Diamond V Pre-Conference Paper

Diamond V Next Generation Technology: Helping Cows Reach Their Genetic Potential Every Day. T.J. Oelberg, Ph.D. Diamond V.

Allowing dairy cows to reach their genetic potential milk production every day requires management focus on transition cows, cow comfort, heat abatement, milking procedures, forage quality, feeding management, and heifer raising to name a few. This manuscript will discuss reducing total mix ration (TMR) variation, improving feed access, and enhancing rumen function and immune system with Diamond V® next generation technology.

Reducing TMR Variation

The first step in reducing TMR variation is pushing and lifting faced silages with skid-steer or payloaders into well-mixed piles. Figure 1 shows nearly a 2.5-fold reduction in standard deviation levels of crude protein in alfalfa haylage (5) before it included in a total mixed ration. This is a key step in reducing variation in the TMR because alfalfa haylage and corn silage make up 50-60% of the TMR on many dairies across the U.S. Also, many dairies blend bales of alfalfa hay by lifting and pushing bales with strings removed into piles before loading into a TMR. These practices are now common-place on many dairies across the U.S.

Figure 1. Lifting and pushing faced alfalfa haylage into a pile reduces variation in crude protein.

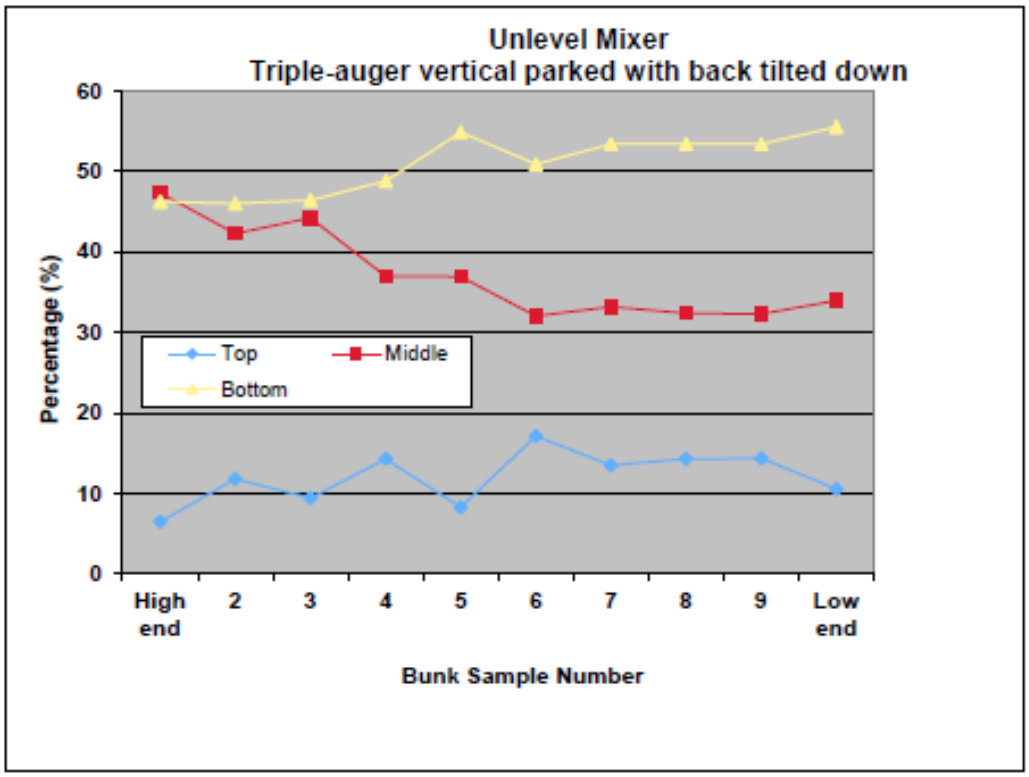
The second step in reducing TMR variation is following the mixing basics described in detail by Oelberg and Stone (4). An on-farm method of taking ten (10) equally-spaced samples of freshly delivered TMR along the feed bunk and subjecting each sample to the Penn State Particle Separation (PSPS) procedure allowed the discovery of the mixing basics shown below:

1. Worn mixer augers, kicker plates and/or knives
2. Unlevel mixer during TMR mixing
3. Mix time after the last added ingredient
4. Loading position on the mixer box
5. Load size
6. Hay quality and processing
7. Loading sequence
8. Liquid distribution
9. Vertical mixer auger speed
10. Vertical mixer auger timing

11. Forage restrictor settings on vertical mixers

The effect of mixing a TMR in an un-level mixer is shown in figure 2. There is 10-point difference in the amount of material in the bottom screen between the high end (start of unloading) and the low end (end of unloading). Because cattle are quite territorial, the cows on the opposite ends of the feed bunk will consume different TMRs and instead of the one formulated by the nutritionist. This will have an impact on rumen health and energy-corrected milk production. Each of the 11 factors listed above can impact TMR consistency and the cow's genetic potential milk production.

Figure 2. Unlevel mixer boxes force heavy dense ingredients to the **bottom** screen of the Penn State Particle Separator (PSPS) which flow to lower section of the mixer (5).



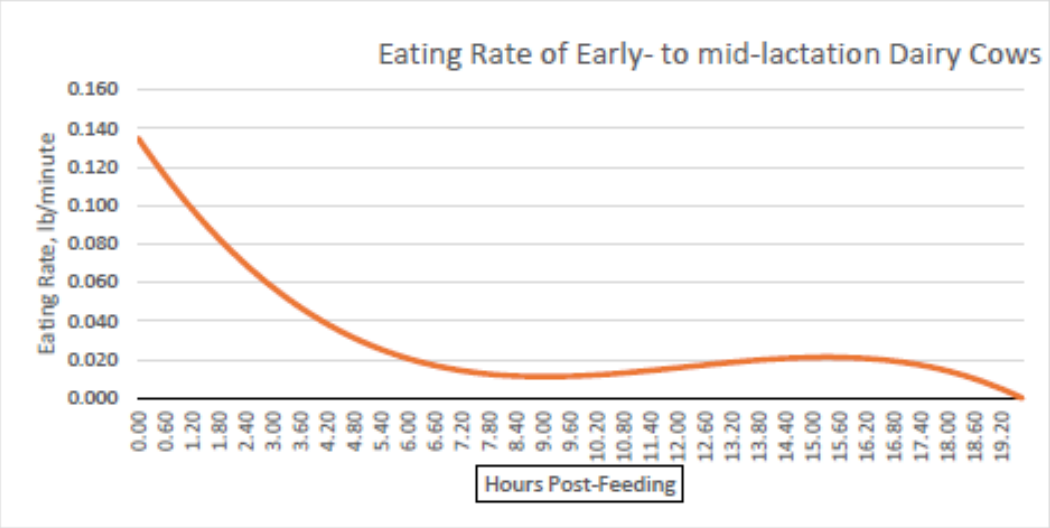
Making TMR More Accessible to Cows

The use of time-lapsed photography to observe feed bunk levels throughout the night and over several days has given great insight on the TMR accessibility to dairy cows (5). Delivering the first-feed drop of TMR at the same time every day and keeping the TMR pushed up so that cows can reach the TMR at all times are critical for maximum dry matter intake (DMI) and genetic potential milk production. First-feed drop TMR should be delivered within 20 minutes of the target time each day so that cows have 24-hour access to fresh feed every day. Refusals need to be pushed out and weighed for each pen so that DMI is accurate. This assumes that feed was

continually pushed up throughout the 24-hour period so that all cows within the pen had access to feed and the net intake (feed offered minus feed refused) reflects their true appetite.

The biggest challenge for many dairy producers is to keep the TMR pushed up so that all cows always have access to feed, especially during the nighttime and early morning hours. Figure 3 shows the eating rates of dairy cows in one experiment conducted by Oelberg (3). Multiparous Holstein cows in early- to mid-lactation were fed once daily around 8:00 a.m. Meal patterns and feed intake were recorded every minute for 20 hours. The eating rates varied from 0.05 to 0.13 lb/minute during first few hours post-feeding and varied by diet and cow. However, eating rate reached a steady level of 0.02 lb/minute 6-to-20 hours post feeding, which is the time frame where many dairies fail to push up feed. This would be considered a conservative estimate of eating rate since dairy cows in 1985 were lower production cows than the current modern dairy cows.

Figure 3. Eating rate of early- to mid-lactation dairy cows (3)



Using the 0.02 lb/minute eating rate during the nighttime hours, the potential DMI lost can be calculated for the hours that cows are either out of feed or cannot reach the feed, as shown in Table 1. Knowing the number of cows in the pen and the percentage of the feed bunk where cows could not reach feed for so many hours, one can calculate potential milk production loss for the pen.

Table 1. Hours out of feed 6-to-24 hours post-feeding (once daily) and potential DMI lost.

Hours out of feed	Potential DMI lost, lb
1	1.2
2	2.4
4	4.8
8	9.6
16	19.2

Supporting Gut Health

Making the TMR consistent and available 24 hours per day will allow cows to reach their genetic potential milk production. Many nutritionists supplement the dairy TMR with feed additives that support rumen fermentation and/or support the cow's immune system. Shen et al. (9) showed a marked improvement in rumen pH of beef heifers fed barley-based grain and barley silage diets containing 54% starch and 29.7% neutral detergent fiber (NDF) when fed Diamond V next generation beef product NaturSafe® compared to control diets or to diets containing beef industry standard antibiotics. They also reported highly significant increases in rumen NDF digestibility levels of 52.9%, 39.3%, and 41.3% for NaturSafe, antibiotics, and control respectively. Total tract NDF digestibility levels followed the same patterns of increase (9).

Shi et al. (10) reported reduced acidosis index in transition dairy cows as they were switched from a pre-fresh diet to a 28% starch control lactation diet or to the control containing Diamond V next generation dairy product, NutriTek®. Acidosis index was calculated as the time in minutes that rumen pH was 5.8 or less divided by DMI in kilograms. The DMI of the NutriTek-treated cows was more consistent and stable during the transition period due to a more stable rumen pH.

Oba (2) reported on a study done at University of Alberta studying the effects of level of starch (22.0 vs 28.3%) on post fresh with and without NutriTek. Cows were fed a 13.9% starch diet with or without NutriTek four (4) weeks before calving. Cows were then fed either the low-starch or high-starch diet with or without NutriTek the first three (3) weeks post-calving. Finally, all cows were switched to a 28% starch diet with or without NutriTek six (6) weeks after calving. Milk production was increased for the high-starch diet and for the cows fed NutriTek. The most interesting result was a significant increase in blood glucose levels at day 42 post-calving with the NutriTek cows. The increase averaged 5.6 mg/dl across the low- and high-starch diets.

Reedy et al. (7) measured levels of acetate, propionate, and total volatile fatty acids (VFAs) in an in vitro rumen system evaluating a wide variety of forages from around the world varying in neutral detergent fiber levels from 32.3% to 70.2%, and starch levels ranging from 0.4% to 40.7%. On average, total rumen VFAs were increased 17% with NutriTek. Recently, Reedy et al. (8) reported changes in rumen VFAs for corn silage samples representing the beginning, middle, and end of the ramp of bunker silo after the silage had been stored for nine (9) months. The rumen VFA levels were significantly lower for silage at the beginning of the ramp compared to silage in the middle and end of the ramp. Supplementing the in vitro system with NutriTek significantly increased VFA levels of the corn silage representing all sections of the ramp. NutriTek can enhance rumen fermentation and help cattle transition more smoothly through forage changes.

Supporting the Immune System

Maintaining a strong immune system to handle many of the challenges a dairy cow encounters throughout is essential for her to reach her genetic potential milk production. Shi et al. (10) reported lower lipopolysaccharide (LPS) levels in the rumen fluid of beef heifers fed NaturSafe compared to animals fed either a control diet or a diet containing antibiotics commonly used in feedlot diets. LPS is a component of the outer wall of gram-negative bacteria and can create major health issues for cattle if the LPS enters the blood stream. Oba (2) reported significantly

lower serum haptoglobin levels at day 7 post-calving in transition cows fed NutriTek compared to control cows. Haptoglobin is a biological marker for inflammation. Olagaray et al. (6) reported lower somatic cells in transition dairy cows fed NutriTek compared to controls during the first six (6) weeks after calving. Finally, Jiang et al. (1) reported improved milk production of dairy cattle fed aflatoxin contaminated diets containing NutriTek and a clay, compared to cattle fed a positive control diet without aflatoxin or an aflatoxin contaminated diet containing clay.

NutriTek has improved 3.5% fat-corrected milk in several university transition cow studies (2, 6, 10), and in over a dozen on-farm field studies. The on-farm field studies use randomized pen studies comparing NutriTek-treated cows to control cows starting approximately three (3) weeks post-calving to 12 weeks post-calving.

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