

Minerals are necessary for the formation of cells and the correct functioning of vital organs. The mineral requirements of dairy cows can be divided between (a) macro- minerals, needed in greater quantities (Ca calcium, P phosphorus, Mg magnesium, Na, sodium, Cl chlorine, K potassium and S sulphur); and (b) micro-minerals which they need in smaller quantities (Co cobalt, Cu copper, I iodine, Fe iron, Mn manganese, Se selenium and Zn zinc). The most important macro minerals for dairy cows are sodium chloride (NaCl, common salt), calcium (Ca), phosphorus (P).

Mineral deficiencies or imbalances in fodder can cause different health, reproductive and metabolic disorders, all of which have a negative effect on productivity. Calcium and phosphorus act together with vitamin D in bone formation. A deficiency in magnesium (hypomagnesemia or grass tetany) causes a fall in production, muscular tremors and general unquiet in cows. Sodium deficiency causes a loss in appetite due to dehydration and lower production.

Copper is essential for various metabolic processes (metabolism: two conjugated processes (a) catabolism which liberates energy and (b) anabolism which uses such energy to create, for example, proteins) and when lacking animals suffer diarrhoea, unhealthy condition and their hair becomes coarse. Cobalt is an essential component of vitamin B12 and when lacking growth rates and production fall. Iodine intervenes in growth as it forms part of the thyroid hormone and, thus, has an impact on milk production. A deficiency of iodine causes goitres (enlargement of the thyroid gland), miscarriages and weak offspring. Selenium is important for reproduction and, with vitamin E, prevents formation of soft tissue. A deficiency of selenium leads to lower rates of fertility.

Examples of the mineral requirements of dairy cows*:

(i) as % and parts per thousand (ppt) of dry matter

Mineral (ingrowth)	Calf 200kg
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Lactating dairy cow (10kg/day)

Pasture composition **(example)

(a) as % dry matter (DM)

2.5- Minerals:

Calcium (Ca)

0.43

0.32 0.59 +/- 0.04

Phosphorus (P)

0.24

0.30

0.34 +/- 0.06

Magnesium (Mg)

0.15

0.18 0.18-0.19 +/- 0.01

Sodium (Na)

0.10

0.10 0.34 +/- 0.14

(b) ppt in DM

Zinc (Zn)

18-25

Copper (Cu)

0.11

Manganese (Mn)

0.11

Cobalt (Co)

0.11

1.39 +/- 1

Selenium (Se)

0.03-0.05

0.03 – 0.05

0.04 +/- 0.003

* Average values are given for the reasons given above.

** 60% sown grasses, 10% Leguminosea, 30% spontaneous species

(ii) in terms of daily requirements (grams)

Ca

P

Mg

Normal sustenance of dairy cows

20.0

12.0

To produce one litre of milk

2.5

2.0

0.8

0.6

Sustenance + milk production:

• 15 litres milk/day 60-70

20-25 20-25

• 20 litres milk/day 85-90

40-50

50-60

25-30

2.5- Minerals:

Dry cow at 7 months gestation

40-50

35-40

Again, the aim is to identify those plants in each farm's pastureland (for grazing or as silage, hay or fresh grass) that jointly satisfy these mineral requirements. The main plants in pasturelands are grasses (Gramineae) and those of the pea family (Leguminosae). The average mineral content of these groups of plants is:

Mineral	Gramineae	Leguminosae	Bazka-edukia *
Calcium (Ca) %	1.86	0.59 +/- 0.04	
Phosphorus (P) %	0.33	0.36	
	0.34 +/- 0.06		
Magnesium (Mg) %	0.29	0.18	
	0.29	0.18-0.19 +/- 0.01	
Sodium (Na) %	0.23		
	0.19	0.34 +/- 0.14	
Zinc (Zn) ppt	42.00 +/- 3.00	32.00	55.00
Copper (Cu) ppt	6.00	12.00	5-10 +/- 1.00
Manganese (Mn) ppt	197.00 +/- 34		
Cobalt (Co) ppt	0.20	42.00	
	1.39 +/- 1.00		
Selenium (Se) ppt	0.04 +/- 0.00		

2.5- Minerals:

* 60% sown grasses, 10% leguminosae, 30% spontaneous species

Examples of different types of forages: (g/kg)

Ca			
P			
Mg			
Na			
* Alfalfa silage	14.4		
1.7			
2.8			
0.9			
* Fresh alfalfa (beginning to flower)	4.84	0.59	0.59
* Grass silage (beginning to mid flowering)	6.5		
1.9	1.3	0.6	
* Grass forage + clovers	3.5	0.6	--
* Maize silage (milky grains)	9.92		
0.55			
0.12			
0.07			

Cows on the Vista Alegre farm eating fresh grass and clover forage

