Effect of Grain Type and Grain Prep® Surfactant on Bacterial Utilization of Ruminal Ammonia Nitrogen *In Vitro*

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Preparations based on *Yucca schidigera* saponins have been used to manipulate ruminal fermentation in beef and dairy cattle. Supplementation of the diet with yucca saponins have resulted in reduced protozoal numbers and ammonia concentration and increased propionate in the rumen. Positive effects on production have also been observed. The objective of this study was to investigate the effect of grain type and a yucca-based product, Grain Prep®, on ruminal fermentation and specifically, ammonia utilization by mixed microbial populations, *in vitro*. Three, 8-h incubations were carried out with ruminal inoculum obtained from two lactating dairy cows fed an alfalfa hay/triticale silage/concentrate diet. Grain Prep®-treated feed mix, containing 40% ground through 1-mm sieve alfalfa hay, 58% grain, and 2% soybean meal, was incubated at 1.5% concentration with buffer and ruminal inoculum (1 part inoculum and 2 parts buffer). The grain part of the diet was either ground corn (Corn) or 50% corn and 50% high-amylopectin (waxy) barley grain (Barley). Grain Prep® was applied to the feed mix at 0, 60, and 120 ppm. At time 0 h, the ammonia pool was labeled with ^{15}N from $(^{15}NH_4)_2SO_4$. Aliquot samples were taken from the incubation media at 0, 2, 4, 6, and 8 h and analyzed for pH, ammonia, VFA, and ^{15}N-enrichment of bacterial and ammonia N. Data were analyzed as split plot in time using GLM procedure of SAS. Replicates were averaged per incubation. Incubation hour 8 data were also analyzed as a completely randomized design.

Across incubation time-points, inclusion of 50% barley into the grain mix slightly increased ($P < 0.05$) media pH (6.68 vs 6.71, Corn and Barley, respectively) and decreased ($P < 0.05$) ammonia concentration (13.0 vs 12.7 mmol/L, respectively). Concentration of total and individual VFA was not affected ($P > 0.05$) by type of grain. Grain Prep® linearly increased ($P < 0.05$) ruminal pH (6.68, 6.69, and 6.71; 0, 60, and 120 ppm, respectively) but had no effect ($P > 0.05$) on ammonia or VFA concentration, except valerate concentration was increased ($P < 0.05$, quadratic response) by 60 ppm Grain Prep®. Incorporation of ^{15}N into fluid bacteria tended to be greater ($P = 0.107$) in Barley than in Corn (0.69 vs 0.59 μg of ^{15}N). Overall recovery of the ammonia tracer in high-speed pellets (free and particle-associated bacteria, protozoa, and feed particles) was not affected ($P > 0.05$) by type of grain. The overall proportion of bacterial N originating from ammonia N was also not different ($P > 0.05$) between Corn and Barley (16.5 and 17.6%, respectively). Grain Prep® had no effect ($P > 0.05$) on the tracer-related parameters. At 8 h, Barley treatments resulted in greater ($P < 0.05$) recovery of ^{15}N in the high-speed pellets (23.5 vs 21.8 μg) and proportion of bacterial N originating from ammonia (35.1 vs 31.9%, respectively) than Corn. Grain Prep® tended to increase ($P = 0.111$) the proportion of bacterial N originating from ammonia N (31.3, 33.6, and 36.2%, 0, 60, and 120 ppm Grain Prep®, respectively).

In conclusion, this *in vitro* experiment indicated that a 50% substitution of corn by barley had a positive effect on ammonia N utilization in the rumen. A trend for enhanced bacterial incorporation of ammonia N was observed with Grain Prep® addition.