38% cube	$10.60	$424	75	43.2

Energy Sources

- 12-14% cubes
- corn
- soybean hulls
- wheat midds
- rice bran

gradually increase levels in the diet

Energy and Protein Sources

- 20% cubes "breeder"
- 20% cubes
- corn gluten feed
- distillers grains
- winter pasture
- whole cottonseed (max. 25% of diet)

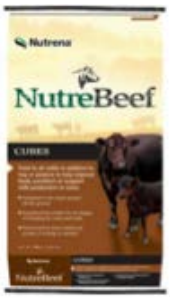
gradually increase levels in the diet

Protein Sources

- 40% cubes
- cottonseed meal
- soybean meal
- sunflower meal
- alfalfa hay
- winter pasture

Less Consistent Labor, More Expensive

20% cubes



VS

20% tub

$10.60/50 lb sack
$424/ton

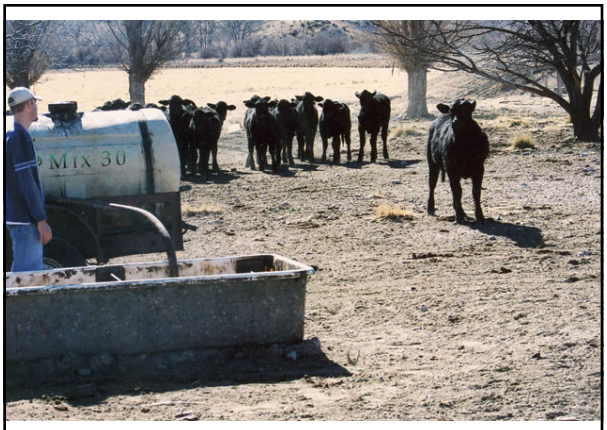
$98.95/225 lb tub
$880/ton

Generally, on all FS protein supplements one tub to 25 head will achieve a .5 to .75 of a pound per-head per-day consumption, which is all that cattle need.

???

Common floor stock formulations: 1 – 3 lbs of intake

Can Provide More Energy



Custom formulations

Starting Point

Hay: 45% TDN, 5.0% CP

Dry cow
- goal: maintain BCS
- 8 lbs of 20% cubes

Wet Cow
- goal: control weight loss
- 11 lbs of 20 % cubes

Hay: 50% TDN, 6.5% CP

Dry cow
- goal: maintain BCS
- 4 lbs of 20% cubes

Wet Cow
- goal: control weight loss
- 6 lbs of 40 % cubes

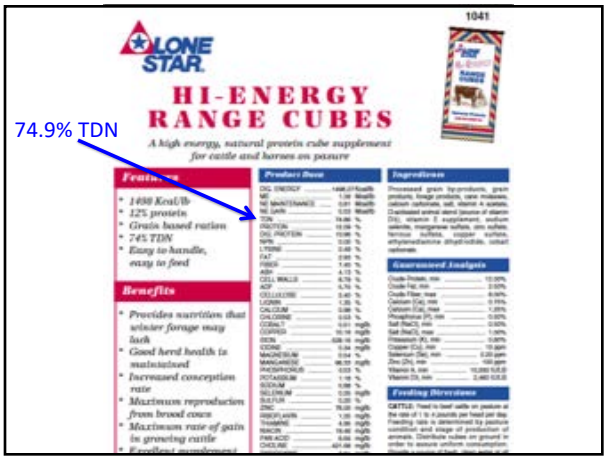
Hay: 55% TDN, 9.0% CP

Dry cow
- goal: maintain BCS
- hay only

Wet Cow
- goal: control weight loss
- 2 lbs of 40 % cubes

Monitor and adjust your supplementation program as performance dictates

Pricing Supplements



Need Protein

20% CP cube (no NPN)
- $10.30 per 50 lb sack
- 10 lb CP per sack (50 x 0.20 = 10 lb of CP)
- $1.03/lb of CP ($10.30 ÷ 10 = $1.03/lb)

38 % CP cube
- $13.55 per 50 lb sack
- 19 lb CP per sack (50 x 0.38 = 19 lb of CP)
- $0.71/lb of CP ($13.55 ÷ 19 = $0.71/lb)

Need Energy

20% CP cube (high energy, 70% TDN, AFB)
- $10.30 per sack
- 35 lb of TDN per sack (50 x 0.70 = 35 lb)
- $0.29/lb of TDN ($10.30 ÷ 35 = $0.294/lb)

38% CP cube (67 % TDN, AFB)
- $13.55 per 50 lb sack
- 33.5 lb TDN per sack (50 x 0.67 = 33.5 lb)
- $0.40/lb of TDN ($13.55 ÷ 33.5 = $0.404/lb)

Supplementation Frequency

Frequency of Supplementation

protein supplements
(no NPN or antibiotics)

- everyday
- 3 times/wk
- 2 times/wk
- 1 time/wk ??

- everyday
  - 2 lbs
- 3 times/wk
  - 4.7 lbs
- 2 times/wk
  - 7 lbs
- 1 time/wk ??
  - 14 lbs

Frequency of Supplementation

energy supplements

- best to feed everyday
- if feeding small amounts, can feed every other day
- feeding at less frequent intervals can lead to big problems

feeding 3 times a week reduced ADG by 10% compared with daily feeding (Loy et al., 2008)

- 3 supplements, 2 supplementation levels

Additional Considerations

- Subacute ruminal acidosis reduces sperm quality in beef bulls (Callaghan et al., 2016)
- Bulls were on free choice hay and 0.5% of BW concentrate for 125 days prior to challenge
- Challenged 1 day with rapidly fermentable CHO source
- Percent normal sperm reduced
- Percent normal sperm still lower at 88 days after challenge

TEXAS A&M AGRILIFE EXTENSION

Mineral Supplementation for Beef Cow-Calf Operations

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Disclaimers

The information given herein is for educational purposes only.

Reference to trade name is made with the understanding that no discrimination is intended and no endorsement is implied by the Texas A&M AgriLife Extension Service.

Only a partial listing of available products and companies is included and no discrimination is intended by the omission of a product.

Listed values do not guarantee current company specifications.

mineral nutrition impacts

- growth
- reproduction
- milk production
- health

PROFITABILITY




Components of a Complete Mineral Supplement

- salt
- macro minerals
- trace minerals (aka micro minerals)
- vitamins A, D, and E

Macro	Trace (micro)
% of diet	ppm or mg/kg
• calcium	• copper
• phosphorus	• zinc
• potassium	• manganese
• magnesium	• selenium
• sodium	• iodine
• sulfur	• cobalt
	• iron
	• *others*

Differences Between Companies

- formulation
- mineral source
- reputation
- palatability enhancers
- research programs
- targeted intake
- weatherization

Common Formulations

- higher-calcium, lower phosphorus
- similar Ca & P levels
- winter pasture (higher Mg)

	Emerald	Bronze	Gold
Calcium	16	12.5	12.5
Phosphorus	5	8	2
Salt	15 - 16	15 - 17	13 - 15
Magnesium	5	3	13
Potassium	0.1	2	0.2
Copper	2,500	2,500	1,500
Zinc	4,500	6,000	4,500
Manganese	4,000	4,000	4,000
Selenium	26	26	26
Iodine	200	200	200
Cobalt	20	20	20
Vitamin A	100,000	100,000	100,000
Vitamin D	-	10,000	-
Vitamin E	100	110	100

3 basic formulas, common in Texas

- Texas All Season 7.5 Complete
- Texas All Season 12 Complete
- Hi-Magnesium Complete

	Texas All Season 7.5 Complete	Texas All Season 12 Complete	Hi-Magnesium Complete
Calcium	15	14	14
Phosphorus	7.5	12	4
Salt	20	24	18
Magnesium	1	1	10
Potassium	1	1	0.1
Copper	2,500	2,500	1,200
Zinc	7,500	7,500	3,600
Manganese	4,000	4,000	3,600
Selenium	27	27	27
Iodine	60	60	60
Cobalt	12	12	12
Vitamin A	150,000	150,000	75,000
Vitamin D	15,000	15,000	7,500
Vitamin E	150	150	75

Targeted Intake

2 or 4 oz.

- most are 4 oz.
- 2 oz. example: Moorman's Range Minerals

target of 4 oz.

- average intake of 3 – 4 oz. would be acceptable

Se level

- 4 oz: commonly 25 - 27 mg

Additive Options

Additives

researched

- IGR
- CTC
- bovatec
- rumensin

- bovatec is not labeled for cows

- Texas All Season 7.5 Complete
- Texas All Season 7.5 Complete AU5600
- Texas All Season 7.5 Complete ALT
- Texas All Season 7.5 Complete AU5600-ALT

Additives

researched
- IGR
- CTC
- bovatec
- rumensin

not well researched or limited/no benefits
- there is a long list of these
- be cautious of claims
- be aware of selectively reporting research
- many would not justify the added cost

Geographic & Forage System Considerations

Native Range

dormant forages
- most mineral concentrations decrease with time especially P & K

protein and energy supplement can greatly impact the Ca:P ratio of the mineral needed

consider K level in protein and energy supplements

product	intake, lbs	% P	gm P supplied
15:4 mineral	0.25	4	4.5
12:9 mineral	0.25	9	10.2
12:9 mineral	0.125	9	5.1
cottonseed meal	2	1.1	10.0
DDGS	2	0.7	6.4

Native Range

Calcium content of the soil
- just because the soil is high in Ca or is sitting on a limestone base doesn't mean the plant will take up more Ca

- bermudagrass average Ca: 0.43%
- native forages average Ca: 0.48%

Winter Pasture

grass tetany concern for cows

- need consistent intake of Mg
  - 5% or greater Mg level
- salt is important for absorption of Mg
- milk fever and grass tetany may both be involved in some cows
  - want higher Ca, lower P level

Poultry Litter

- inverted Ca:P ratio in forage
- milk fever and grass tetany concerns
- may need P free mineral

Trace Mineral Considerations

- copper
- zinc
- manganese
- selenium
- iodine
- cobalt

Cu, Zn, and Mn

the copper race

- many products have way more copper than needed
- a few are at levels that are concerning

desirable ratios

- 1:4 or 1:3 for Cu: Zn
- 1:2 for Cu:Mn is probably sufficient

Copper

- female: no effect
- male: probably no effect

Zinc

- female: very little data in cattle, but important in ovarian remodeling and CL production
- male: impacts testicular growth

Manganese

- female: possible estrous effect
- male: no claims

Selenium

requirement
- 1.30 mg/d for 1250 lb cow

legal limit
- 3 mg/d
- that is 2.31 times requirement

Se has the smallest safety margin of any trace mineral; toxicity could be a concern if getting more Se from other sources

Iodine

preferred forms
- calcium iodate
- EDDI (organic form)

don't want
- potassium or sodium iodide
- less stable

to much calcium iodate has been reported to reduce weight gain and feed intake

Sources of Trace Minerals

inorganic
- ionic bond
- copper sulfate, zinc oxide, sodium selenite, etc.

organic
- covalent bond to carbon-containing ligand
- mineral bonded to: amino acid, protein, or CHO
- zinc methionine, copper amino acid complex, cobalt glucoheptonate, etc.

hydroxy
- covalent bond to a hydroxy (OH) group
- zinc hydroxychloride, basic copper chloride, manganese hydroxychloride

inorganic vs. organic vs. hydroxy

research is inconsistent on animal growth, reproduction, and health

organic and hydroxy sources are likely safer for vitamins added to mineral supplements

availability of copper oxide is extremely low

Things to consider if you choose to feed a mineral with organic sources of trace minerals.

- What trace minerals are supplied by organic sources?
- How much of the trace mineral is supplied by an organic source?

How Much of the:
Cu, Zn, Mn, & Co
comes from an organic source?

PURINA® WIND AND RAIN® STORM® ALL SEASON 7.5 AVAILA® 4 COMPLETE

INGREDIENTS:

Dicalcium Phosphate, Monocalcium Phosphate, Calcium Carbonate, Salt, Processed Grain By-Products, Vegetable Fat, Mineral Oil, Magnesium Oxide, Iron Oxide, Vitamin E Supplement, Vitamin A Supplement, Silica Dioxide, Zinc Amino Acid Complex, Manganese Amino Acid Complex, Copper Amino Acid Complex, Ethylenediamine Dihydriodide, Cobalt Glucoheptonate, Vitamin D_3 Supplement, Natural and Artificial Flavors, Sodium Selenite.

Meets 100% of zinc, copper, manganese and cobalt trace mineral requirements using Zinpro® Availa®4 complex trace minerals at a 4 ounce consumption rate.

Contains chelated/ organic trace minerals.

INGREDIENTS

Molasses products, monocalcium phosphate, dicalcium phosphate, magnesium oxide, dehydrated seaweed meal, hydrolyzed vegetable oil, calcium carbonate, manganous oxide, manganese sulfate, manganese amino acid complex, zinc oxide, zinc sulfate, zinc amino acid complex, copper sulfate, copper chloride, copper amino acid complex, ethylenediamine dihydroiodide, calcium iodate, cobalt glucoheptonate, cobalt carbonate, sodium selenite, vitamin A acetate, vitamin D-3 supplement, vitamin E supplement, thiamine mononitrate, menadione sodium bisulfite complex, riboflavin supplement, calcium pantothenate, niacin supplement, vitamin B-12 supplement, choline chloride.

Tubs

Thoughts

- most need separate source of salt
- most have a similar Ca:P ratio
- most have less Ca then loose supplements

	Mineral-lyx	IGR Max
Calcium	3.5 - 4.5	5 - 6
Phosphorus	4	5
Salt	none	none
Magnesium	3.0	5.0
Potassium	1.7	1.5
Copper	500	1,000
Zinc	1,500	3,000
Manganese	2,000	4,000
Selenium	8.8	13.2
Iodine	25	50
Cobalt	5	10
Vitamin A	100,000	200,000
Vitamin D	10,000	20,000
Vitamin E	100	200

recommended intake
mineral-lyx: 4.8 to 12 oz.
IGR max: 4 oz.

	AS 4 CP add Zn& Cu	MAG Mineral Tub
Calcium	4.5	5.5
Phosphorus	4	4
Salt	10	0
Magnesium	1	5
Potassium	1	2
Copper	1,250	650
Zinc	3,750	2,375
Manganese	1,250	1,250
Selenium	10	10
Iodine	68	68
Cobalt	30	30

recommended intake 4 to 8 oz.

need to put salt out with the “MAG” tub

Blocks

	Big 6	Se-90	Iodized	Sulfur
Calcium				
Phosphorus				
Salt	96 - 99	95 – 98.5	97 – 99.7	95 - 97
Magnesium				
Potassium				
Sulfur				3
Copper	260 - 380	280 - 420		
Zinc	320	3,500		
Manganese	2,400	1,800		
Selenium		90		
Iodine	70	100	100	
Cobalt	40	60		
Vitamin A				
Vitamin D				
Vitamin E				

American Stockman Big 6® Trace Mineralized Salt is the most popular in the eastern half of the United States. With the six core micro-minerals required for animal health - zinc, manganese, cobalt, copper, iodine and iron - it's the first choice for weight gain, feeding efficiencies and overall herd performance. For all classes of beef and dairy cattle, pigs and horses.

Ingredients:

Salt, Manganous Oxide, Ferrous Carbonate, Magnesium Oxide, Copper Oxide, Zinc Oxide, Calcium Iodate, Cobalt Carbonate, Red Iron Oxide for Color.

Guaranteed Analysis:

Salt (min.) 96.0%, Salt (max.) 99.0%, Manganese (min.) 2,400 ppm, Iron (min.) 2,400 ppm, [illegible] (min.) 260 ppm, Copper (max.) 380 ppm, Zinc (min.) 320 ppm, Iodine (min.) 70 ppm, Cobalt (min.) 40 ppm.

Feeding Instructions:

Allow livestock free access to this feed salt.

Ingredients:

Salt, Sulfur, FD&C Yellow #5 Dye for Color.

Guaranteed Analysis:

Salt (min.) 95.0%, Salt (max.) 97.0%, Sulfur (min.) 3.0%.

Things That Don't Make Sense To Me

- having more P than Ca in the mineral
- not having any Ca in the mineral
- putting sodium bicarbonate in a mineral
- adding sulfur to the mineral

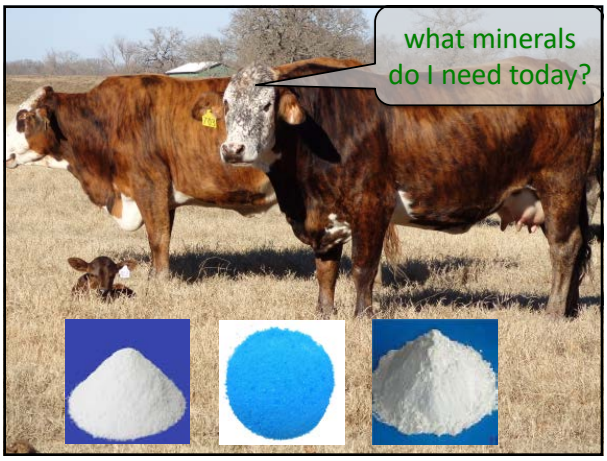
Injectable Products

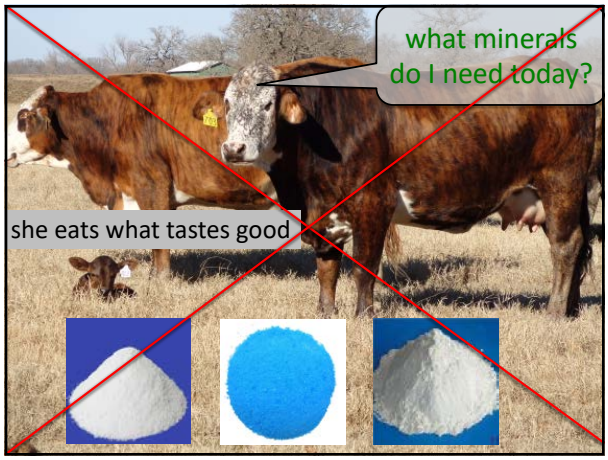
Can an animal get too much mineral?

What else if being consumed or feed?

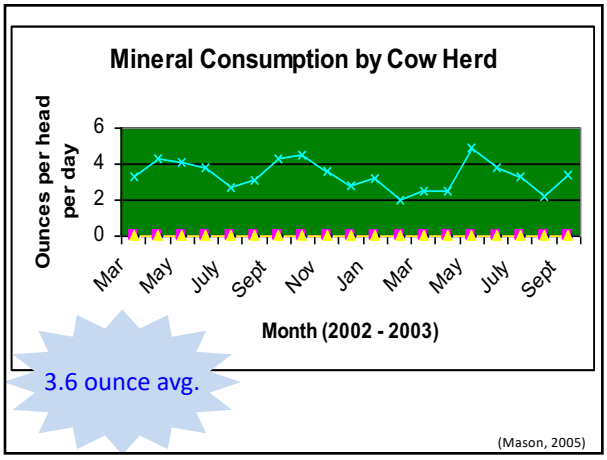
Mineral Feeders

Mineral Intake





- 2 or 4 oz. average consumption
- intake varies over time
- lactation may increase intake, 2 to 2.5x



- if intake is to high
  - provide free choice salt
  - check location of mineral feeder
  - reduce amount of mineral fed
- if intake is low
  - determine if cattle are receiving salt from another source
  - check location of mineral feeder

- salt
  - initially encourages intake
  - as salt consumption increases mineral intake is reduce
- phosphorus
  - generally decreases intake
- magnesium
  - generally decreases intake

additives that stimulate intake

- molasses, yeast, other flavoring agents
- mineral oil and weatherization products

Calculating Mineral Intake

- 35 cows
- put 50 lbs of mineral in an empty feeder
- mineral lasts for 6 days
- 50 lbs ÷ 6 days = 8.33 lbs per day for the herd
- 8.33 lbs per day ÷ 35 hd = 0.24 lbs/hd/d
- 16 oz. x 0.24 lbs = 3.8 oz./hd/d

IGR

Horn Fly Control: Feed Additives

Insect Growth Regulators (IGR)
methoprene (ex. Altosid)

- dosage 0.8 – 1.5 mg/100 lbs
- 1300 cow: 10.4 – 19.5 mg/d

4 oz. intake

- 80 gm/ton = 10 mg/d
- 120 gm/ton = 15 mg/d
- 160 gm/ton = 20 mg/d

When and What Do I Feed

Reputable Company with a Nutritionist on Staff

Consider Flexibility

When should I feed a cow-calf mineral?

- year round is best
- last 3, first 3
- provide salt at other times

introduced pasture and hay

- higher Ca, lower P

winter pasture

- higher Ca, lower P
- 5% or more Mg, make sure intake is good

growing native range

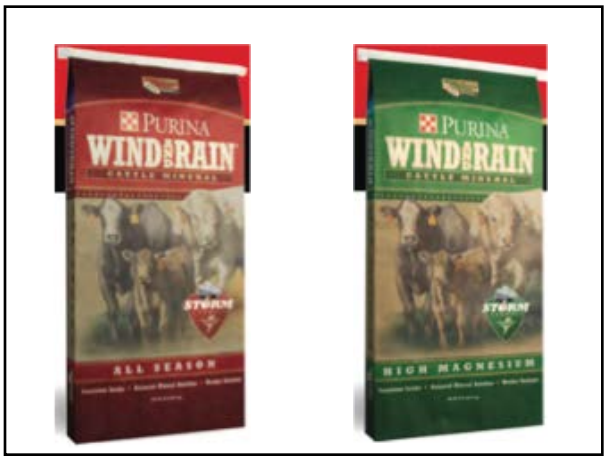
- higher Ca, lower P

dormant native range (with protein/energy supplement that has some P)

- higher Ca, lower P
- if possible get protein/energy supplement with added K

dormant native range (no protein/energy supplement)

- similar Ca & P levels
- make sure intake is adequate



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