The Alpharma Beef Cattle Nutrition symposium was held at the joint annual meeting of the American Society of Animal Science, the American Dairy Science Association, the Asociación Mexicana de Producción Animal, and the Poultry Science Association in San Antonio, Texas, July 8 to 12, 2007. The purpose of the symposium was to discuss the potential to influence ruminant animal production through nutrient synchrony, to summarize the contribution of N recycling to nutrient synchrony, and to determine opportunities to enhance animal performance and efficiency through nutrient synchrony in both forage- and concentrate-fed ruminants.

Nutrient synchrony refers to providing dietary protein and energy sources to the rumen in such a manner that they are available simultaneously in proportions needed by the ruminal microorganisms. The concept is that synchrony between the supply of N and energy to the ruminal microorganisms should improve capture of N, improve efficiency of ATP use for microbial growth, increase nutrient supply to the host animal, and thereby improve animal performance. With traditional feedstuffs being processed to provide substrates for other purposes (e.g., ethanol production), the availability of coproducts will most likely continue to increase. If nutrient synchrony is important, then altered rate and extent of ruminal degradation of key nutrients in coproducts relative to the parent feedstuff becomes important to evaluate.

Hall and Huntington (2008) explored factors that affect our ability to impose nutritional synchrony in ruminant nutrition. Nutrient supply, ruminal considerations, postruminal nutrient supply and use, and animal factors were discussed. Because of the complexity of the pools that exist within the animal, it is difficult to quantify where substrates come from and how they may contribute to nutrient synchrony. In addition, animal influences such as an immune challenge or tissue damage may alter synchrony because of the animal's innate drive to maintain homeostasis. These factors most likely contribute to why nutritional synchrony of protein and energy has not consistently resulted in increases in microbial efficiency and animal production. Hall and Huntington (2008) proposed that we may need to look at the whole animal, not just the rumen, when considering nutritional synchrony, and that a term such as balance may be more appropriate when considering the complexity of the ruminant animal.

Quantification and regulation of nonprotein N flux between the gastrointestinal tract and body of ruminants was reviewed by Reynolds and Kristensen (2008). Effects of rumen synchrony or asynchrony on nonprotein N cycling and productive responses, and the potential role of labile protein reserves on response to variations in dietary protein supply were considered. One of the advantages of the ruminant animal is its ability to recycle N from blood and saliva to the gastrointestinal tract during periods of dietary protein deficiency or during periods of asynchronous carbohydrate and protein supply. Urea is salvaged when dietary protein is in short supply and provides a source of N for microbial protein synthesis. Urea recycling buffers the effects of asynchronous energy and N supply to the rumen, which may explain a lack of negative effects of oscillating or infrequent protein supplementation on animal production. Factors such as the role of urea transporters, which control urea transfer from the blood to the gastrointestinal tract, need to be determined (Reynolds and Kristensen, 2008).

Hersom (2008) and Cole and Todd (2008) evaluated potential opportunities to enhance performance and efficiency through nutrient synchrony in forage- and concentrate-fed ruminants, respectively. Nutritional management challenges for forage-fed ruminants will most...
likely limit opportunities for nutrient synchronization (Hersom, 2008). Estimating forage intake and chemical composition remains a challenge, and the forage base alone generally provides an asynchronous diet in regard to release of important nutrients, because digestion rates of the carbohydrate fractions are generally slower than those of the protein fractions. In addition, characteristics (e.g., type, nutrient profile, degradation rates, etc.) of supplemental feedstuffs and temporal intake patterns of forage vs. supplement interact to alter nutrient synchrony. The robust nature of the ruminant animal allows it to accommodate a wide range of dietary situations (Hersom, 2008). For cattle fed high-concentrate diets, Cole and Todd (2008) hypothesized that N utilization could be improved by oscillating the dietary CP concentrations between adequate and deficient at 48-h intervals. Although results have been variable, there appears to be potential to increase N retention when CP concentrations are oscillated in cattle fed high-grain diets. Cole and Todd (2008) also suggested that nutrient intakes should be synchronized with animal requirements, such as by phase-feeding dietary CP to cattle on high-grain diets. Results indicate that CP can be decreased late in the finishing period with no adverse effects on animal performance.

In summary, although theoretically sound in principle, nutrient synchrony has generally not resulted in improved animal performance, increased efficiency of nutrient utilization, or decreased nutrient excretion. The adaptive mechanisms of the ruminant animal appear to allow it to overcome any potential negative effects of nutrient asynchrony. The papers cited provide an excellent overview of these physiological mechanisms and the whole-animal response.

LITERATURE CITED


