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Isoacids In The Ruminant

Introduction

The Cornell University ruminant physiologist Peter J. Van Soest has stated "As a result of evolution, ruminants have probably adapted to efficient gluconeogenesis, while the lower digestive tract has adapted to the lack of sugar and starch. The true diet of the ruminant is not what it eats, but rather, the combination of fermentation products and fermented feed that escapes from the rumen. The net changes in the ingested feed include conversion of dietary protein and nitrogen into microbial protein, and conversion of carbohydrate into a variety of non-carbohydrate products." Considering the importance of ruminal action in this light, it becomes obvious that desired changes in bovine production, whether milk or meat, very possibly could be effected by altering rumen function.

The rumen is a complex environment of biochemical reactions and bacterial and protozoal interactions interwoven one with the other. Altered metabolism due to exogenous influences can have multiple effects. Conversely, a desired production effect may be obtained through more than one nutritional approach. The following two articles provide insight as to the rationale of one such endeavor and a commercial product that has resulted. The first article provides a general background of the ruminal environment and the role of isoacids in this environment. The second article reviews the clinical findings surrounding the release of the commercial product and field observations of the effects of its use.

— Eldon K. Uhlenhopp, DVM, MS

Effects of Isoacids on Ruminal Metabolism and Milk Production

Richard R. Becht, DVM*

Cellulolytic bacteria

The digestion of cellulose in the rumen requires the interaction of both cellulolytic and non-cellulolytic bacteria, as well as protozoa. Even when the energy source is entirely roughage material, the cellulase-producing bacteria comprise only about one-fourth of the total bacterial population. Major cellulolytic species include: Fuminococcus albus, Ruminococcus flavisfaciens, Bacteroides succinogenes, and Butyrivibrio fibrisolvens. Of these, Bacteroides succinogenes is the most active in digestion of cellulose, especially the more resistant forms. Butyrivibrio fibrisolvens is able to ferment a greater variety of carbohydrates than the other species, but most strains are relatively inactive fermentors of cellulose. This species can utilize both amino acids and non-protein nitrogen sources, but requires a complete amino acid mixture for effective nitrogen assimilation.

Cellulolytic bacteria can obtain energy from -keto acids derived from deamination of amino acids. If hydrolysis of amino acids and rate of ammonia production is greater than utilization for microbial protein, the ruminal ammonia and plasma urea levels will increase greatly, resulting in a wastage of nitrogen and possible urea toxicosis to the animal. This occurs most often when the diet is deficient in carbohydrate sources of energy. It is important to provide adequate levels of carbohydrate in the diet so that most of the nitrogen will be incorporated directly into protein and ammonia production will be lower.

*Dr. Becht is a 1986 graduate of the College of Veterinary Medicine at Iowa State University.