

Daily and Alternate-day Supplementation of Natural Protein and Non-protein Nitrogen to Ruminants Consuming Low-quality Forage

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Introduction

Supplementation of natural protein (alfalfa, soybean meal, cottonseed meal, etc.) to ruminants consuming low-quality forage (<6 percent crude protein [CP]) has improved forage intake, nutrient digestibility, animal performance, and reproductive efficiency compared with nonsupplemented controls. Similarly, providing non-protein nitrogen (NPN), such as urea or biuret, to ruminants consuming low-quality forage also has increased forage intake, nutrient digestibility, and animal performance, compared with no supplemental CP. Urea is very soluble in water and is degraded rapidly within the rumen to ammonia. This can result in ammonia toxicity if a large amount of urea is consumed in a short period of time. In contrast, biuret is insoluble and is broken down to ammonia slowly within rumen. As a result, biuret is safer and can be fed at higher levels than urea.

Non-protein nitrogen, primarily urea, is a popular source of supplemental CP because it is normally less expensive per unit of CP, compared with most natural protein sources. In addition to actual supplement costs, supplementation includes other expenses such as the labor and equipment associated with supplement delivery; therefore, infrequent supplementation of CP to ruminants consuming low-quality forage can decrease supplementation costs. Nevertheless, infrequent

supplementation of NPN to ruminants is not a common management practice because of the potential for ammonia toxicity and decreased supplement intake, and it is often considered inferior to sources of natural protein. Therefore, we conducted a series of experiments to compare daily and every-other-day supplementation of natural protein or sources of NPN on forage intake, nutrient digestibility, and efficiency of CP use in ruminants consuming low-quality forage.

Experimental Protocol

The first set of experiments evaluated daily and every-other-day supplementation of two NPN sources, urea or biuret, to lambs, steers, and cows consuming grass seed straw. The second set of experiments compared daily and every-other-day supplementation of urea or soybean meal to lambs and steers consuming the same low-quality hard fescue straw.

Urea versus biuret. Five steers, 5 wethers, and 80 pregnant (approximately 200 days gestation) Angus × Hereford cows were provided 4 percent CP grass seed straw and allotted to one of five treatments. Experimental treatments included no supplementation or provision of a urea or biuret supplement daily or every other day. All supplemented treatments provided the same quantity of supplemental protein over a 2-day period, so that the every-other-day treatments received double the quantity of supplement on the day of supplementation, respectively, compared with the

daily supplemented treatments. The urea and biuret supplements (5.3 percent urea and 6.1 percent biuret, respectively) were soy hull-based and contained approximately 30 percent CP.

Soybean meal versus urea. Five steers and 5 wethers were provided 4 percent CP grass seed straw and allotted to one of five treatments. Experimental treatments included no supplementation or provision of a soybean meal (SBM) or urea supplement daily or every other day. All supplemented treatments provided the same quantity of supplemental protein over a 2-day period, same as above. The SBM and urea supplements (31.0 percent SBM and 5.3 percent urea, respectively) were soy hull-based and contained approximately 30 percent CP.

Results and Discussion

Urea versus biuret. These experiments were conducted to determine the effects of type of supplemental NPN and supplementation frequency on nutrient intake and digestibility and performance by ruminants consuming low-quality forage. Supplementation with NPN increased nutrient intake and digestibility, the quantity of protein digested and incorporated into body tissues, and cow weight and body condition score at calving compared with no supplemental NPN. No differences were noted between daily and

every-other-day supplementation. Therefore, with proper nutritional management, the nutrient intake, nutrient utilization, and cow performance can be maintained with daily or every-other-day supplementation of NPN to ruminants consuming low-quality forage.

Soybean meal versus urea. These experiments were conducted to compare daily and every-other-day supplementation of SBM or urea to ruminants consuming low-quality forage. Supplemental CP from both SBM and urea increased intake and digestibility of nutrients and the

quantity of CP digested and incorporated into body tissues. Also, no difference was noted between daily and every-other-day supplementation. Therefore, nutrient intake and nutrient utilization by ruminants consuming low-quality forage was not affected by source of CP, even when provided every other day.

Management Implications

The cost of a CP supplement can be reduced by incorporating NPN (specifically urea) into the supplement rather than using all natural protein, with little effect on nutrient intake, nutrient digestibility, or cow performance. However, to minimize the potential of ammonia toxicity, producers should consult a nutritionist or Extension specialist for assistance in developing a

supplementation plan that uses urea as a source of supplemental protein. This is especially true when the supplement will be provided every other day. Considerations include adequate bunk space, accessibility of supplement by animals, water supply, forage availability, and supplement carrier (ground corn, ground barley, ground soy hulls, etc.). In addition, the labor and fuel costs associated with supplement delivery can be reduced by approximately one-half with every-other-day compared with daily supplementation.