

# Nitrogen And Energy Nutrition Of Ruminants

## AMMONIA AS A COMMON DENOMINATOR

It is important to indicate that NPN compounds are normal constituents in the biological fluids of ruminants, even when NPN is absent from the diet. Also, natural feedstuffs that are fed to ruminants contain a variable amount of NPN. Thus, the ruminant continually uses NPN as a normal dietary and metabolic constituent.

Ammonia is the common denominator in the utilization of NPN by ruminants (Hungate, 1966). If the rumen microorganisms cannot degrade the compound in question to yield free ammonia, it is useless as a nitrogen source to the microorganisms. When urea is the substrate, the following steps appear to be involved in its complete utilization:

1. Urea  $\xrightarrow[\text{Urease}]{\text{Microbial}}$   $\text{NH}_3 + \text{CO}_2$
2. Carbohydrates  $\xrightarrow[\text{Keto Acids}]{\text{Microbial Enzymes}}$  Volatile Fatty Acids (VFA) +
3.  $\text{NH}_3 + \text{Keto Acids} \xrightarrow[\text{Amino Acids}]{\text{Microbial Enzymes}}$
4. Amino Acids  $\xrightarrow[\text{Microbial Protein}]{\text{Microbial Enzymes}}$
5. Microbial Protein  $\xrightarrow[\text{Amino Acids}]{\text{Animal Enzymes in the Abomasum and Small Intestines}}$  Free
6. Free amino acids are absorbed from the small intestine and used by the host animal.

Similar schemes would be appropriate for other NPN sources if enzymic action is needed for hydrolysis. However, different enzymes may be involved for each NPN compound. Bloomfield *et al.* (1960) reported that step number one usually proceeds at a faster rate than step number two. This is especially true if the lignocellulose complex of poor-quality forages is the primary carbohydrate source in the diet. In this case the keto acids necessary for amino acid synthesis are limiting; thus there may be a considerable loss of ammonia through the ruminal wall, resulting in poor utilization of dietary nitrogen. If the rate of urea intake

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