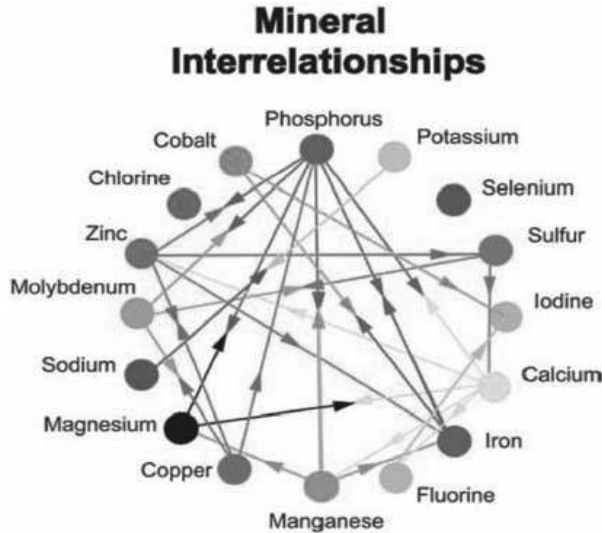


# MINERALS AND VITAMINS FOR SHEEP

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Of sheep nutrition topics, mineral and vitamin nutrition are rarely considered the most interesting. A couple factors probably contribute to the issue. One is that we are primarily concerned when there is too much or too little of a particular element. Most nutritional symptoms are related to toxicity or deficiency levels. In between the two extremes there is little visual we can detect that would indicate mineral status. Another contributing factor to diagnosing issues related to minerals is there are several key interactions between several minerals which can impact absorption or utilization. The figure below depicts the interrelationship between various minerals.



In most production situations, forage in the form of hay or pasture supplies the majority of minerals needed. Proper fertilization, harvest maturity and incorporating legumes into grasses all positively impact the mineral content of forages. Since forage provides the bulk the minerals needed, providing a quality mineral supplement can make up the difference between forages and animal requirements. In Table 1 are shown the various minerals of concern, levels found in good forage, and the requirements for these nutrients by various classes of sheep. The requirements are based upon the

Nutrient Requirements of Sheep, Sixth Edition (1985), and the forage values based upon pasture and hay samples taken in southwest, central and the Shenandoah Valley areas of Virginia over the last several years.

Table 1. Minerals in Forage and Required by Sheep

Nutrient	Good Forage	Class of Sheep and Their Requirements (in diet Dry Matter)		
		Mature Ewe		Young Lamb
		Early Pregnancy	Nursing Twins	Fast Gain
Calcium,%	.62	.25	.4	.55
Phosphorous, %	.32	.2	.3	.25
Potassium, %	2.3	.5	.8	.6
Magnesium, %	.25	.12	.18	.12
Sulfur,%	.25	.15	.25	.15
Sodium,%	.02	.10	.15	.10
Iron, PPM	354	40	40	40
Copper, PPM	9	10	10	10
Manganese, PPM	70	40	40	40
Zinc, PPM	31	30	30	30
Selenium, PPM	.15	.3	.3	.3

Macro-minerals are required in larger amounts, with that requirement expressed as a % of the diet or as grams per head per day. In Table 1, above, they are shown on the first 6 rows of the table. Some of these are already in sufficient quantity in forages, so supplementation is not needed. Others are never in adequate amounts, so they must always be in a supplement. Finally, there are those that are marginal in forage and supplementation is sometimes needed.

- Adequate Potassium
- Deficient Sodium (when combined with Chlorine, makes salt)
- Marginal Calcium, Magnesium, Phosphorous, Sulfur

Calcium is often in adequate amounts in forages, and legumes have higher levels than do grasses. It is a relatively inexpensive mineral to add to feeds or mineral supplements. Grains and grain crop silages have high levels of phosphorous and very low levels of calcium. Many grain byproducts such as distiller's grains, corn gluten feed and wheat midds have higher phosphorus content than the grain. In many situations forage phosphorus is low due to soils are low in phosphorous fertility levels. Because phosphorous is important to reproduction and growth, it is often included in minerals for the ewe flock year around. It is the most expensive macro-mineral to add to a mineral supplement. Magnesium is often low in lush forage growing in early spring or when spring-like conditions occur. A deficiency of Magnesium causes grass tetany, a problem in cows that rarely occurs with ewes.

Micro-minerals or trace minerals are needed in very small quantities. The requirement by animals for these minerals is expressed in milligrams per head per day or in parts per million. Just as with the macro-minerals, some are adequate, others are deficient, and several are marginal.

- Adequate Manganese, Iron, Copper
- Deficient Selenium
- Marginal Zinc

Iron is often added to minerals (iron oxide or ferric oxide on the tag), even though the required amount is included in the forage that is consumed in the basal diet. The reason it is added is to give minerals the typical reddish-brown color. However, iron can interfere with the uptake of other minerals that are not in large amounts, such as zinc. Thus, it is recommended that iron not be added to complete minerals for sheep.

Zinc, Copper, and Selenium are all important in many physiological functions, including the immune response and disease-fighting ability. Our soils are often deficient in Selenium, making forage grown on those soils also deficient. Consequently, it is strongly recommended to include Selenium in mineral mixtures for sheep of all ages. The rules, for adding maximum levels of Se for sheep, are:

- 0.3 Parts per Million (PPM) in the total diet
- 0.7 mg per head per day
- 90 PPM in a free-choice mineral mixture

Because Se is not stored in the body for very long, frequent intake or dosing of Se is critical. A good sheep mineral needs to be available at all times that contains at least 50 or 60 PPM of Se. Assume Se is not included in a mineral product. If it is included, the amount must be stated on the label of the product. It often is stated as a percent. To convert % to PPM, move the decimal 4 places to the right. Thus, a product with 60 PPM would be stated to include 0.006% Se.

Copper (Cu) can be toxic to sheep. Although there is an important function of Cu in the body, and thus it is a required mineral, excess amounts are concentrated in the liver rather than being excreted. Over time, this excess of Cu can destroy liver tissue, resulting in death of the animal. Our soils, and thus the forages grown on them, contain Cu levels that are close to the animals' requirements. Consequently, sheep minerals for the mid-Atlantic region should not have any Cu added to them.

**\*\*Note** These levels are too low for cattle and goats, thus properly formulated minerals for these species always have Cu added to them. Mineral mixtures formulated for cattle and goats can be toxic to sheep if used for a long time.

## Vitamins

Sheep, with their ruminant digestive system, can make vitamins from the raw materials consumed in their diet. They do this very well with all of the B-Vitamins; thus these are not any concern with sheep.

Vitamins A and E are made from compounds found in green forage. Vitamin A can be stored in the liver for 2 or 3 months after sheep have been eating green forage for several months. Consequently, when eating fresh pasture or hay no supplemental vitamins are needed. However, when sheep are eating forage that is old, weathered, mature, or otherwise low in Vitamin A precursor (carotene), then this Vitamin should be added to the mineral mixture. Other feeds that will result in inadequate Vitamin A levels are corn silage, corn stalks, and straw.

Vitamin D is made from exposure to sunshine. For sheep housed indoors for more than 2 to 4 weeks, such as lambs being finished in confinement, Vitamin D should be included in the diet.

Most commercial minerals for sheep designed for free-choice feeding will contain added Vitamins A, D, and E. When making a total mixed ration, vitamin premixes can be added inexpensively to the formulation if a free-choice mineral is not going to be fed.

Table 2. Vitamins in Forage and Required by Sheep

Nutrient	Class of Sheep and Their Requirements (in diet Dry Matter)			
	Good Forage	Mature Ewe		Young Lamb Fast Gain
		Early Pregnancy	Nursing Twins	
VitA, IU/lb DM	50,000	1000	1200	500
Vit D, IU/lb DM	500	100	100	100
Vit E, IU/lb DM	10	7	7	7

### Intake of Mineral

Sheep do not eat the same amount of mineral throughout the year. They have a craving for salt, and consume a complete mineral to get salt. Some ingredients, such as dicalcium phosphate and especially magnesium oxide, are not very palatable; thus intake may be lower when these ingredients are included. Often grain products or artificial flavor enhancers are added to mineral mixes to encourage higher intake. Intake is higher when consuming lush fresh forage, such as in the early spring. During the dry summer months intake is lower, this is also the case when sheep are eating hay. If a water source is nearby intake is higher than when water is a great distance away. In addition to nearby water, intake is higher if mineral feeders are located in shady areas or along paths frequently traveled by sheep.

### Composition of Minerals (Feed Tag Information)

By law the tag on a mineral product must contain certain information. It must contain guarantees of various minerals included in the product. The minimum information to be stated is:

- Minimum and Maximum Calcium
- Minimum Phosphorous
- Minimum and Maximum Salt
- Minimum and Maximum Copper (if added, or if it exceeds 20 PPM)
- Minimum Selenium
- Minimum Vitamin A

Information about other minerals and vitamins may be displayed on the label. If a product contains a feed additive (antibiotic, ionophore or coccidiostat), it will say "Medicated" on the label, and the FDA-approved purpose and feeding directions for that additive will be stated. FDA-approved coccidia control products include Lasalocid (brand name Bovatec) which is to be fed at between 15 and 70 mg per head per day in a complete feed. Monensin (brand name Rumensin) is not approved for sheep, but is approved for goats in a complete feed at the rate of 20 g/ton. Decoquinatate (brand name Deccox) is approved for both sheep and goats at the rate of 22.7 mg/100 pounds of bodyweight.

## **Form of Mineral Supplement**

Minerals and salt products are available in loose, granular form and in block form. Because blocks are hard enough to shed rainwater, it is sometimes difficult for sheep to get enough mineral from licking them. In addition, sheep have broken their teeth on blocks. Finally, few if any complete minerals are in block form. Loose minerals must be put in a covered feeder of some type to keep rain out so they don't cake and become hard. Loose mineral mixes are the recommended form of mineral for sheep.

## **Types of Mineral Supplements**

Sheep producers with forage-based feeding programs normally provide minerals in a self-feeder to their animals. They normally do not mix minerals with other feeds that are fed each day, as is the case with pigs, poultry, dairy, and beef feedlots. There are several types of free-choice mineral mixtures available to sheep. These are:

White Salt The only minerals this contains are Sodium and Chlorine. This is not an adequate mineral supplement. Often contains Iodine, and is therefore called Iodized Salt.

Trace Mineral Salt (TMS) TMS is White Salt with added Trace Minerals. No macrominerals are included. Often colored red from the Iron compounds added. Unless specifically stated, TMS contains no added Selenium, although there are some TMS products that do. TMS with added Selenium is considered to be the minimum acceptable mineral supplement for sheep, and only then sheep consuming high quality pasture.

Complete Mineral A mixture containing salt, the macrominerals Calcium and Phosphorous, and trace minerals. May or may not have added Selenium. Magnesium may be added, but perhaps not enough to prevent grass tetany. Often the ratio of Calcium to Phosphorous is in the product name, such as 2:1 or 4:1. Because Phosphorous is the needed item and Calcium is normally adequate, a lower ratio is more appropriate for forage-based feeding programs. A higher ratio just dilutes the Phosphorous with Calcium-containing ingredients.

## **Lambs fed a high-grain diet**

The rapidly growing lamb fed a high grain diet can experience many nutritionally related problems. One of these is called urinary calculi, a blockage of the urinary tract caused by "stones" that develop. An unsupplemented high grain ration contains an excess of phosphorous and small amounts of Calcium. The requirement (table 1 is for calcium in higher amounts than Phosphorous. This reversal of Ca:P ratio results in a change in the pH of the urine and the development of mineral-based precipitates in the urinary tract.

One solution to this problem is to use ammonium chloride in the ration. This changes the pH of the urine back towards normal, thus preventing the precipitates from forming. However, the Ca:P imbalance still persists. This is best fixed by feeding the lamb a mineral supplement that provides lots of Ca and little or no P. Ground limestone (feed grade) added to a complete ration at the rate of 1% of the mixture is recommended. In this way the diet will contain the recommended Ca:P ratio of at least 2:1, even though the actual amounts of both Ca and P will greatly exceed the animal's requirements for these minerals. Many lamb feeders use added limestone plus ammonium chloride in the same feed.

## **Summary**

Mineral supplementation need not be complicated or expensive. Intake of minerals by sheep needs to be monitored to ensure that amounts adequate to meet the needs are consumed. Excessive intake is costly and does not result in higher production. By focusing on forage production and quality first, then providing minerals that are likely to be deficient, producers can cost effectively meet the mineral needs of their sheep.

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Adapted from Minerals and Vitamins for Sheep, Mark Wahlberg (2004). Disclaimer: Mention of specific brand names is for information only. No recommendation or endorsement is implied.