MINERALS AND MICRONUTRIENTS FOR GOATS

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Objectives

1. 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.

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

Introduction

Mineral contents of the diet may be deficient, resulting in reduced animal production or deficiency symptoms, if really low, in which case we supplement to overcome the deficiency to restore optimal performance. 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 require all the minerals for growth that goats do except for iodine. However, the mineral requirements for plants may be much lower for plants than for animals such as for cobalt and selenium.

Many Factors Affect Mineral Concentrations in 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 and calcium.

4. Different species of plants will have different concentration of minerals when grown in the same soil. Therefore, since goats eat a variety of plants, it probably makes them less likely to have mineral deficiencies.
5. Some soils are inherently deficient in some minerals due to parent material the soil was formed from, e.g., iodine and selenium.

6. Plants grown on soils deficient in a mineral may be deficient in that mineral. Some plants however can concentrate available minerals.

7. Phosphorus fertilizer reduces potassium in plants and potassium fertilizer reduces calcium content.

8. Soil pH is a factor in that the farther from neutrality, trace mineral availability to the plants is reduced.

9. Temperature-grass tetany, a deficiency symptom for magnesium, usually happens under cool soil temperatures which may reduce root uptake of magnesium.

10. Seasonal variation, which may be an affect of maturity of the plants.

Can analyze plants for mineral content, 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 for most producers. Many state extension specialists know what minerals are likely to be deficient in given areas of their state i.e. Se, and I. Goats have similar mineral requirements to beef cattle.

**Macrominerals**

Macrominerals are required in fractions of percentages, and include calcium, phosphorus, sodium, potassium, chloride, sulfur, and magnesium

*Calcium* 0.4%

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

**Deficiency symptoms**
- 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
- Reduced growth, pica, decreased serum phosphorus

Sources of phosphorus
- Protein supplements, cereal byproducts, mono and dicalcium phosphate

Sodium 0.2%

Potassium 0.8-2.0%

Chloride 0.15%

Biological function
- All three function as electrolytes in the body
- Lost in diarrhea

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

Sources
- Salt block, potassium is adequate in most forages

Sulfur 0.2-0.32%

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. Water can contain sulfur
- Sulfur blocks used for ticks
Magnesium 0.18-0.4%

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
Death, loss of appetite, excitability, staggering, convulsions, deficiency on fast growing lush pasture, especially cool season grasses called grass tetany

Sources
Forages, magnesium oxide fed with protein supplement to prevent grass tetany

Micro or Trace Elements

Microminerals are required at the ppm level, and include iron, copper, cobalt, zinc, iodine, manganese, selenium, and molybdenum.

Iron 50-1000 ppm

Biological function
Component of hemoglobin, required for oxygen transport
Component of certain enzymes

Deficiency symptom
Anemia lack of hemoglobin (contains iron) Seldom deficient because of soil

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 10-80 ppm

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, mineral supplements, trace mineralized salt, organic copper

\textit{Cobalt} \ 0.1-10 \text{ 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

\textit{Zinc} \ 40-500 \text{ ppm}

Biological function
Found in all animal tissues
Required for the immune system function

Deficiency symptoms
Dermatitis, thick dry patches of skint hair loss, lesions
Swollen feet, poor hair growth, loss of hair
Essential for male reproduction

Sources
Bran and germ of cereals

\textit{Manganese} \ 40-1000 \text{ ppm}

Biological function
Bone formation reproduction enzyme functioning

Deficiency symptoms:
Reluctance to walk, deformity of forelegs,
Delayed onset of estrus, poor conception rate
Low birth weight
Source
Difficult to get a deficiency

Selenium 0.2-3 ppm

Biological function- requires vitamin E
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 0.1-3 ppm

Deficiency very rare
Toxicity above 3 ppm due to reduced copper absorption

Iodine 0.5-50 ppm

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
Deficiencies or Toxicities

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, hemoglobin for iron, 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.

Summary

Adequate levels of calcium and phosphorus in 2:1 ratio.
Free-choice mineral supplements contain macrominerals, microminerals and vitamins
Use trace mineralized salt if macrominerals are adequate.
Avoid going overboard on any supplementation.

Sources of mineral information

Goat Medicine by Smith and Sherman
Merck Veterinary Handbook
State Livestock Extension Specialist
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