

MINERALS AND VITAMINS FOR SHEEP

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Proper animal nutrition means giving the animals the proper amount of all nutrients necessary for optimum production. This involves knowledge of the nutrients themselves, factors that affect the requirements of animals, and the feeds used to deliver those nutrients. Cost is always a consideration for profit-motivated producers. This interplay of factors can become very intricate, but it need not be.

For the ewe flock, proper nutrition involves giving animals all the good quality forage they want, and supplementing that with nutrients that may be deficient. So the basics of animal nutrition are good forage management, such as proper fertilization, a mixture of grasses and legumes, maintaining forage at a nutritious stage of growth, and providing forage in adequate quantities. That's another talk for another day, so let's now focus on the supplementation side of this issue.

Supplements are just that – sources of nutrition that are given to animals in addition to their basic ration, with the intent of increasing the intake of that critical nutrient. Thus, we can't properly supplement without knowing the requirements of animals, or without knowing the amount of nutrition provided by the basal ration.

In Table 1 are shown the various minerals and vitamins 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 samples taken in southwest Virginia over the last several years.

Table 1. Minerals and Vitamins in Forage and Required by Sheep

Nutrient	Class of Sheep and Their Requirements (in diet Dry Matter)			
	Good Forage	Mature Ewe		Young Lamb
		Early Pregnancy	Nursing Twins	Fast Gain
Calcium, %	.45	.25	.4	.55
Phosphorous, %	.40	.2	.3	.25
Potassium, %	2.0	.5	.8	.6
Magnesium, %	.25	.12	.18	.12
Sulfur, %	.25	.15	.25	.15
Sodium, %	.0005	.10	.15	.10
Iron, PPM	100	40	40	40
Copper, PPM	8	10	10	10
Manganese, PPM	70	40	40	40
Zinc, PPM	30	30	30	30
Selenium, PPM	.15	.3	.3	.3
Vit A, 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

Macrominerals

There are many minerals that are required in the diet of sheep. Macrominerals 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 must always be in a supplement. Finally, there are those that are marginal, meaning amount in the forage and amount needed are close to each other, thus supplementation is sometimes needed, and sometimes not.

- **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. Grains and grain crop silages have very low levels of Calcium. Phosphorous is just the opposite. It is high in grains and low in forages, often because 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. 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.

Microminerals

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

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

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 included/added to complete minerals for ruminants.

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 Food and Drug Administration (FDA) oversees Selenium (Se) in livestock feeds, since it is a cancer-causing element at high levels. They have established rules for inclusion of supplemental Se, and expressed those in 3 different ways. Those rules, indicating 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 for sheep 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 well-made hay no supplemental vitamins are needed.

However, when sheep are eating forage that is old, weathered, mature, or otherwise low in Vitamin A precursor, 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 to the formulation if a free-choice mineral is not going to be fed.

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.

Producers should monitor intake periodically. Put out a known amount of mineral and keep track of the number of days a group of sheep takes to consume it. Divide by the number of head to calculate the intake per head per day. This should be an average of ½ to 2 ounces per day.

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 included may be displayed on the label.

If a product contains a feed additive, it will say “Medicated” on the label, and the FDA-approved purpose for that additive will be stated.

A list of ingredients will be displayed. They are not necessarily in order of amount used. Complete mineral products often have non-mineral products included. These are often added to increase consumption, and thus are such products as grains, molasses products, or flavorings. Grains do not have to be specifically identified (i.e. corn), but a general ingredient may be shown instead. Approved general ingredient items are:

- Forage Products
- Grain Products
- Plant Protein Products
- Processed Grain Byproducts
- Roughage Products
- Molasses Products

Specific grains, flavorings, or one of the general ingredient categories shown above may constitute a significant amount of the total product in the bag. Minerals that include these items usually cost less per pound or per bag, because grains and byproducts are less expensive than are the mineral products. However, their use dilutes the mineral content of the product. They also stimulate intake by the animal, resulting in higher consumption per head per day. So the reduced cost per pound may be offset by the higher intake per head per day, resulting in little or no savings.

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. May have added Magnesium, 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.

Feed Additives

Free-choice mixtures are sometimes medicated with feed additives. Although there is a much longer list of approved products for cattle, there are several helpful products included in minerals for sheep. Probably the most helpful are those products that help combat Coccidiosis, which is a gut disorder caused by a protozoa parasite. It must be said that animals develop resistance, perhaps even immunity, to coccidia with exposure. Because coccidiosis is a sanitation disease, many producers do not include a coccidian control product in the mineral consumed by ewes and young lambs, and focus on good management and sanitation to prevent major outbreaks. This allows lambs to become exposed to limited numbers of coccidia without experiencing major problems.

FDA-approved coccidia control products are led by 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.

A major problem with additives to feeds is the lack of precise dosing to the animal. Intake of the feed determines intake of the medication in the feed. The variability in intake of free-choice minerals has already been addressed. More precise dosing occurs when additives are included in a grain supplement that is hand fed each day. Even more precision occurs when these products are included in a total mixed ration, although few sheep producers feed their sheep in this way.

Because of problems with intake, and thus correct dosing of feed additives, plus the limited number of additives approved by FDA for use in sheep, medicated mineral products should not be used with sheep. The only exception to this recommendation is for coccidia control, when it is appropriate.

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 negligible 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.

Chelated minerals are minerals which are formed into a chemical compound with some organic product, often an amino acid. Some of these include Zinc-Methionine and Copper-Lysine. The benefit of chelated minerals, or organic minerals, is the higher availability (digestibility) by the animal. This comes at a noticeably higher price, however. Under conditions of high stress, or extremely high levels of production, these products may have a positive cost:benefit ratio. These would include extremely high producing dairy cows, or feeder calves that are abruptly separated from their dams and immediately transported, sold, and put into a feedlot. Sheep producers in the east rarely impose such conditions on their animals, thus the use of chelated or organic minerals is not necessary, and not cost effective.

Summary

High quality forages consisting of mixtures of grasses and legumes provide the basis for good sheep nutrition in the mid-Atlantic region. These forages also provide many of the needed minerals and vitamins for sheep. However, several minerals will likely be deficient, thus mineral supplements must be offered. These supplements should be in loose form, fed in a feeder to keep out the weather. Free-choice minerals for sheep must contain added Selenium, and should not have any Copper added to them. The basic ingredient is salt.

Special attention must be paid to the grow-finish lamb receiving a high grain ration. The imbalance in Calcium:Phosphorous must be rectified to reduce the incidence of urinary calculi.

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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