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Funded by: F.B. Miller Animal Sciences Summer Undergraduate Research Program

Coupling ammonia-N production with ammonia-N uptake in the rumen

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Microbial efficiency is defined as a measure of microbial yield in the rumen per unit of organic matter fermented. Because the ruminant is dependant on microbial mass for its supply of amino acids, the nutritional goal is to maximize microbial efficiency. However, an excessive supply of nutrients to rumen microbes can result in waste. Excessive waste can have negative economic and environmental consequences. A study was conducted to determine if prediction of ammonia-N release could be optimized with bacterial ammonia uptake in the rumen. The hypothesis of this research was that a diet could be formulated such that ammonia-N release would match the ammonia uptake by rumen microflora. To test this hypothesis, a continuous culture system of twenty fermentors placed in a 39°C water bath was used. Dietary treatments were basal, 0.33X, 0.66X, X, and 1.33X. The optimal diet (diet X) was formulated using substrates with complementary degradation rates in order to maintain an optimal ammonia level of 2 mM (Satter & Slyter, 1973). Following an acclimation period of 4 days, samples were collected for 3 days. Collected samples were analyzed for organic matter digestibility (OMD), concentration of volatile fatty acids (VFA), pH, and microbial efficiency. Microbial efficiency was maximized for diet X. As the degradable protein level increased in the diet, VFA increased and pH decreased. The degradable protein level did not influence OMD. Conclusions from this data were that increasing degradable protein increased fermentative activity but not microbial yield. We further deduced that previous research conducted in our laboratory was valid in concluding that ammonia-N requirements could be modeled. This will enhance diet formulation for ruminants.