



Macro-Minerals in Sheep Nutrition

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● WHAT ARE MACRO-MINERALS?

Only 15 of the mineral elements in the sheep's body have been shown to be essential. The major or macro minerals involved in sheep nutrition are sodium (Na), chlorine (Cl), calcium (Ca), phosphorous (P), magnesium (Mg), potassium (K) and sulphur (S). These are referred to as major or macro elements or macro minerals because they are required by the animals in relatively large amounts.

All body cells and tissues contain minerals in widely varying amounts in different chemical forms. Approximately 99% of the total body calcium, 80-85% of the total phosphorous and 70% of the total magnesium occur in the bones and teeth of the sheep.

Cobalt (Co), copper (Cu), iodine (I), fluorine (F), manganese (Mn), molybdenum (Mo), selenium (Se) and zinc (Zn) are also required by the animal but in very small amounts and are therefore referred to as trace minerals or micro minerals. Regardless of whether the mineral is a micro or macro mineral it is important to note that all minerals are important in the physiological functioning of the animal. This factsheet focuses on the macro minerals in sheep nutrition.

● SALT (NaCl)

Salt is essential for proper function, but it may be unnecessary to provide supplementary salt under most feeding conditions since sheep seem to have the ability to utilize the natural salts in their feed in sufficient quantity. Salt is routinely added to sheep concentrate feeds at a level of 1.0%.

There is a disagreement between animal scientists as to the importance of supplemental salt in a sheep's diet. Very few of the 180 million sheep in Australia receive supplemental salt whereas in Europe and North America sheep routinely receive supplemental salt. In fact farmers in the USA provide their sheep on range with between 200 and 350 g (7-12 oz) of salt per ewe every month.

Sheep are particularly fond of salt and consume considerably more of it per unit body weight than do cattle. If fed free choice sheep will consume between 250 and 350 g (7-12 oz) of salt per month. This can be provided in either block or loose form.

Since salt is so palatable, it is a useful carrier for supplying other minerals that are either unpalatable or are required in minute amounts, such as iodine and cobalt.



Loose salt

The total salt requirement of growing lambs is about 0.4% dry matter of the ration. Finishing lambs consume about 275 g (9 oz) per head/month.

A deficiency of salt may result in: an abnormal appetite, with the sheep trying to satisfy their craving by licking dirt; a decrease in feed consumption; and a decrease in performance.

● CALCIUM (Ca)

Calcium is essential for development and maintenance of normal bones and teeth. Approximately 99% of the total calcium found in the sheep's body is in its bones and teeth. It is also important in blood clotting and lactation. Forages, especially legumes, are generally high in calcium. However, to meet the requirement for this mineral, sheep rations should contain a minimum of 0.5% Ca.

Sheep are able to tolerate wide ratios of Ca to P in their diets as long as this situation is only for short periods of time. Although a ratio of 1.1 - 1.4 parts Ca to 1 part P has been recommended, the ruminant animal can utilize rations with ratios of up to 7:1. However, one should not deliberately formulate rations for ruminants with a ratio of Ca:P greater than 2:1 unless the ingredients being used are high in Ca and the extra Ca cannot be removed. High levels of Ca will affect the Zn metabolism. If Ca levels are high, then you should place additional Zn in the diet. Note that high levels of Zn can interfere with the metabolism of iron (Fe) and copper (Cu) when the levels of these minerals are marginal to low. If P is high, sheep can get urinary calculi (kidney stones).

Excessive calcium in the diet may be more of a problem than a deficiency, especially if phosphorous is low. In feeding trials CARDI scientists observed that Barbados Blackbelly rams were especially prone to 'water belly' (urolithiasis) when the Ca to P ratio exceeded 2 parts Ca to 1 part P. However, this condition can be prevented by increasing the level of P in the diet to 0.2% if the sheep are consuming feedstuffs known to be high in Ca.

Finishing lamb rations based on low-quality roughage or high in concentrates may require calcium supplementation. Legumes are generally high in Ca and low in P. The source of Ca for young animals is milk. After weaning it becomes uneconomical to feed the growing animal milk. Limestone (CaCO₃) can be used as a cheap source of Ca. It should be noted that the levels of Ca in limestone can vary from place to place.



Forages are generally high in calcium

In young animals, Ca and P deficiency can manifest in the form of Rickets. This is a deficiency disease characterized by the tendency towards the formation of enlarged extremities such as long bones and the bending of the shafts. This can be corrected in young animals if detected early. In older animals the bones do not bend but they become fragile, easily broken or cracked because of a loss of bone density. This condition is called osteomalacia or osteoporosis.

● PHOSPHOROUS (P)

P is important for proper growth. It is needed along with Ca for bone development and soft tissue formation as well as metabolic processes. Forages are generally low in phosphorous. Also as plants mature, the phosphorous content decreases. A phosphorous deficiency may occur in sheep if fed on hay or standing hay especially in the dry season when forage quality is poor.

The sheep's ration should contain 0.4% P. Forages containing below 0.2% phosphorous are usually considered deficient for ewes during gestation, and 0.34% is considered borderline during lactation.



Fifteen of the mineral elements in the sheep's body have been shown to be essential

Phosphorous deficiency is characterized by a decreased appetite, craving and chewing on bones, and the eating of soil. Young lambs may show lameness, bent leg bones and swollen joints. Some ewes will become infertile and milk production is reduced in nursing dams. The level of phosphorous in the blood is less than 4 mg/100 ml of plasma.

● MAGNESIUM

Magnesium is important in bone formation and necessary for many enzyme systems to function in the cells and for the proper functioning of the nervous system in sheep. It is closely associated with the metabolism of calcium and phosphorous. If the diet is high in Ca and Mg, the Mg may become unavailable. The exact requirement of magnesium for sheep is unknown.

The levels of this mineral in tropical forages are generally low leading to some deficiency symptoms in some ruminants. If the diet contains less than less than 2g magnesium/kg dry matter then you can expect some Mg deficiency. However, rations containing 0.06% are considered adequate for the adult ewe. The blood serum of the mature ewe normally contains about 2.5 mg/100 ml.

There have been no reports in the literature of magnesium deficiency symptoms in Caribbean sheep.

● POTASSIUM (K)

Potassium is essential for proper nerve, muscle and enzyme functions in sheep. It is also required to maintain the activity of the rumen microorganisms and is important in the production of milk. The potassium requirements of sheep have not been clearly defined but appear to be about 0.5% of the diet. Roughages don't always contain adequate quantities of potassium.

Scientists have reported that the incidence of urinary calculi in feedlot lambs can be reduced by feeding supplemental potassium chloride.

● SULPHUR (S)

This macro-mineral functions in the synthesis of the sulphur containing amino acids, cystine and methionine in the sheep's rumen. Two vitamins Biotine and Thiamine and the hormone insulin contain sulphur. The sheep's wool also contains sulphur. Rations for mature ewes should contain 0.16 - 0.18% sulphur. Young lamb rations require a higher level around 0.26%. Most feedstuffs contain more than 0.1% sulphur.

Australian scientists have shown that mature tropical grasses and grass hays are very often low in sulphur and recommend that grazing ewes receive sulphur in their mineral supplement.

● SHEEP MINERAL PROFILE

A good sheep mineral source should provide the following minerals and vitamins A and E.

| Minerals | Range | Recommended Level |
|------------------|------------------------|-------------------|
| Calcium | 12-20% | 14% |
| Phosphorous Salt | 12-20% | 14% |
| Magnesium | 10-18% | 12% |
| Sulphur | 3-6% | 4% |
| Iron | 0.15 - 0.2% | 0.2% |
| Zinc | 0.2% - 0.3% | 0.25% |
| Iodine | 0.1% - 0.3% | 0.125% |
| Manganese | 0.003 - 0.006% | 0.005% |
| Copper | 0.05-0.08% | 0.075% |
| Cobalt | None | None |
| Vitamin A | 0.002 - 0.003% | 0.0025% |
| Vitamin E | 70,000 - 100,000 IU/Kg | 80,000 IU/Kg |
| | 50-200 IU/Kg | 100 IU/Kg |



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