A toolbox for troubleshooting dairy nutrition problems

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Abstract

Nutrition is a crucial determinant of dairy cow health and productivity. Veterinarians can leverage their regular access to cows and feed bunks to provide herd owners with regular evaluation and monitoring of nutritional management. The 5 areas in which dairy veterinarians can have the most impact on nutritional management are particle length of total mixed rations, sorting of total mixed rations, adequacy of eating space, adequacy of feed refusals, and appropriate timing of feed deliveries. The pre- and post-fresh groups are the highest priority pens for evaluation and monitoring. The most common problems that may be encountered are inappropriate proportion of long particles in the total mixed rations, excessive sorting of the total mixed rations, insufficient bunk space for all of the cows to eat at the same time, insufficient targeted feed refusals such that cows do not have full access to feed throughout the day, and lack of fresh feed in the bunk when cows return from the parlor after the first milking of the day.

Key words: dairy cows, nutrition diagnostic investigations, nutrition troubleshooting, diet evaluation

Résumé

L'alimentation est un élément essentiel de la santé et de la productivité des vaches laitières. Les vétérinaires peuvent miser sur leur accès fréquent aux vaches et aux mangeoires pour fournir aux propriétaires de troupeau une surveillance et des évaluations régulières de la régie de l'alimentation. Les vétérinaires peuvent avoir le plus grand impact sur la régie de l'alimentation dans cinq grands domaines : la longueur des particules dans la ration totale mélangée, le triage de la ration totale mélangée, la suffisance d'espace pour l'alimentation, la suffisance des refus d'alimentation et le moment propice pour la distribution d'aliments. Les groupes avant ou après le vêlage sont les enclos avec la plus haute priorité pour l'évaluation et la surveillance. Parmi les problèmes les plus courants qu'on puisse rencontrer on retrouve une proportion inadéquate de particules longues dans la ration totale mélangée, un triage excessif de la ration totale mélangée, le manque d'espace dans la mangeoire faisant en sorte que les vaches ne peuvent pas toutes manger en même temps, un mauvais calcul de refus de sorte que les vaches n'ont pas pleinement accès à la nourriture toute la journée et le manque d'aliments frais dans la mangeoire lorsque les vaches retournent de la salle de traite après la première traite de la journée.

Introduction

Veterinarians serving dairy clients can provide comprehensive investigations of nutritional management on a dairy herd. The process for doing this has been described in detail elsewhere.[2]

Because the dairy industry has consolidated so much, the need for veterinarians to conduct comprehensive nutritional investigations has declined. Dairy nutritionists are more than able to provide comprehensive investigations to a shrinking number of dairy producers. However, several areas of nutritional management are often overlooked. Dairy veterinarians, who regularly visit herds and already spend much time around the cows and the feed bunks, are well-positioned to monitor and evaluate these areas. These are 1) particle length of total mixed rations (TMR); 2) TMR sorting; 3) eating space; 4) feed refusals; and 5) timing of feed deliveries relative to milking and pen lock-ups. These are the most useful dairy nutrition tools to have in your toolbox.

Particle Length of Total Mixed Rations

Forage particle length is a critical determinant of dairy cow health and productivity. Long forage particles constitute the ruminal mat layer, determine rumination time, and determine how much endogenous buffer is secreted into the rumen via saliva. The general importance of adequate forage particle length in dairy cattle diets has been reviewed in detail.[1]

The most critical TMR on any dairy are those for the pre- and post-fresh cows. Your time is best spent evaluating these diets. Other diets can be evaluated if the dairy producer first finds value in monitoring the pre- and post-fresh groups.

Visual appraisal of the length of forage particles in a TMR is generally unreliable, unless the TMR is on the extremes of particle size. The Penn State Particle Separator (PSPS) is a practical on-farm tool for evaluating forage particle length. Some forage laboratories also offer forage particle length evaluations; however, the PSPS is not difficult to use and can be operated either on-farm or at the veterinary clinic.

A dairy practitioner interested in providing some form of nutritional services would be well-served to invest in a PSPS, watch the Penn State videos showing how to use it, and then gather experience applying it. For routine herd monitoring, the basic PSPS with 2 sieves (19 mm upper sieve and 8 mm middle sieve) plus the pan is sufficient. A 4-mm sieve is also available but is not essential for our purposes. The main value of the 4-mm sieve is to fine-tune the physically effec-

tive neutral detergent content of the diet. A digital platform scale (capacity of about 400 grams and 0.1-gram readability) plus 3 tubs (usually plastic or aluminum) for collecting and weighing the forage from each sieve are also needed.

Forage particle length determination first requires that a representative sample of the TMR be obtained. Grabbing a few handfuls of the TMR from the top of the bunk is not sufficient. It is important that the TMR bunk sample be as representative as possible of the entire load. The best time to sample a TMR for particle size analysis is immediately after it is fed - before the cows have a chance to sort it. Collect about 12 handfuls of TMR from the start to the end of the bunk. Place these handfuls into a 5-gallon bucket (or similar) as you collect them. The bucket will be full by the last handful. Collect the handfuls by scooping upwards and placing 1 hand above the TMR sample and 1 hand below it. Grabbing a TMR sample with 1 hand from the top of the bunk and pulling it away could result in the selective loss of finer particles from the sample.

After collecting the TMR, empty the TMR in the bucket onto a flat, smooth surface (I use a folding table for this purpose) and then mix the TMR gently in several directions. Next, separate the TMR into 4 distinct quarters. Make sure that the quarters are completely separated, with no loose feed between them. Randomly select 2 of the quarters and discard them. Re-mix the remaining 2 quarters of TMR, quarter them, and randomly discard 2 quarters. Continue mixing, quartering, and discarding until you have reduced the sample to a volume of 6 cups. If you wish to run the PSPS sample in duplicate (a good idea as you are learning to use it), then collect another 6-cup sample at this time.

It is crucial to add the correct volume of feed to the PSPS. A common mistake is to add more than 6 cups of TMR; this could result in incomplete separation of the sample on the sieves.

My goals for the particle size distribution of a TMR are 2 to 8% above the top sieve, 30 to 50% above the middle sieve, and 40 to 60% in the pan. These goals apply to any TMR on the farm; there are no separate goals for dry cow vs milking cow diets.

The main outcome of interest from the PSPS is the percentage of the sample above the top sieve. Less than about 2% above the top sieve results in inadequate ruminal mat layer, which will lead to reduced cud chewing and higher risk for ruminal acidosis. Dairy nutritionists can partially compensate for inadequate long particles by increasing the chemical fiber in the diet formulation. A TMR with over about 8% above the top sieve is at increased risk for sorting.

Analysis of Total Mixed Rations for Sorting

Evaluating TMR for sorting is an especially useful application of forage particle length determination. Sorting is evaluated by comparing the particle length of the TMR offered to the cows to the particle length of the refusals. This requires collecting a representative sample of the TMR offered and the TMR refused. Refusal samples should be collected with the same care as described above. It is typically necessary to be at the farm very early in the morning in order to collect the TMR refusal sample. On-farm personnel can be trained to collect these samples for you.

As mentioned earlier, the pre- and post-fresh diets are the most critical ones to evaluate carefully. Sorting is often a problem in these 2 diets.

Refusals of TMR should have the same visual appearance and particle length distribution as the TMR that was originally offered. The main problem with a sortable TMR is that cows will sort away from the long particles (usually long or coarse forage particles) and selectively consume only the finer ones (often concentrates, which are more ruminally fermentable and could cause ruminal acidosis). Modest increases in the proportion of long particles in the refusals (up to 5 percentage points) appear to cause no problem. For example, if the TMR offered contained 7% long particles, it would be acceptable for the refusal sample to contain up to 12% long particles. An increase of 5 to 10% long particles from the TMR offered to the TMR refused is considered to be moderate TMR sorting. More than a 10% increase in long particles represents a severe sorting problem and requires immediate correction.

Excessive TMR sorting is often caused by dry forage particles (especially coarse dry hay or straw) that are longer than about 2.5 inches (6.35 cm) in length. Straw is particularly prone to sorting if it is not chopped prior to adding it to the mixer. Sorting is also increased if the TMR is too dry (>50% dry matter).

Whenever a TMR is sortable, high rank cows and cows with the ability to sort can select diets that are too low in effective fiber, while low rank cows are left with diets that are too high in fiber. Both groups suffer as a result. Cows that sort may get ruminal acidosis, and the cows that do not sort may be left with inadequate soluble carbohydrates to support optimal ruminal fermentation.

Mitigating TMR sortability depends upon the underlying factors that caused it. The most common solution for a sortable TMR is to more finely pre-process any dry hay or straw before adding it to the mixer. There should be no dry hay or straw particles in the diet over 2.5 inches (6.35 cm) long. This typically requires running the hay or straw through a tub grinder before adding it to the mixer.

If the TMR is too dry, add adding extra water or wet by-product feed(s) may solve the problem. The target dry-matter percentage for a TMR is 40 to 50%. Liquid molasses is particularly useful for this purpose; it adds extra water and helps the TMR particles stick together.

Dairy herds often cannot fully remedy the problems that made the TMR sortable. In these situations, providing ample bunk space so that all cows can eat at the same time is critically important. It also helps to feed the TMR twice rather than once daily.

Dairy producers may be quick to point out that adding water or molasses to TMR mixes shortens their bunk life during hot weather. The extra moisture and sugar, combined with summer heat, allows spoilage bacteria and yeasts to proliferate faster. This could create a difficult trade-off between reducing sortability and preventing over-heating of the TMR in the bunk. The best solution is to feed the TMR more frequently; this reduces the risk for TMR heating and simultaneously decreases sortability.

Evaluating and Monitoring Eating Space

Dairy cows are about 30 inches (76 cm) wide. Therefore, their eating space must provide at least 30 inches (76 cm) per cow so that all cows may eat at the same time.

Housing and bunk space for dairy cows is very expensive in colder climates. Thus, dairy producers in these regions are very much tempted to overstock their pens and provide less than 30 inches (76 cm) of eating space per cow. However, this can be disastrous for the herd. The pre- and post-fresh cows are particularly sensitive to the effects of insufficient eating space.

Cows eat larger and fewer meals per day when they cannot all eat together at the same time. This increases the risk for ruminal acidosis and magnifies the influence of TMR sorting. Lower rank cows eat less total feed than they are capable of consuming when eating space is limiting. There is no way to fully avoid the negative impacts of inadequate eating space. Feeding twice daily, eliminating TMR sorting, and feeding for very generous feed refusals helps some.

Dairy producers may become defensive when confronted about the lack of eating space they provide for their cows. There are complex economic and business reasons that may pressure them into overstocking their facilities. It likely does no good to repeatedly express dismay with the lack of eating space provided on a dairy. Nonetheless, dairy veterinarians can be ready to provide input about overstocking when teachable moments do arise on the farm.

Dairy practitioners are also in a good position to keep an eye on the availability of eating space, especially in the pre- and post-fresh pens. Cow flow through these pens is very dynamic, and dairy producers may simply be unaware of that these pens are overstocked.

Pre-fresh overstocking can be difficult to avoid during transient periods of heavy calving. Moving cows into the pre-fresh pen closer to calving is not recommended, because it leads to very short stays in the pre-fresh pen for cows that calve early. The only solution to this problem is to design pre-fresh pens with access to flexible eating space via movable gates. Creating some flexible pen space that is shared with late-lactation cows is often the most practical approach. This allows pre-fresh pen capacity to be expanded when needed. It is unusual for season shifts in calving patterns to simultaneously affect cow density in both the late lactation and pre-fresh pens.

Post-fresh pen overstocking during transient periods of heavy calving is not as difficult to manage as for the pre-fresh cows. Healthy cows can simply be moved out of the post-fresh pens whenever eating space falls below 30 inches (76 cm) per cow. For this to work, however, there must be enough capacity in the post-fresh pen to assure that all cows can spend at least 10 days there. Moving cows out of the post-fresh pen less than 10 days after calving is not recommended.

Evaluating and Monitoring Feed Refusals

Someone on the dairy must decide each day how much feed to mix for each group of cows. Feeding the ideal amount keeps cows from becoming too hungry (and potentially overeating when new feed is offered) with the smallest possible amount of feed refusal.

The amount of feed mixed each day should be based on the appearance of the bunk at the end of the previous feeding day. A typical target is a 5% daily feed refusal; however, the tendency is to lower feed refusals when milk prices are low or feed costs are high.

A 5% daily feed refusal is inadequate for pens with very dynamic populations, such as the pre- and post-fresh groups. Mid- and late-lactation pens can be fed to lower feed refusal because their populations are more stable.

Some dairy herds consistently feed to zero daily feed refusals. This usually compromises dry-matter intakes, increases meal sizes, magnifies the impact of TMR sortability, and increases the risk for ruminal acidosis. The impact of low feed refusals is somewhat lessened if feeding management is very consistent, the bunks are empty for only a few hours each day, the TMR is not sortable, and the cows have adequate eating space. Cows may be able to self-regulate intakes and ruminal pH if they can consistently have access to feed at the same time each day. Most dairies cannot manage their feed bunks this well and should target at least 5% daily refusals.

How much daily TMR refusal a dairy producer will target is in part dependent on how much value the farm gets from its TMR refusals. The ideal destination for dairy TMR refusals is to beef feedlot animals. Some dairies have this option within their own farm enterprise. Other dairies are able to sell TMR refusals to beef feedlot producers. Farms with methane digesters may add TMR refusals directly to the digester and realize value from the extra electricity generated. If these options do not exist, the best approach is to feed TMR refusals to pregnant heifers on the farm. Varying amounts of TMR refusal can be added to the TMR mix for pregnant heifers, as long as the amounts are known and the other ingredients added to the mix are adjusted accordingly. Pregnant heifers may become too fat if they consume too much of their diet as TMR refusal or if their TMR is not properly adjusted for the amount of TMR refusal that it contains.

Dairy producers should be encouraged to record the amount of feed offered and feed refused for each pen. Refusals do not have to be weighed daily; an estimation of the

amount refused (usually as a fraction of a loader bucket) is usually sufficient. This does require the occasional weighing of a bucket of TMR refusal to make sure that the estimated weight is accurate.

Because veterinarians regularly visit dairies and spend much of their time there around the feed bunks, it makes sense that they be aware of the amount of feed available to the cows. Veterinarians can make themselves more valuable to a dairy simply by monitoring feed in the bunks and communicating this information to farm management. One approach is to take pictures when the bunks are empty and send them to person in charge.

Monitoring the Timing of Feed Deliveries

The timing of feed deliveries on a dairy should be fanatically consistent. If feed is always available at the same time, cows have considerable ability to learn to control their meal patterns (meal frequency and meal size) in order to self-regulate ruminal pH. However, if the delivery of feed to the bunks is erratic, the cow's self-regulation will fail.

It is particularly harmful if cows receive their TMR later than usual; hungry cows may over-eat when feed is finally offered. Problems with an inconsistent feeding schedule are magnified by inadequate eating space, inadequate resting space (cows may be more concerned about securing a place to lie down rather than regulating their ruminal pH), or inadequate availability of feed or water immediately after milking.

The post-fresh pen is usually locked up once daily to allow for diagnosis and treatment of the fresh cows. It is particularly helpful if feed delivery is consistently synchronized with return from the parlor after the first milking of the day. This is the biggest and most important meal of the day for most cows. Cows also lock up better when they return from the parlor to fresh feed.

Conclusions

Dairy veterinarians, even though usually not involved with the day-to-day details of diet formulation, can still provide important nutritional assistance to their dairy clients. The key areas for involvement are in forage particle length, TMR sorting, feed refusals, eating space, and timing of feed deliveries. Veterinarians working regularly on dairies can leverage their access to cows and feed bunks by providing their clients with highly useful information in these areas.

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