

Minerals and Micronutrients for Goats

Objective

Learn that most minerals in the goat's diet come from plants and therefore, mineral levels in the diet are dependent on the plant species and the fertility of the soil.

Understand that minerals in the diet interact and an excess of one may depress the utilization of another.

Mineral contents of the diet may be deficient resulting in reduced animal production and deficiency symptoms in which case we supplement. Minerals are often adequate, but at times may be excessive which results in toxicity.

Nutrition is the science of determining the nutrients required by animals and how to provide those nutrients to the animal.

Plants are the major source of minerals for the goat. Plants require all the minerals for growth that goats do except for iodine. However, the requirements for plants may be much lower for plants than animals such as cobalt and selenium.

Many factors affect mineral content of plants.

1. Legumes tend to be richer in minerals than grasses.
2. Browse and weeds usually have higher mineral contents.
3. Some minerals which are excess in the soil can result in high levels in plants, especially potassium, calcium.
4. Different species of plants will have different concentrations of minerals when grown in the same soil.
5. Therefore since goats eat a variety of plants, it probably makes them less likely to have mineral deficiencies.
6. Some soils are inherently deficient in some minerals due to geology such as iodine and selenium.
7. Plants grown on soils deficient in a mineral may be deficient in that mineral. Some plants can concentrate available minerals.
8. Phosphorus fertilizer reduces potassium in plants and potassium fertilizer reduces calcium content.
9. Soil pH is a factor in that especially in acid conditions, trace mineral availability to the plants is reduced.
10. Temperatures-grass tetany deficiency symptom for magnesium usually happens under cool soil temperatures which may reduce root uptake of magnesium.
11. Seasonal variation which may be an affect of growth rate
Can test plants, but you need to get a sample of what the goats are eating throughout the day and take several samples throughout the growing season. Is expensive and not likely worth the expense. Many state extension specialists know what minerals are likely to be deficient in given areas of their state i.e. Se, I.

Macrominerals-required in fraction of percent.

Calcium, phosphorus, sodium, potassium, chloride
sulfur, magnesium

Microminerals, required at the ppm level

Iron, copper, cobalt, zinc, iodine, manganese, selenium,
molybdenum

Calcium

Biological function

Bones-contain 99% of calcium in body
Necessary for muscle contraction, nerve conduction, blood clotting

Deficiency symptom

Rickets, bowing of limbs, lameness
Vitamin D deficiency causes similar symptoms
Urinary calculi if not 2:1 calcium to phosphorus ratio

Toxicity

Metabolic bone disease-bent legs

Sources of calcium

Legumes, limestone, bone meal, dicalcium phosphate

Phosphorus

Biological function

Soft tissue and bone growth
Energy metabolism and acid-base balance

Deficiency

Slowed growth, pica, decreased serum phosphorus

Sources of phosphorus

Bone meal, protein supplements, cereal byproducts

Sodium

Potassium .8-2.0%

Chloride

Biological function

All three function as electrolytes in the body
Lost in diarrhea

Deficiency

Potassium on high concentrate diets-poor appetite, urinary calculi, stiffness progressing from front to rear, pica
Chloride depressed growth
Sodium-reduced growth and feed efficiency

Sources

Salt block
Potassium in most forages

Sulfur .2-.32%

Biological function

Protein synthesis, including milk production and hair production
Production of amino acids enzymes, hormones, hemoglobin, connective tissue and vitamins

Deficiency symptoms

Poor performance, hair loss, excessive saliva, excess tearing of eyes, weakness

Sources

Protein therefore, may be a problem on NPN diets
Sulfur blocks used for ticks

Magnesium .18-.4%

Biological Functions

Proper function of nervous and muscular systems, enzyme systems

Closely associated with metabolism of calcium and phosphorus. Essential component of bones and teeth

Deficiency symptoms

Loss of appetite, excitability, staggering, convulsions,
death
deficiency on fastgrowing lush pasture, especially cool
season

grasses called grass tetany

Sources

Bone meal

Magnesium oxide fed with protein supplement

Micro or trace elements

Iron 50-1000ppm

Biological function

Component of hemoglobin, required for oxygen transport

Component of certain enzymes

Deficiency symptom

Anemia lack of hemoglobin

Sources

Iron is stored in the liver, spleen and bone marrow

Iron is very low in milk, kids raised for a long time on
milk alone will develop anemia

* / Copper 10-80ppm

Biological function

Essential for formation of hemoglobin

Component of enzymes

Deficiency symptoms

Anemia, rough "bleached coat", diarrhea and weight loss

Toxicity

Angora goats are sensitive, meat and dairy goats are similar
to beef cattle

Sources

Forages, Grains

Trace mineralized salt

Cobalt .1-10 ppm

Biological function

Essential for formation of vitamin B-12

Rumen microbes utilize cobalt for growth

Deficiency symptoms

loss of appetite, anemia, decreased production, weakness

Sources

Most natural feedstuffs

Zinc 40-500ppm

Biological function

Found in all animal tissues

Required for the immune system

Deficiency symptoms

Dermatitis, thick dry patches of skin, hair loss, lesions
scalded feet, poor hair growth, loss of hair

Essential for male reproduction

Sources

Bran and germ of cereals

Manganese 40-1000ppm

Biological function

Bone formation reproduction enzyme functioning

Deficiency symptoms:

Reluctance to walk, deformity of forelegs,
Delayed onset of estrus, poor conception rate
Low birthweight

Source difficult to get a deficiency

Selenium .2-3ppm

Biological function

Reproduction

Metabolism of copper, cadmium, mercury, sulfur and vitamin E

Deficiency symptoms

Poor growth rate, kids unable to suck

White muscle disease sudden death by heart attack
progressive paralysis

Retained afterbirth

Toxicity in a few regions

Shedding of hair, diarrhea, lameness

Sources

Most plants which are not grown is Selenium deficient soils

Molybdenum .1-3.ppm

Deficiency very rare

Toxicity above 3 ppm due to reduced copper absorption

Iodine

Biological function

Formation of thyroid hormones which regulate energy
metabolism

Reproductive function

Deficiency symptoms

Goiter-swelled or enlarged thyroid

Do not confuse with the thymus gland on young animals

Reproductive problems-late term abortion, hairless fetus,
weak kids

Source

Iodized salt

Diagnosing mineral deficiency or toxicity-procedure used is
dependent on which mineral you are looking at.

1. Blood tests for some may be mineral level such as magnesium
calcium or phosphorus or another factor in the blood
such glutathione peroxidase for selenium or hemoglobin for
iron or zinc binding protein for zinc or thyroid hormones
for Iodine.
2. Hair analysis has been used for zinc and Selenium
3. Tissue tests such as liver for iron and copper
4. Deficiency or toxicity symptoms are important-manganese and
knuckling over.

To summarize:

Adequate levels of calcium and phosphorus in 2:1 ratio.

Free-choice salt

Use Trace mineralized salt for prevention.

Avoid going overboard on any supplementation.

Sources of mineral information

Goat Medicine by Smith and Sherman

Mercks Veterinary Handbook

State livestock Extension Specialist