

phosphorus of the body are present in bones and teeth. Bone, therefore, not only serves as an organ of structure, but also as a reservoir of both calcium and phosphorus.

Calcium and phosphorus are closely related elements and are found in bones in about 2:1 ratio. Likewise, the preferred calcium-phosphorus ratio in the ration is from 1.5:1 to 2:1. Rations containing wider ratios than 2:1 are generally no problem so long as both minerals are adequate. The levels of minerals recommended for dairy goat rations are shown in Table 1.

**Table 1. Mineral content recommended in rations for lactating dairy goats (DM basis)**

Major Mineral	Percent in Total Ration	Minor Mineral	Total Ration
	(%)		(ppm)
Calcium	.78	Iron	50
Phosphorus	.45	Manganese	40
Magnesium	.25	Copper	10
Potassium	1.00	Zinc	50
Sulfur	.20	Cobalt	15
Salt (sodium chloride)	.60	Iodine	0.5
		Selenium	0.15

Minerals may be provided in the grain mixture as well as outside in protected mineral boxes. Select a mineral supplement that balances with the forages or roughages being fed. Legume forages are excellent sources of calcium, but relatively low in phosphorus. As a guide, use mineral supplements lower in calcium when legumes are fed (Approx. 1:1 ratio) and higher in calcium when other forages are used.

An adequate amount of salt in the diet increases palatability and stimulates appetite. It is commonly recommended that dairy goats have free access to salt. Salt provides the needs for sodium and chlorine. Feeding too high a level of salt prior to kidding can increase problems with udder edema.

Magnesium functions in many enzyme systems in the body, as a constituent of bone, and in muscle contractions. Grass tetany is the common condition associated with magnesium deficiency.

Potassium plays many important roles in the body including enzyme systems, muscles, cells, water retention and osmotic pressure. More recently, research has indicated that the level of potassium may need to be increased during heat stress because there is a greater need for potassium during hot weather.

Sulfur is an important element in the synthesis of protein since two amino acids, methionine and cysteine, contain sulfur. Sulfur is related to protein and nitrogen utilization in the dairy goat.

Iron, copper and cobalt have different functions in the body but deficiencies in any of these minerals are associated with anemia in dairy animals. Cobalt is a component of vitamin B12 and therefore affects blood formation.

Zinc is involved in many enzyme systems in the body and is essential in the normal mobilization of vitamin A from the liver. Deficiency symptoms include leg and bone disorders, parakeratosis (a psoriasis-like skin disorder), or rough and thickened skin.

Iodine is a component of hormones secreted by the thyroid gland that regulate energy metabolism. A deficiency of iodine causes an enlargement of the thyroid gland or goiter. Research has indicated a relationship between thyroid activity and reproductive performance.

Manganese is needed in the body for normal bone structure, for reproduction and for the normal functioning of the central nervous system. Since forages are fairly high in manganese, most rations are adequate.

Selenium is the newest mineral element given consideration following studies showing a reduction in retained placentas when selenium is added to rations. The more classical deficiency symptoms include white muscle disease in calves, stiff lamb disease, and muscle degeneration in pigs.

The total ration dry matter is frequently evaluated to determine the level of minerals. Those of most importance to goat producers are calcium, phosphorus and salt. Table 1 contains a suggested level of minerals in the ration dry matter. Lactating dairy goats need more calcium and phosphorus than do kids, dry does, or bucks, since sizable amounts of these minerals are secreted in milk.

Specific and non-specific symptoms may be observed with nutrient deficiencies. Table 2 contains a list of clinical signs of deficiencies that are associated with each mineral element.

**Vitamins** - The vitamins can be divided into two major groups: fat soluble and water soluble. The descriptive terms simply mean that solvents are used to extract certain vitamins whereas others are soluble in water. The fat soluble vitamins are stored in the fat or lipid portion of the feed and include vitamins A, D, E and K. The water soluble vitamins are usually met with the use of natural feedstuffs, rumen synthesis and tissue synthesis.