

Macro minerals

Macro Minerals	Calcium (Ca)	Phosphorus (P)
Function	Milk production Skeletal production Maintenance Nervous system function	Energy utilisation Metabolism Skeletal functions
Source	Forage (grazing and conserved) Drinking water Fodder beet Seaweed meal Limestone flour Some straights	Forage (grazing and conserved), test forage to know ration between P & Ca. Some straights
Storage	99% in animal's skeleton	80% in skeleton, also in blood cells, muscle and nerve tissue
Requirement	Daily supply	Daily supply, at 1.5:1 Ca:P
Chemical sources	Bought-in feeds Supplements	Bought-in feeds Supplements
Relationships	<ul style="list-style-type: none"> • Vitamin D₃ required for calcium absorption • Excess phosphorus can lower calcium absorption • High calcium may lower magnesium, zinc, copper and cobalt absorption • High calcium may increase molybdenum absorption 	<ul style="list-style-type: none"> • High aluminium affects phosphorus metabolism • High phosphorus decreased calcium absorption • Vitamin D₃ metabolism is linked to phosphorus • High phosphorus reduces magnesium availability Phosphorus and copper status maybe interdependent
Clinical signs (deficiency)	Milk fever (hypocalcaemia), lower milk yield, poor skeletal development, poor growth rates	Depressed fertility from reduced energy utilisation and skeletal disorders
Clinical signs (toxicity)	Lower feed intake Lower performance	Associated with effects on calcium such as downer cows and complicated milk fever
Warning		

Macro Minerals	Magnesium (Mg)	Potassium (K)
Function	Nervous system health Bone formation Enzyme system function Metabolism of carbohydrates and lipid	Cell permeability Maintains the body fluid balance which controls the animal's pH. Buffers pH changes in tissues and blood cells
Source	Forage (grazing and conserved) Some straights Spring grass can be low in Mg – test forage	Forage (grazing and conserved) Some straights
Storage	70% in skeleton, reminder in soft tissues and fluids	Within muscle, skin, plasma and extracellular fluids
Requirement	Daily supply	Daily supply
Chemical sources	Bought-in feeds Supplements	Not usually in feed or supplements. Most forage over supplies
Relationships	<ul style="list-style-type: none"> • High calcium may lower magnesium absorption • High phosphorus reduces magnesium availability • Increased potassium lowers magnesium absorption • Deficiency of magnesium will elicit potassium depletion. • Magnesium absorption is aided by vitamin D₃ • Elevated aluminium can depress magnesium absorption 	<ul style="list-style-type: none"> • Deficiency of magnesium will elicit potassium depletion. A ratio of less than 6 to 1 potassium to magnesium is recommended • Increased sodium and chloride (salt) decreases potassium absorption
Clinical signs (deficiency)	Grass staggers or tetany, twitching, tremors and collapse, extreme nervousness, sudden death	Reduced appetite, depressed weight gain, decreased milk production, loss of coat condition and oedema
Clinical signs (toxicity)	Diarrhoea Lethargy	No signs but death from cardiac arrest has been known
Warning	Magnesium levels should not be increased for fattening cattle or sheep as can cause urinary calculi issues	When potassium levels are high and other factors combine they reduce magnesium absorption, leading to grass staggers

Macro Minerals	Sodium (Na)	Chloride (Cl)
Function	Maintaining fluid balance and cell function. Saliva production. Helps maintain rumen pH. Role in nutrient uptake and transmission of nerve impulses and aids palatability of feeds influencing dry matter intake	Maintaining fluid balance and cell function. Can play a role in production of saliva and helps maintain rumen pH. Role in nutrient uptake and transmission of nerve impulses alongside sodium
Source	Forage (grazing and conserved) tend to be low to medium in sodium content. Coastal areas are higher due to seawater spray	Forage (grazing and conserved) tend to be low to medium in chloride content Coastal areas are higher due to seawater spray.
Storage	Most is present in soft tissue and body fluids	In and around the cells of body tissue and blood cells
Chemical sources	Bought-in feeds Supplements	Bought-in feeds Supplements
Relationships	<ul style="list-style-type: none"> Increased sodium and chloride (salt) decreases potassium absorption. A ratio of 6:1 potassium to sodium is recommended. Sodium and chloride readily react to form salt	Sodium and chloride readily react to form salt
Clinical signs (deficiency)	Urine drinking, eating strange things and dehydration	Urine drinking, eating strange things and dehydration
Clinical signs (toxicity)	Anorexia, dehydration, weight loss and collapse	Anorexia, dehydration, weight loss and collapse
Warning/Note	If livestock are fed products treated with caustic soda, sodium must be reduced in the rest of the diet	

Macro Minerals	Sulphur (S)	Dietary Cation Anion Balance (DCAB)
Function	It helps feed the rumen microbes which produce absorbable protein	Combination of four elements - potassium and sodium are positive ions, chloride and sulphur are negative ions. This is reported on forage mineral reports. A negative DCAB increases acidity and a positive decreases acidity. Manipulation of the balance can be used to control blood calcium supply. Increased acidity will mobilise calcium from the skeleton into the blood. Decreased acidity may inhibit calcium utilisation.
Source	Forage (grazing and conserved) but it varies a lot across the UK. Starch-based crops are generally low. Testing is recommended. Sulphur based fertilisers can increase content over time. Check water from wells, streams and boreholes.	Potassium level in forages can increase by applying slurry, dirty water, or fertiliser. Sodium levels within soils varies widely and may increase in coastal areas. Chloride may be present in soil and increases if fertiliser or dirty water is applied.
Storage	Most sulphur is in the form of proteins and amino acids.	
Chemical sources	Not commonly added to feedstuffs but protein sources will have sufficient levels in them	
Relationships	<ul style="list-style-type: none"> • High sulphur can inhibit the absorption of selenium • Elevated sulphur can inhibit copper absorption • High sulphur in combination with either iron or molybdenum can impair copper absorption and utilisation 	<ul style="list-style-type: none"> • A forage test and soil analysis along with management policies as to what to apply where to correct any imbalances
Clinical signs (deficiency)	It is not common to get signs but can reduce performance	Incorrect DCAB will most likely lead to calcium or magnesium issues
Clinical signs (toxicity)	Can develop polioencephalomalacia (PEM), blindness, muscle problems and coma	
Warning/Note		