TECHNICAL BULLETIN
DAIRY

QLF QUALITY LIQUID FEEDS

WHAT DOES RUMEN FERMENTATION DYNAMICS TELL US ABOUT SUGAR & STARCH? FERMENTATION RATE OF QLF, CORN AND WHEY PERMEATE

Not all carbohydrates are created equal. Molasses-based liquid feeds which contain sucrose, glucose, and fructose sugars have a much faster fermentation rate in the rumen compared with starch-based corn products or lactose-based whey permeate. To quantify the fermentation rate of various carbohydrate sources, we took 4 different on-farm samples and sent to Dairyland Labs (Arcadia, WI) for analysis: a molasses-based QLF product (QLF 36-12, 36% sugar 12% CP as fed basis), a whey permeate sample, a ground corn sample, and a ground high moisture shell corn sample (72% DM, in storage about 3 months). These samples were incubated for 48 hours in rumen fluid with gas production being measured every hour.

QLF vs. Corn

Based on the results (see Figure 1), the QLF sample showed significant gas production in the first few hours of rumen incubation, and peaked around 5 hours, whereas either dry or high moisture corn had a relatively slower fermentation and didn't peak until 12 hours. The graph showed that molasses-based QLF and corn have dramatic differences in rumen fermentation dynamics. The results are in line with the concept that faster fermentation of QLF matches up with the fast release of urea to drive rumen microbial protein yields. On the other hand, the rate of corn fermentation matches up with soybean meal pretty well. The fast release of sugar allows microbes to utilize it as a quick highly digestible energy source, without sustained depressing effects on rumen pH as that from starch. Matching the speed of carbohydrate and protein pools is important to maximize rumen nutrient utilization efficiency and maintain a steady ammonia level. Although high moisture corn fermented a little bit faster than dry corn, the difference is not huge compared with QLF sample. This graph tells us the fundamental difference between sugar and starch on rumen dynamics.

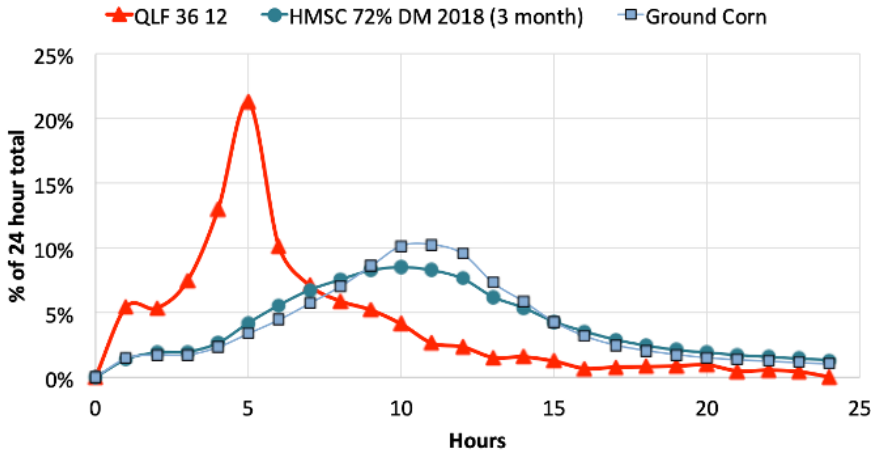

Figure 1: QLF vs. corn fermentation rates estimated by rumen gas production. Analyzed by Dairyland Labs in 2019.

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QLF vs. Whey Permeate:

Consistent with previous research, our results (Figure 2) showed that molasses-based QLF ferments much faster than lactose-based whey products. Please note the peaks of the graphs do not represent the volume of gas production, but simply the rate of gas production. In the first few hours of fermentation, only QLF but not whey permeate showed significant fermentation. This is why feeding QLF can help rumen microbes to capture free N and soluble protein and turn into microbial protein. Whey products may provide some energy to the cows but do not grow rumen bugs like other types of sugars, especially given the microbes in the mature rumen were not exposed or adapted to lactose in the diet before. Therefore, molasses-based liquid feeds are superior in improving rumen dynamics and increasing fermentation substrates for milk component yields.

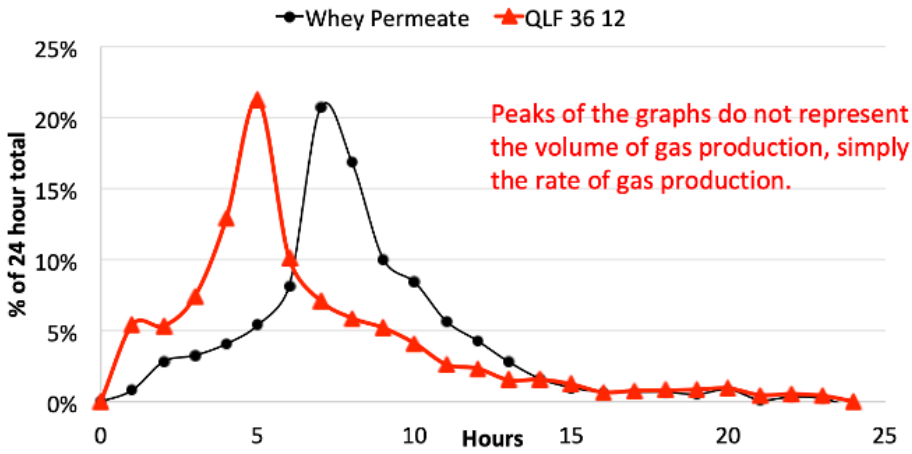

Figure 2: QLF vs. whey permeate fermentation rates estimated by rumen gas production. Analyzed by Dairyland Labs in 2019. Note in the first few hours of fermentation, only QLF but not whey permeate showed significant fermentation.

Overall, rumen gas fermentation analysis showed that molasses-based QLF liquid feeds (primarily sucrose, fructose, and glucose) ferment much faster in the rumen compared with starch-based corn products or lactose-based whey permeate. Matching the speed of carbohydrate and protein pools is important to drive rumen nutrient utilization efficiency and microbial population growth. Maximizing rumen microbial protein yields and fatty acid fermentation is the key to optimize milk component yields. Our ongoing project is measuring the types of rumen gas and volatile fatty acids been produced by different feed ingredients.