Feeding Notes – M. L. Thonney
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Sheep & goats are ruminants with 4 compartments in their stomachs (rumen, reticulum, omasum, abomasum). The rumen and reticulum serve as large fermentation vats holding bacteria and protozoa. These ruminal microorganisms provide advantages for sheep & goats compared with simple-stomached animals. They:

- Digest cellulose and hemicellulose in fiber to produce volatile fatty acids that are absorbed through the rumen wall and used as the main precursors of glucose and fatty acids.
- Make B vitamins.
- Make essential amino acids from non-protein nitrogen and carbon skeletons.

As fermented feed and ruminal microbes pass through the omasum from the reticulum, the moisture content is reduced. From the omasum, this digesta enters the abomasum. The abomasum is the gastric stomach equivalent to the stomach of simple-stomached animals.

Feed components are nutrient precursors

Feed ingredients can be analyzed for components. The components can be digested to supply nutrients directly or be fermented by ruminal microbes to supply nutrients. See Table 1 on the last page of this document for feed ingredient components and the nutrients they provide.

Feeding levels

Like all ruminants, sheep & goats should be able to eat as much and as often as they wish. Component concentrations in diets should be adjusted for stage and level of growth, reproduction, milk production, and wool production. The *FeedForm* diet formulation tool or other diet formulation software can be used to assess and adjust diets.

Fermentable NDF

Neutral detergent fiber (NDF) measures the fiber component of feeds or ingredients. Ruminants need minimum levels of fermentable NDF (FNDF) to develop and maintain rumen function. Normal rumen fermentation produces volatile fatty acids (VFAs) such as acetic acid (vinegar), propionic acid, and butyric acid. High grain diets with insufficient levels of FNDF, may allow lactic acid-producing bacteria to predominate. Lactic acid is ten times stronger than the VFAs and one form is not easily metabolized by mammalian tissues. This type of fermentation causes rumen acidosis with the resulting degradation of the absorbing papillae on the ruminal wall. High enough concentrations of lactic acid will be absorbed into the blood stream, resulting in metabolic acidosis. Both rumen acidosis and metabolic acidosis results in lowered feed intake and a spiral toward death.

Based upon designed experiments at Cornell and evidence from private farms, **minimum FNDF levels range from 15% of the dietary dry matter for growing lambs to 35% of the dietary dry matter for lactating ewes or does consuming high levels of digestible carbohydrates.** Click here for more information.

Experiments have shown that “roughage” (Google definition: fibrous indigestible material in vegetable foodstuffs that aids the passage of food and waste products through the gut) is has no ruminal function. The so-called “scratch factor” should be scratched (Debbie Hogue).

Minerals

Copper is needed in sheep diets, but sheep are very susceptible to copper toxicity. Only rarely should copper be added to feeds or included in mineral mixes. Copper poisoning usually is a result of feed mixing errors or the use of mineral mixes or mineral blocks for other farm animals, such as cattle.

Molybdenum is an essential dietary element. At the low end of high dietary copper levels, higher molybdenum levels can help to prevent copper toxicity.

Cobalt is part of vitamin B12 (cyanocobalamin), produced by ruminal microorganisms. Cobalt is deficient in most soils and should be included in a mineral supplement.

Selenium is part of glutathione peroxidase, which prevents white muscle disease. Selenium is deficient in most soils and should be included in a mineral supplement.

Iodine is part of thyroxine, a hormone produced by the thyroid gland than regulates metabolism. Iodine is deficient in most soils and should be included in a mineral supplement.

Phosphorus does not normally needed to be added to feeds for sheep & goats. High grain feeds supply more than enough.

Calcium normally should have a concentration twice as high as phosphorus. This helps to prevent urinary calculi and maintain healthy bones. Dicalcium phosphate should not normally be used to increase calcium concentrations in diets because it contains phosphorus. Limestone or calcium carbonate should be used. Milk fever is the name given to hypocalcemia, when so much calcium is taken from the body to produce milk that a ewe or doe develops neurological symptoms so severe that she can not get up. Milk fever can be prevented by proper dietary mineral balance near the end of gestation. Milk fever can be cured by administering large amounts of appropriately buffered calcium subcutaneously or intravenously. The symptoms of milk fever can be confused with those of pregnancy toxemia.

Because sheep & goats consume minerals for the taste of sodium chloride, only one mineral mix that includes salt – like the Agway Sheep Mineral Mix – should be used. Sheep & goats do not have nutritional wisdom.

Loose minerals should be used instead of mineral blocks because sheep & goats will not consume sufficient amounts of minerals from blocks.

Silage feeds

Sheep & goats are prone to infection by *Listeria monocytogenes*, the organism that causes listeriosis. The organism likes to grow in cool, moist environments. Unless feedbunks are cleaned daily, they provide great environments for listeria. Corn silage seems to cause the highest incidence. Grass silage is an excellent feed for mature animals with a lower incidence of listeriosis.

Pregnancy ketosis

A ewe or doe carrying multiple fetuses in late gestation may not have enough abdominal space to consume the large amounts of a low-digestibility diet necessary for metabolism. The ewe or doe will draw on body fat without sufficient glucose to properly metabolize the resulting fatty acids. The fatty acids will be transformed to ketones to create ketosis. This causes general lethargy and reduces feed intake further, which results in a vicious, downward spiral toward death. Pregnancy ketosis can be prevented by feeding very highly digestible hay or silage or supplementing with grain during the last third of gestation. Pregnancy ketosis can be treated by oral administration of glycerol several times daily until after the ewe or doe gives birth. The symptoms of pregnancy ketosis can be confused with those of hypocalcemia (milk fever).

Table 1. Feed components in ruminant nutrition.

Component category	Subcategory	Feed analysis	Nutrient	Nutrient function
Carbohydrate	Indigestible neutral detergent fiber (INDF)	NDF remaining after in vitro fermentation or calculated as (indigestibility of dry matter – metabolic fecal loss)	None (fecal material)	None
	Fermentable NDF (FNDF)	NDF - INDF	Volatile fatty acids (acetic, propionic, butyric, others)	• Development and maintenance of rumen. • Absorbed through rumen wall as precursors for glucose, fatty acids • Carbon components for microbial replication
	Non-fiber carbohydrates	Sugars & starches	Glucose	• Synthesis of lipid • Synthesis of amino acids for protein • Fuel for biochemical reactions
Crude protein	Ruminal degradable intake protein	Kjeldahl nitrogen x 6.25	Amino acids	• Synthesis of microbial protein
	Ruminal undegradable intake protein	Kjeldahl nitrogen x 6.25	Amino acids	• Synthesis of animal protein
Fat	Fat	Ether extract	Glycerol and fatty acids	• Synthesis of lipid
Minerals	Minerals	Ash or individual minerals	Minerals	• Skeletal synthesis • Components of enzymes • Cofactors in biochemical reactions
Vitamins	Water soluble Fat soluble	Various methods Various methods	B-vitamins A, D, E, K	• Cofactors in biochemical reactions • Cofactors in biochemical reactions