

Refining our Mineral Nutrition Program

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Objective of Supplementation

Provide for animal needs
 Low cost
 Livestock do not read the labels

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Types of Minerals

Macro
 Ca, P, K, Mg, S
 Required in %
 .1 to .7%

Micro
 Zn, Se, Co, Cu,
 Mn, I, Fe
 PPM or mg/kg

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Do I have a problem?

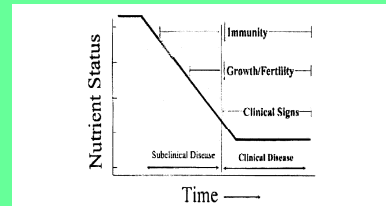
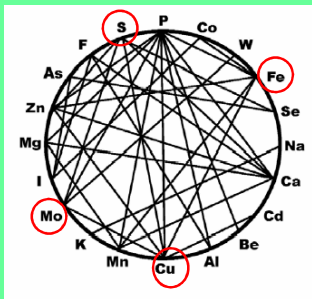


Figure 1. Schematic depiction of the relationship between nutrient status and presence of subclinical or clinical disease manifestations. (Redrawn from S. Wisse, 1992, Texas A&M University Beef Cattle Short Course).

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Mineral Interactions



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Copper Antagonist	Deficient	Ideal	Antagonistic Level**		MTC*
			Marginal	High	
Iron (ppm)	below 50	50-200	>200-400	>400	1000
Molybdenum (ppm)	---	below 1	1-3	above 3	5
Sulfur (% DM)	below .10	.15- .20	> .20-.30	>.30	.40

*Maximum Tolerable Concentration

**Levels above these can potentially adversely affect copper availability

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Iowa Beef Center Forage Survey 2010

Type	Region	ppm									
		Mn	SD	Zinc	SD	Copper	SD	Iron	SD		
Grass	1	77.7	53.3	31.8	6.4	8.6	2.3	312.7	242.1		
Grass	2	77.1	21.1	22.1	5.7	9.8	2.4	532.2	297.0		
Grass	3	108.6	53.8	30.3	10.4	9.8	2.0	304.0	103.1		
Grass/Legume	1	45.9	6.8	27.7	2.2	14.6	10.6	492.8	137.5		
Grass/Legume	2	70.7	23.6	28.7	5.0	10.5	2.7	299.0	126.8		
Grass/Legume	3	115.3	58.0	49.5	67.4	9.3	2.0	551.4	414.1		
Legume	1	34.2	2.0	31.1	4.9	15.3	9.2	241.7	104.7		
Legume	2	45.4	17.5	28.9	5.8	8.8	0.9	444.7	296.6		
Legume	3	65.5	17.0	28.9	1.1	9.3	0.8	551.2	181.3		

Region 1: north of I-80; Region 2: southwest IA; Region 3: southeast IA
n = 3 per type per region

Mod. def

Mod. to high antagonism

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IBC & ISWPB Micro mineral Survey 2016

50 samples	Aver	SD	Mark	Shane
Copper	9.7	3.5	11.2	3.8
Iron	351	222	174	158
Zinc	26.4	8.0	37.7	10.8
Manganese	90.2	43.1	97.7	92.1
Molybdenum	1.9	1.1	2.2	6.8
Selenium	.24	.21	.71	.32
Cobalt	.44	.47	<.5	<.5
Iodine	.35	.21	.31	.32

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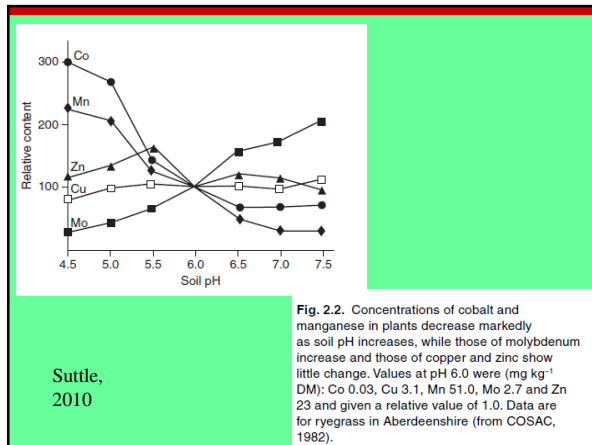


Fig. 2.2. Concentrations of cobalt and manganese in plants decrease markedly as soil pH increases, while those of molybdenum increase and those of copper and zinc show little change. Values at pH 6.0 were (mg kg⁻¹ DM): Co 0.03, Cu 3.1, Mn 51.0, Mo 2.7 and Zn 23 and given a relative value of 1.0. Data are for ryegrass in Aberdeenshire (from COSAC, 1982).

2016 Forage Survey Results

Trace Mineral	2016 Average	SD	1994 Average	2007 Sheep NRC Req.	Toxic level sheep
Copper	11.5	9.78	11.0	5 to 8	10 to 25
Molybdenum	1.9	1.1	NA	0.50	10 ^a
Iodine	0.35	0.21	NA	0.6 ^b	50
Selenium	0.24	0.21	0.28	0.9 ^c	2
Zinc	26.4	8.0	26.0	35 to 40	500
Manganese	90.0	43.0	75.0	20 to 40	1000
Cobalt	0.44	0.47	NA	0.24	10
Iron	380	298	300	30	500

^a Problems with copper deficiency will happen way below this level. Copper:molybdenum ratio 6:1 up to 10:1. Must also monitor sulfur levels.
^b Iodine level is based on high milk and high intakes. Requirement increases dramatically (up to 150%) in cold weather.
^c This level is way above FDA approved supplementation rate at .69 mg per head per day.

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Biologically Critical Times for Trace Minerals

Stress increases urinary excretion of Cu, Zn
Weaning, transport/shipping, parasitism, lactation and cold stress

Reproduction (conception and fetal development, including fetal liver mineral storage)

Immune response (vaccination titer response, neutrophil function, other mechanisms?)

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Requirements, 07 NRC

Stage of production
Other mineral levels
Age
Level of production

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Ewe Lambs vs Ewes

		Lambs	Ewes
E. Lactation	Ca	8.6g	12g
E. Lactation	P	7.9g	11g

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Doing the math

Lactating ewes
 4.5 lbs alfalfa hay and 2 lbs corn

$4.5 \times 2.4\% P = .01 \text{ lb P}$

$2.0 \text{ corn} \times .35\% P = .007 \text{ lb P}$

$.017 \text{ lb P} \times 454 \text{ g/lb} = 7.7\text{g provided vs } 11\text{g req.}$

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Meeting animal needs

Mineral Consumption
 Salt driven
 grain byproducts
 molasses

Mineral Density
 Se 10-90 PPM
 controlled by FDA .69mg intake/d

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Mineral Sources

Feedstuffs
 ex. alfalfa hay high calcium

Sheep Mineral contains
 macro and micro minerals
 10-12% calcium
 6-10% phosphorous
 10-35% salt
 expensive \$20-50 per bag

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Sheep Mineral, Kansas

GUARANTEED ANALYSIS		
Calcium	7%	
Phosphorous	5%	
Salt	45%	Better mineral
Sulfur	1%	Calcium not needed with legumes
Magnesium	1%	Phosphorous not needed with corn ?
Zinc	150 PPM short	High salt equals lower intake levels ++
Iodine	125 PPM okay	
Cobalt	150 PPM okay	
Selenium	10 PPM super, super short	

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Mineral sources

Trace mineral salt
 95-98% salt
 only micro minerals
 lower intake required
 lower cost

approx. half price w/ lower intake (mostly salt)
 total cost of mineral supp. 25%

Water may also provide minerals

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Big Gain T.M. SALT w/ Selenium

GUARANTEED ANALYSIS

Salt, min	90.00%	
Salt, max	92.00%	
Zinc, min	0.45%	4500 PPM
Magnesium, min	0.45%	4500 PPM
Manganese, min	0.19%	1900 PPM
Iron, min	0.25%	2500 PPM
Iodine, min	0.025%	250 PPM
Cobalt, min	0.0022%	22 PPM
Selenium	.009%	90 PPM <i>max.</i>
Vit A	235850 IU/lb	
Vit D	79375 IU/lb	
Vit E	2500 IU/lb	39 IU/hd/d

PPM = mg/kg (four decimal places)

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What should You do?

Test forages

Macro minerals

Micro MSU (\$60 to \$150)

Monitor mineral intake

put out set amounts, ex. Week's supply

monitor how long it lasts

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Selenium Deficiency

Reproductive failure

Embryonic mortality (wks 3-4)

White muscle disease

Poor suckling reflex

Indirectly hypothermia/goiter

Deiodinase enzyme

I4 to I3 which is the biologically active form

BAT activity

Reduced growth

Reduced disease resistance

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BMP Selenium

Read mineral tag

Monitor mineral intake

Add to grain mix and force feed

Eliminates animal to animal variation

Needed year round

Pre-caution, some is good more may not be better.

Toxic at 2 ppm

High S decrease absorption (DDGS)

also heavy metals

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Iodine

Lactation Ration = .8 ppm or mg/kg

Most mineral mixtures are short
needs to be 120 ppm mineral
with .5 oz intake

Solution free choice iodized salt in LG
Add eddi to trace mineral .1 in 10 pounds

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Copper Toxicosis

Breed Susceptibility
(Suffolk and Texels)

Mineral interactions-Mo & Su,
along with high Zn & Ca

Normal copper, low molybdenum

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Copper Toxicosis...continued

Prevention

- Sheep specific feeds
- No additional copper
- Feed some Mo

CU & MO are both toxic

CU:MO ratio range 6-1 up to 10-1

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Vitamins

<p>Fat Soluble</p> <ul style="list-style-type: none"> A, night blindness, green feeds D, rickets, sunshine E, white muscle, immune issues K, blood clotting, body synthesis 	<p>B vitamins and C</p> <ul style="list-style-type: none"> No concern with healthy rumen C is synthesized by the sheep
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Vitamins in mineral sources

Vitamins are inactivated during storage

Half life 14-21 days

Do not count on them to help.

EX. 10 IU E per pound of mineral

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Critical Nutrient, Vitamin E

White muscle disease
Interacts with Selenium
Oxidative stress and free radicals

Cellular level metabolism
Free radicals are a product of energy metabolism
Accumulation creates cell/muscle damage
ex. White muscle disease

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ISU Results - Serum E levels in ewes

ISU, 900 IU injected weekly

	Con	E-G	E-L	E-GL
Pretreatment	1.27	1.26		
Pre-lambing	1.51 ^a	1.91 ^b		
Post-lambing ^a	.93 ^a	1.13 ^b		
Mid-lactation	.97 ^a	.95 ^a	1.28 ^b	1.37 ^b
Milk e at 3 days	10.8	15.1		

^{a,b} Row means with different superscripts differ (p<.05).

Base ration was excellent alfalfa hay and corn

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Results - Serum E lambs

Age	Con	E-G	E-L	E-GL
3 days	1.08	1.08		
28 days		.41	.38	1.33 1.33

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BMP Vitamin E

Feed ewes >100 IU/hd/d

late gestation and lactation

Creep feed minimum 40K IU/ton

Up to 100K IU per ton

Do not count on E in mineral

Concentration is **way too low**.

Grazing on green grass no problem

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Late gestation

Stressful which leads to reduced immunity

Cold stress

Milk fever

inadequate calcium or too much other minerals

cation-anion imbalance, see Dairy Nutritionist

occurs in late, late gestation mostly

Reduced immunity leads to more health issues,
(mastitis, respiratory, uterine infections)

Reallocation of nutrients

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On farm vitamin fortification

50 ewes free choice mineral with .5 ounce intake

ADE premix 2 million A, .5 million D and 4000 E / lb

Vitamin E 20,000 iu/lb

Ewes need 3500 IU A and 150-300 IU E

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Mineral recipe

.5 oz X 50 head X 7 days / 16oz = 10.9 lbs add

.7 pounds Kent ADE Premix (storage)

2.5 pounds Vitamin E (20K IU/lb)

.1 pound EDDI

Provides ewes 3800 IU A, 960 D and 138 E

Cost per week \$3.00 or \$3.00 per ewe per year

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What should You do?

Harvest kidney and liver from deads.

Sample forages

Trace minerals are around \$35-50 per sample

Read mineral tags

Monitor mineral intake

Plain salt is not enough

Sheep have zero nutritional wisdom

Consult a nutritionist

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Good Scales



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Questions?

