TRUE PROTEIN VS NON-PROTEIN NITROGEN

Katie Mason, UTIA Assistant Professor and Extension Beef Cattle Specialist

Protein is a vital nutrient for cattle, especially for rapidly growing or lactating animals. In cattle diets, protein is commonly expressed as “crude protein” (CP). The CP concentration is determined by multiplying nitrogen (N) concentration of the feed or forage by 6.25. Most protein contains 16% N, which is why the conversion factor is 6.25 (1 ÷ 0.16 = 6.25). For example, 1.8% N in a sample × 6.25 = 11.25% CP.

Crude protein comprises true protein, sometimes called “natural protein,” and non-protein nitrogen (NPN). Natural protein comes from plant-based sources. Cottonseed and soybean products, as well as corn gluten feed and dried distillers grains, are commonly used natural protein sources for cattle. Non-protein nitrogen sources do not contain amino acids; however, rumen microbes are able to convert NPN to true protein if there is sufficient energy in the diet. Urea and biuret are commonly used NPN sources.

Rumen microbes produce ammonia to convert NPN to protein. Ammonia released from this process follows one of two pathways: (1) used to make microbial protein, which can be absorbed and utilized by the animal, or (2) excess amounts are absorbed and detoxified in the liver, then excreted in the urine. If urea is consumed too quickly, or if microbes do not have sufficient energy, ammonia may be absorbed at levels too high to be broken down by the liver. Ammonia toxicity or death may result.

Therefore, it is important to provide plentiful, moderate to high-quality forage before feeding NPN-based supplements. This can mitigate overconsumption by ensuring that cattle are not hungry when they access the supplement. Giving adequate time for microbes to acclimate to NPN-based supplements can also reduce the risk of ammonia toxicity. While supplementing with degradable intake protein (e.g. urea) can increase consumption of low-quality forages, it can also create some nutritional concerns. Namely, low-quality forages do not have enough energy content for microbial digestion, and increased intake of low-quality forage can cause compaction issues and nutrient deficiencies.

I like to share this analogy about the need for energy to utilize dietary protein: a hungry contestant on survival competition reality TV show finds himself looking for a nutrient dense food source. He is alone, far from camp, and in the middle of a blizzard. He manages to take down a musk ox, which will provide a great amount of protein for his diet. Because the musk ox is so large and he is low on energy, he cannot get the it back to camp through the blizzard as darkness sets in. Either he will wear himself out trying to bring musk ox back, or he will have to waste the protein by leaving it where it is. If he had more energy, he may actually be able to make use of the musk ox. Think of the contestant as the rumen microbes.

Remember: you cannot feed your way out of an energy deficiency by just providing protein. Test your hay and provide sufficient energy in tandem with protein supplements. And in terms of NPN-based supplements, it is recommended that no more than 15% of the total CP in the diet comes from a non-protein nitrogen source.