

COURSE TITLE: Animal Production

SECTION: Principles of Animal Nutrition

COURSE CODE: VETM1111

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Lecture 2

Reminders:

Thur 31 Jan 2013; 7-10 pm

Sat 02 Jan 2013; 6:00 am

Sun 03 Jan; 8:00 am

6. Course Objectives

List of Topics

Part 1: Principles of Animal Nutrition

- 1.1 The Animal and its Food
- 1.2 Comparison of the Digestive Systems in Farm Animals and their practical implications in the feeding of Animals and the Balancing of Rations
- 1.3 What is a Feed?
- 1.4 Components of Feeds/ Feed Nutrients
 - 1.4.1 Lipids/Fats
 - 1.4.2 Carbohydrates [Soluble (Sugars), Starches, Structural (Fibre)]
 - 1.4.3 Proteins
 - 1.4.3.1 Animal Acids
 - 1.4.3.2 True Proteins
 - 1.4.3.3 Non Protein Nitrogen
 - 1.4.4 Vitamins
 - 1.4.4.1 Fat Soluble Vitamins
 - 1.4.4.2 Water Soluble Vitamins
 - 1.4.5 Minerals
 - 1.4.5.1 Macro Minerals
 - 1.4.5.2 Micro Minerals
 - 1.4.6 Water
- 1.5 Classification of Feeds and Feedstuffs with particular reference to the Caribbean Region
- 1.6 Feed Additives
 - 1.6.1 Probiotics
 - 1.6.2 Essential Amino Acids
- 1.7 Ideal Protein Concept
- 1.8 Anti Nutritional Factors
- 1.9 What is a Ration?
- 1.10 Evaluation of Foods and Feeds:
 - 1.10.1 Chemical Composition
 - 1.10.2 Digestibility
 - 1.10.3 Energy Content
 - 1.10.4 Partitioning of Feed Energy within the Animal
 - 1.10.5 Systems of expressing the Energy Value of Feeds
 - 1.10.6 Feed Protein
- 1.11 Feed Intake
 - 1.11.1 As Fed
 - 1.11.2 Dry Matter
 - 1.11.3 Voluntary Feed Intake
- 1.12 Feeding Standards
- 1.13 Ration Formulation
 - 1.12.1 Monogastrics
 - 1.12.2 Ruminants
- 1.14 Feed Conversion Ratio
- 1.15 Feed Conversion Efficiency
- 1.16 Economics of Feeding Animals

Minerals

Minerals

- minerals are inorganic elements, frequently found as salts with either inorganic elements or organic compounds
- proximate feed analyses - ash
- major/macrominerals (>mg-g)
- trace/microminerals (μ g-mg)

Minerals - functions

- rigidity and strength to the skeletal structure
- constituents of organic compounds
- activate enzyme systems
- control fluid balance - Osmotic pressure and excretion
- regulate acid-base balance
- mineral-vitamin relationships (Se - Vit E)
- muscle contraction and CNS

Minerals – Macro/Micro

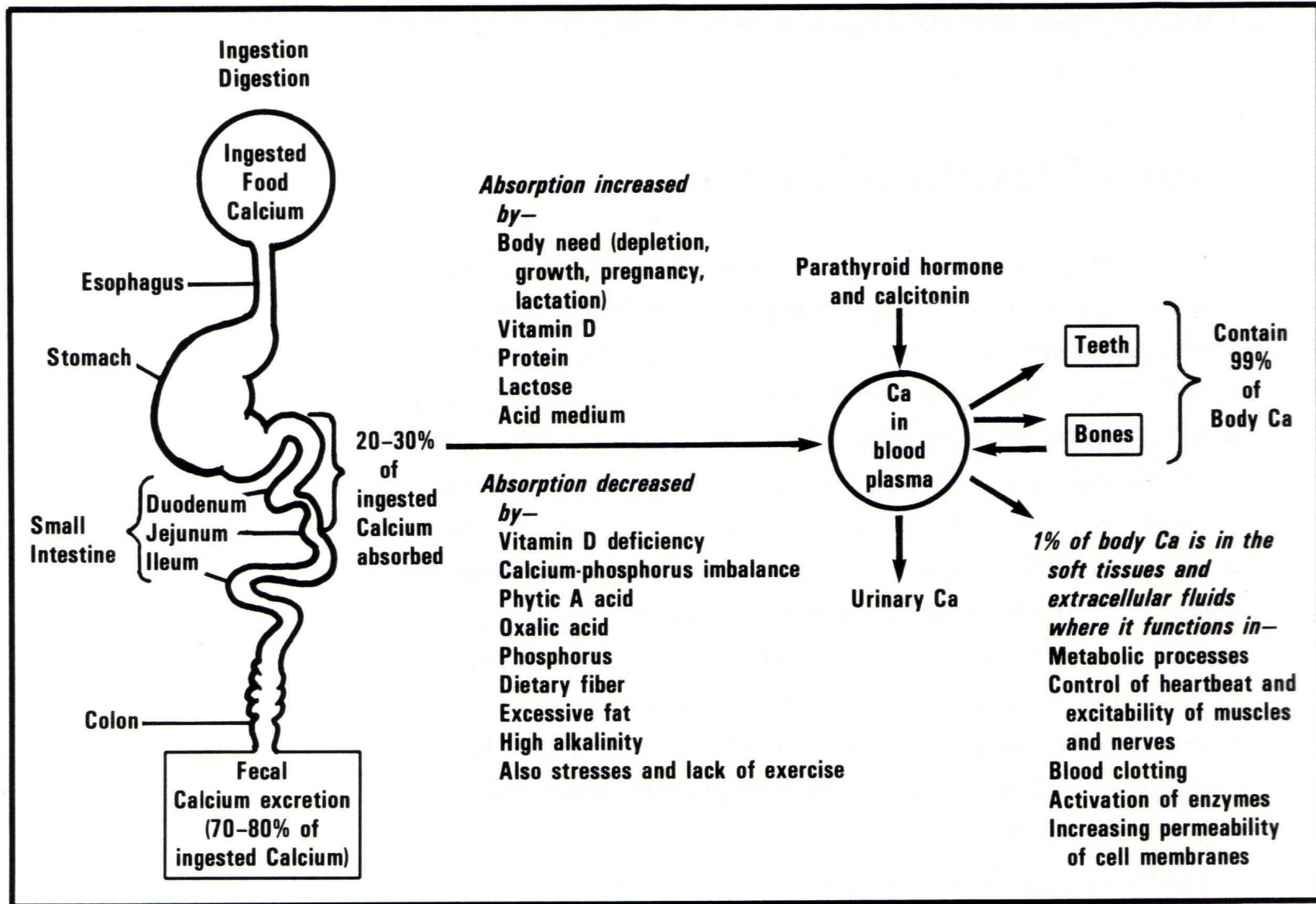
MACRO

- Calcium (Ca)
- Phosphorous (P)
- Sodium (Na)
- Chlorine (Cl)
- Sulphur (S)
- Potassium (K)
- Magnesium (Mg)

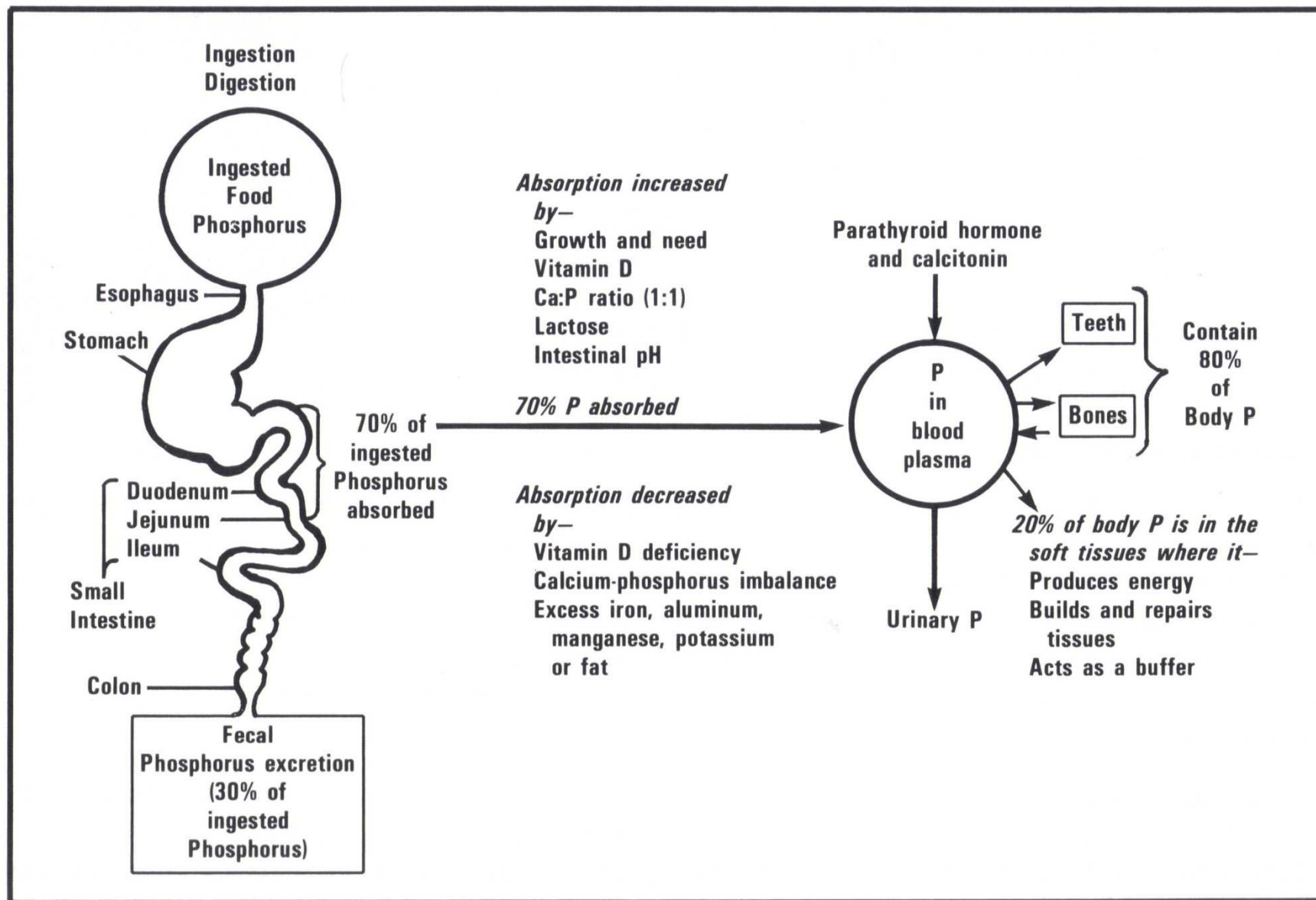
MICRO

- Iron (Fe)
- Copper (Cu)
- Iodine (I)
- Fluorine (F)
- Cobalt (Co)
- Manganese (Mn)
- Molybdenum (Mo)
- Selenium (Se)
- Zinc (Zn)

Calcium



Phosphorus



Macro mineral requirement and maximum tolerable levels for beef cattle

Mineral	Lactating Cows	Dry Cows	Growing Calves	Maximum Tolerable Level
Calcium, %	0.31	0.18	0.58	—
Magnesium, %	0.10	0.12	0.20	0.40
Phosphorus, %	0.21	0.16	0.26	—
Potassium, %	0.60	0.60	0.70	3.0
Sodium, %	0.07	0.07	0.10	—
Sulfur, %	0.15	0.15	0.15	0.40

NRC, 1996. Adapted from NRC. Nutrient Requirements of Beef Cattle, Sixth Edition.

Micro mineral requirement and maximum tolerable levels for beef cattle

Mineral	Lactating Cows	Dry Cows	Growing Calves	Maximum Tolerable Level
Chromium	—	—	—	50.0
Cobalt, ppm	0.1	0.1	0.1	10.0
Copper, ppm	10.0	10.0	10.0	100.0
Iodine, ppm	0.50	0.50	0.50	50.0
Iron, ppm	50.0	50.0	50.0	1000.0
Manganese, ppm	20.0	40.0	40.0	1000.0
Molybdenum, ppm	—	—	—	5.0
Nickel	—	—	—	50.0
Selenium, ppm	0.10	0.10	0.10	2.0
Zinc, ppm	30.0	30.0	30.0	500.0

NRC, 1996. Adapted from NRC. Nutrient Requirements of Beef Cattle, Sixth Edition.

Calcium - deficiency symptoms

- stunting of growth
- ↓ in milk and egg production
- ↓ quality of bones and teeth
- rickets/osteomalasia
- osteoporosis

Phosphorus- deficiency symptoms

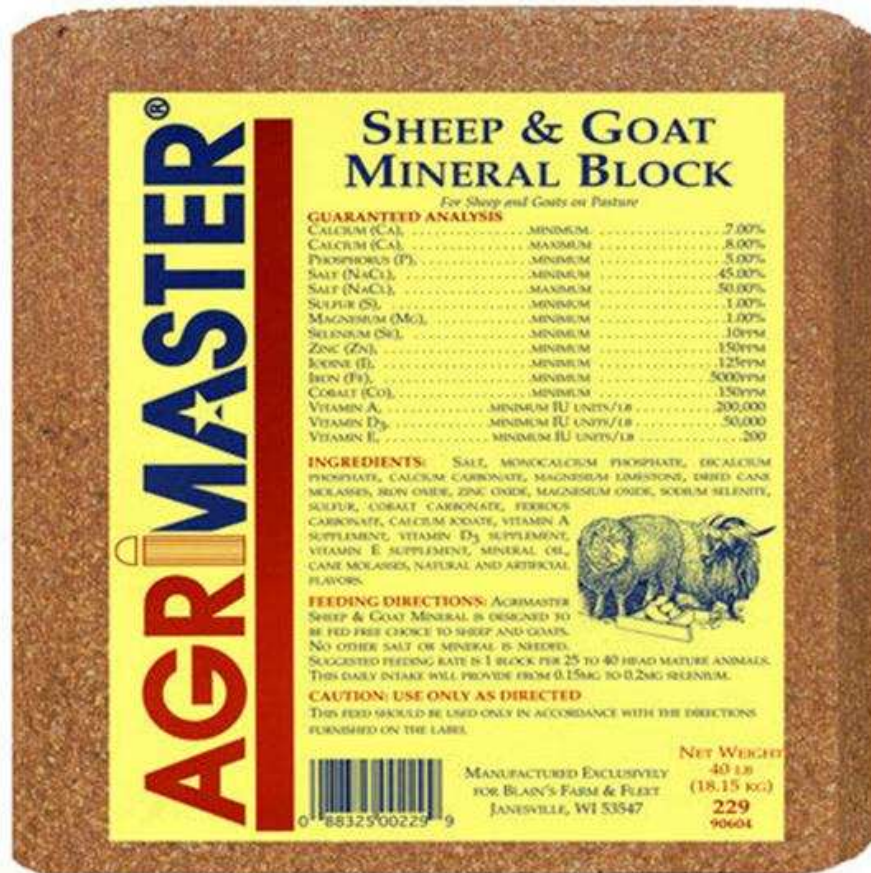
- weakness; loss of appetite; weakness; breeding problems
- rickets; osteomalacia; osteoporosis
- blood in the urine (red water)

Minerals Mix

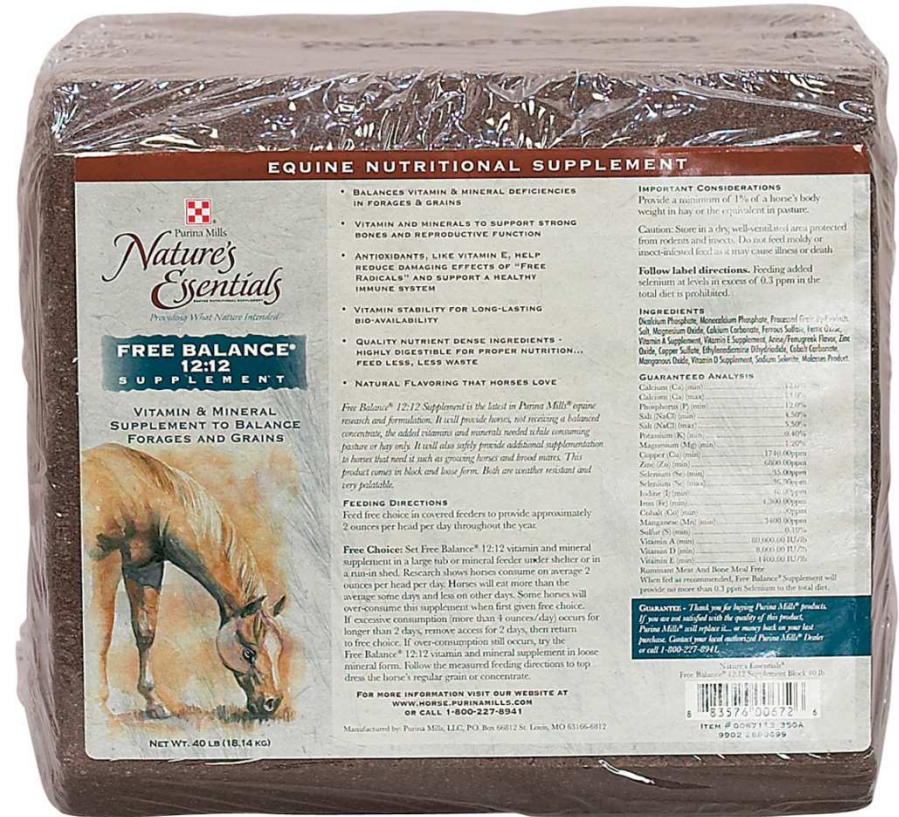
The screenshot shows a web browser window with the URL <http://www.dyets.com/table1.html>. The browser's address bar and tabs are visible at the top. The website header features the Dyets Inc. logo and the tagline "Experimental Diets & Ingredients for Laboratory Animals". A navigation menu includes links for About Us, Diet Information, Experimental Diets, Products, Ordering, and Contact Us. Below the menu, a list of products is provided: Mixing/Cutting Paddle®, AIN Purified Diets, L-Amino Acid Diets, Modified Formulas of AIN-93G and M Diets, Mineral Mix Compositions, Vitamin Mix Compositions, Typical Caloric Density, and New Ingredients. The main content area is titled "Mineral Mix Compositions" and includes a subtitle: "Quantity of Elements Provided to Diets when Salt Mixes are Used at Prescribed Rates mg/Kg Diet". A table follows, detailing the composition of various diets in terms of mg/kg of different elements. The table has 25 columns: DYETS #, Description, g/kg Diet, and 23 elements (Ca, P, K, Na, Cl, S, Mg, Fe, Cu, Mn, Zn, Cr, I, Se, Al, F, Co, B, Mo, Br, Si, Ni, Li, V). The table lists seven diets: AIN-76, AIN-Liquid Diet, No. 4164 (Draper), Bernhart-Tomarelli, Fox-Briggs N, Briggs Chick Salts A, and Monkey Salt Mix. The bottom of the screenshot shows the Windows taskbar with various application icons and the system clock indicating 08:21 PM on 29/01/2013.

DYETS #	Description	g/kg Diet	Ca	P	K	Na	Cl	S	Mg	Fe	Cu	Mn	Zn	Cr	I	Se	Al	F	Co	B	Mo	Br	Si	Ni	Li	V
200000	AIN-76	35	5,200	4,000	3,600	1,020	1,560	337	507	35	6.0	54.0	30.0	2.0	0.2	0.10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
201200	AIN-Liquid Diet	35	5,200	4,000	3,600	1,020	1,560	337	507	35	6.0	54.0	30.0	2.0	0.2	0.10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
200650	No. 4164 (Draper)	40	6,800	3,790	4,810	1,700	2,620	11	405	107	2.0	18.0	10.0	N/A	1.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
200030	Bernhart-Tomarelli	40	9,000	7,460	2,680	760	740	500	600	81	7.6	81.0	17.0	N/A	0.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
200050	Fox-Briggs N	60	12,370	7,990	3,670	3,840	5,760	850	600	33	4.0	81.0	68.0	N/A	6.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
200100	Briggs Chick Salts A	60	11,000	5,760	4,050	5,830	5,340	710	490	67	5.0	103.0	11.0	N/A	31.0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
240003	Monkey Salt Mix	40	5,550	3,470	5,830	2,680	4,125	830	485	260	10.0	30.0	100.0	0.4	24.0	0.08	N/A	0.40	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	um Free	35	N/A	4,000	5,030	1,020	1,560	337	507	35	6.0	54.0	30.0	2.0	0.2	0.10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Minerals



www.farmandfleet.com



horse.purinamills.com

Nutribio Mineral Range Analysis

Analysis	Units	Pre-Calver Standard	Pre-Calver Super	Pre-Calver Gold	Nutribio Hi-Phos Post-Calver	Cattle Gen Purpose
Calcium	%	2 Max	2 Max	2 Max	24	20
Phosphorous	%	-	1	3	7	2
Sodium	%	25	21	18	6.8	16
Magnesium	%	15	18	22	8	-
Selenium	mg/kg	60	60	60	37	35
Selplex	mg/kg	-	-	6	-	-
Iodine	mg/kg	700	700	700	550	400
Cobalt	mg/kg	99	99	99	70	65
Zinc	mg/kg	5,000	5,000	5,000	3,500	4,000
Bioplex Zinc	mg/kg	-	400	750	250	-
Copper	mg/kg	4,000	4,000	4,000	3,000	2,400
Bioplex Copper	mg/kg	-	400	1,000	250	-
Manganese	mg/kg	1,000	2,000	2,000	3,500	1,000
Vitamin A	Iu/kg	250,000	300,000	500,000	375,000	200,000
Vitamin D3	Iu/kg	50,000	100,000	120,000	100,000	40,000
Vitamin E	Iu/kg	500	2,000	4,000	1250	500
Vitamin B12	mcg/kg	-	-	-	-	-
Sodium Bicarbonate	%	-	-	-	-	-
Feeding Rate	g/day	100g	100g	100g	200g	25g/100k g/LW

Analysis	Units	Hi-Mag	Maize Beet	Sheep	Iodized Salt	Sweetened Cal/Mag
Calcium	%	8	25	18	-	-
Phosphorous	%	0	7	2	-	-
Sodium	%	10	6	16	37.8	11.5
Magnesium	%	28	6	4	-	33
Selenium	mg/kg	50	26	35	-	-
Selplex	mg/kg	-	-	-	-	-
Iodine	mg/kg	600	437	500	1,500	-
Cobalt	mg/kg	80	56	300	-	-
Zinc	mg/kg	5,000	3,100	5,000	-	-
Bioplex Zinc	mg/kg	-	770	500	-	-
Copper	mg/kg	4,000	2,400	-	-	-
Bioplex Copper	mg/kg	-	600	-	-	-
Manganese	mg/kg	1,000	3,000	1,000	-	-
Vitamin A	Iu/kg	200,000	340,000	250,000	-	-
Vitamin D3	Iu/kg	40,000	100,000	50,000	-	-
Vitamin E	Iu/kg	500	2,000	1,000	-	-
Vitamin B12	mcg/kg	-	400	-	-	0
Sodium Bicarbonate	%	-	7	-	-	-
Feeding Rate	g/day	150g	250g	16-24g	See Label	See Label

All of the above are available in 25kgs bags

Molassed Minerals and Blocks Feeding Calendar

Livestock Category	Time of Year	Recommended Minerals	Recommended Blocks
Dairy Cows	Dry Period	Pre-Calver	Pre-Calver
	After Calving	Post-Calver	Fertility
	Summer Grazing	Post-Calver	Hi-Mag
Beef Cows	Autumn Grazing	-	Hi-Mag
	Dry Period	Pre-Calver	Pre-Calver
	After Calving	-	Hi-Mag
Dry Cattle	Summer Grazing	-	Hi-Mag
	Autumn Grazing	-	Hi-Mag
	Calves	-	Calf/Beef
Sheep	Weanlings and Upwards	Cattle/Gen Purpose	Calf/Beef
	Replacements	Cattle/Gen Purpose	Calf/Beef
	In-calf Heifers	Pre-Calver	Pre-Calver
Sheep	Pre-Tupping	Sheep	Sheep
	Pre-Lambing	Sheep	Sheep
	Post-Lambing	Sheep	Sheep
Sheep	Tetany Risk	-	Nutribio Block
			Sheep-Mag

Note: Information contained in this leaflet may change from time to time to meet departmental regulations, for the most up to date product information please consult the product label.

All feeding guidelines should be strictly followed.

For further details please contact your local Nutribio Rep

Keith Chambers	087 2534585	Commercial Manager
Enda Moran	086 8240808	South
Paddy Sheahan	087 2854570	South West
Joe Sinnott	087 2535875	East
Kevin Conroy	087 2590183	West
Trevor Adams	0044 778 665 2944	North



Nutribio Ltd.
Tivoli Ind. Est.
Cork, Ireland
0214507303
www.nutribio.ie

Revised: Aug 2010

Nutribio

Precision Nutrition

Nutribio Block & Molassed mineral range



Premium Quality
Mineral/Vitamin supplement
range to meet the needs of
your valuable livestock



Vitamins

Vitamins

- organic compounds which function as metabolic regulators
- originate mainly in plant tissues (except C & D)
- fat soluble vitamins may occur in plant tissue as pro-vitamins (and converted in the body)
- fat soluble vitamins are stored in the body; water soluble vitamins are not
- water soluble vitamins need to be supplied in the diet

Vitamins

Water soluble vitamins - B & C

- B₁- thiamine
- B₂- riboflavin
- B₃ - niacin
- B₅ - pantothenic Acid
- B₆- pyridoxine
- B₇ - biotin
- B₉ - folic Acid
- B₁₂- cyanocobalamin
- choline
- C - ascorbic acid

Fat soluble vitamins

- A; precursor - β -carotene
- D; precursors - ergocalciferol (D₂) and cholecalciferol (D₃)
- E; α -tocopherol
- K; blood clotting

Water soluble vitamins - B & C

- normally, rations for farm animals contain adequate quantities
- deficiencies may occur during extended drought, when ↑ quantities of refined feed are fed and when ↓ quality forage is fed
- absence of vitamins may lead to ↓ in growth and reproduction and death

Vitamins - B

Functions	Sources	Def. symptoms	General comments
coenzymes in several cellular rxns including e.g. amino acid synthesis, deamination, carboxylation/dec arboxylation rxns. and carbohydrate and fatty acid oxidation,	<ul style="list-style-type: none"> • Meat and meat products • leafy green vegetables • whole grain cereals 	<ul style="list-style-type: none"> • diarrhoea & vomiting in swine • poor feathering in chicks • anorexia • ↓ egg production • retarded growth 	<ul style="list-style-type: none"> • all animals must have a source unless there is rumen synthesis • grain is very deficient in vitamin B • monogastrics are most susceptible to vitamin B deficiencies

Vitamins - C

Functions	Sources	Def. symptoms	General comments
<ul style="list-style-type: none">• metabolism of a.a's tyrosine & tryptophan• absorptions & movement of Fe• fat & lipid metabolism• sound teeth & bones• a powerful antioxidant	<ul style="list-style-type: none">• fresh fruit• citrus	<ul style="list-style-type: none">• scurvy (swollen, bleeding gums)• malformed joints• weak capillaries → hemorrhages• degeneration of muscle fibres	<ul style="list-style-type: none">• necessary for ALL animal sp.• rapidly absorbed into the circulatory system excreted in urine• not metabolised by rodents

Vitamins - A

Functions	Sources	Def. symptoms	General comments
<ul style="list-style-type: none">• maintains normal vision in dim light• supports body and bone growth• maintains healthy epithelial tissues	<ul style="list-style-type: none">• carrots• yellow corn• grass• sweet potatoes• fish oils	<ul style="list-style-type: none">• night blindness• stunted growth• poor denture• reproductive disorders	<ul style="list-style-type: none">• required by all animals• a product of animal metabolism• β carotene is the precursor of vitamin A• β carotene is yellow coloured and synthesized by plants

Vitamins - D

Functions	Sources	Def. symptoms	General comments
<ul style="list-style-type: none"> • aids in Ca & P assimilation • growth of bones especially fetal • sound teeth • maintains citrate in blood • hormonal control 	<ul style="list-style-type: none"> • UV rays from the sun • eggs • milk • forages (as β carotene) • corn • cocoa shells 	<ul style="list-style-type: none"> • rickets in young • enlarged joints, bowed legs, knocked knees • muscle twitching, convulsions • poor eggshells; ↓ hatchability 	<ul style="list-style-type: none"> • the sunshine Vitamin • regulates Ca & P metabolism and absorption • occurs naturally in few feeds • can be formed in the body by exposure to UV rays • stored in the fatty tissues and skeletal muscles

Vitamins - E

Functions	Sources	Def. symptoms	General comments
<ul style="list-style-type: none">• an antioxidant• involved in cellular respiration• regulator in the synthesis of DNA and vitamin C	<ul style="list-style-type: none">• widely distributed in all natural feeds• found in corn, corn by-products, rice, rice by-products	<ul style="list-style-type: none">• degeneration of skeletal muscle	<ul style="list-style-type: none">• E works with Se to neutralise the detrimental effects of peroxides

Vitamins - K

Functions	Sources	Def. symptoms	General comments
<ul style="list-style-type: none">• the antihemorrhagic vitamin• necessary for prothrombin synthesis and other blood clotting factors	<ul style="list-style-type: none">• whole corn, milk, green pastures• wheat	<ul style="list-style-type: none">• prolonged blood clotting• hemorrhages• death in severe cases	<ul style="list-style-type: none">• K₁ (phylloquinone) occurs in green plants;• K₂ is synthesized from K₁ in the intestine by bacteria