Tips and Tools for Troubleshooting Nutritional Management on Dairy Herds

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Abstract

Veterinarians can play an important role in troubleshooting nutritional management problems on dairy herds. While nutritionists typically do the bulk of these activities, veterinarians bring a different and complementary perspective to nutritional management. Specific areas where veterinarians may become involved include evaluating diet formulation, individual feed ingredients, feed mixes or the total mixed ration, consistency and frequency of feed delivery, and amount of feed called for each pen. Dairy clients receive the best consulting services possible when there is a healthy respect and appropriate tension between veterinarians and nutritionists.

Résumé

Les vétérinaires peuvent jouer un rôle important dans le dépistage des problèmes reliés à l'alimentation des troupeaux laitiers. Bien que les nutritionnistes accomplissent habituellement la plupart des tâches requises par la gestion des aliments, les vétérinaires y apportent une perspective différente et complémentaire. Les domaines précis où peuvent intervenir les vétérinaires sont par exemple l'évaluation et le suivi de la formulation des rations, des ingrédients alimentaires individuels, des mélanges de moulée ou de la ration totale mélangée. Ils peuvent aussi surveiller la régularité et la fréquence des repas et la quantité d'éléments à servir à chaque enclos. En fait, les clients producteurs laitiers bénéficient des meilleurs services possibles quand les vétérinaires et les nutritionnistes se vouent un franc respect, avec le minimum de tension entre eux.

Veterinarians vs. Nutritionists

Veterinarians and nutritionists are increasingly working together and assuming overlapping roles in servicing dairy clients. In years past, nutritionists complained that veterinarians were encroaching on their business of formulating and delivering rations to dairy clients. But with the rapidly decreasing number of dairy producers in the US, veterinarians have felt much less compelled to enter the realm of ration formulation and delivery. Nutritionists are now generally able to cover the needs of the industry. Instead, complaints now are more likely to arise from veterinarians, who are finding nutritionists encroaching more and more into cow health, disease diagnosis, and disease prevention. A better understanding of how both professions are trained and function on dairies should enhance both groups and improve the overall delivery of consulting services to dairy clients.

I enter this discussion fully aware of the dangers of making general comments about groups of professionals. These groups can be considerably diverse and dynamic within themselves. There are glorious exceptions to every generality. Yet, I believe there important insights to be gained by understanding the generalities, and forge ahead with a series of comparisons and contrasts between veterinarians and nutritionists.

Veterinarians are trained to work primarily with the outliers in the herd management system - individual animals with health problems. We tend to see our client's herds first as a mix of lame, sick, dead, or open cows. In contrast, nutritionists are trained to be more attuned to central tendencies of herd performance (milk yield, dry matter intake, income over feed costs). Nutritionists tend to see herds first through the bulk tank.

Veterinarians are trained to always make at least a tentative diagnosis and initiate treatment, even when the diagnostic data are incomplete or obscure. We are generally quite comfortable with vague situations and were trained to confidently make clinical judgments. This is often perceived as professional arrogance - a sometimes unwarranted judgment. On the other hand, nutritionists tend to be less likely to make diagnostic decisions in response to unclear problems of herd performance. Nutritionists often prefer to move cautiously, gathering more data or making very incremental changes in diets before making a "diagnosis", a somewhat foreign notion to many of them.

Veterinarians are generally trained to find a single cause of an animal's health problems and then initiate the single, proper treatment for the affected animal. Veterinarians may be uncomfortable with multi-factorial causes of herd-based problems. Nutritionists, in contrast, are typically more comfortable integrating multiple causes of herd problems. They do not find it difficult to rank multiple factors and to start working on the highest priority ones. Most veterinarians would do

well to learn to work within the framework of multiple causality. Fixing just one underlying problem rarely solves the entire herd problem. Yet, we were trained to see vaccinations and antibiotics as the "silver bullets" that they rarely are.

Veterinarians often deal in realms of high mystique, such as pregnancy diagnosis or life-and-death clinical decisions, and thus are afforded disproportionately high standing with dairy producers. A corollary to this is that veterinarians are more likely to be given the benefit of the doubt by producers. This certainly contributes to our clinical confidence and gives us the boldness to implement major herd changes. In contrast, nutritionists generally have a less secure position with their clients. They are often fired on a whim by the very same dairy producer who is fiercely loyal to his veterinarian. This leaves nutritionists more cautious and fearful of making a mistake.

Nutritionists often focus on shorter-term production goals in a herd - today's average milk production, this week's milk components, or this month's milk check. It can be difficult for them to take a long view of the herd because they may very well not be a part of the herd's future. On the other hand, veterinarians are more likely to be concerned with longer-term issues of cow health, longevity, and culling. It is not hard to take this approach when your job is secure.

The differences between nutritionists and veterinarians are complementary. Neither profession has the right approach or the more important task. Dairy herds are most profitable when they have consultants who bring different perspectives to herd problems. It is wise for dairy producers to watch both short- and long-term goals. Consulting services to dairies are generally maximized when there is a healthy respect and appropriate tension between veterinarians and nutritionists.

Veterinarians' Role – Evaluating Diet Formulations

It is very difficult for most veterinarians to evaluate diet formulation (i.e., the paper ration) - and for good reasons. First, the complexity of diet formulation has increased considerably over the last decade. Many commercially available ration formulation programs (Cornell or Penn Models, CPM Dairy, Amino Cow, 2001 Dairy NRC) model nutrient uptakes based on level of intake, individual feed ingredient digestibility, estimated amino acid composition, and physiological state of the cow. It difficult to understand these models unless you are well-trained in nutrition and have experience running them.

While diet formulation has become more complex, the variation in diet formulations, especially for lactating cows, has decreased. The decrease in the number of herds has also decreased the number of nutritionists needed in the field. As a result, only the most competent have remained in business, and in general they do a very good job of formulating diets. There is also more agreement amongst nutritionists as to what nutrient requirements should be for lactating cows, so the lactation diets I now see in the field are quite similar.

Recent trends in lactation diets are toward higher carbohydrates - diets that are relatively high in both neutral detergent fiber (NDF) and non-fiber carbohydrate (NFC). They also contain more forage, albeit higher digestibility forage, than diets of the past. Nutritionists are making room for more carbohydrate in their diets by decreasing the amount of crude protein (about 16.5% crude protein is all that is needed, provided amino acid balance is good) and decreasing the amount of supplemental fat (diets with 6.0 to 6.5% fat are uncommon now – 4.5 to 5.0% is more the norm). These relationships are illustrated in Figure 1. I encourage you to be supportive of nutritionists who are moving in the direction of higher carbohydrate, higher forage diets. They appear to optimize rumen function and allow for very high dry matter intakes without undue risk for ruminal acidosis.

In contrast to lactating diets, formulations used for dry cow diets are quite variable from one nutritionist to the next. This is expected, given that the science behind dry cow feeding is equally variable and in fact is quite confusing. Some studies demonstrate benefits for higher energy, higher intake dry cow diets, but other studies show the exact opposite. Some studies suggest that cows should be grouped into two or more groups, while others suggest that only the far-off diet is important.

I have seen all kinds of dry cow formulations seemingly "work" on dairies. And I have seen formulations that "work" on one farm fail miserably on another farm.

'Old' diet		High NDF diet		'High carb' diet	
CP	18.5%	CP	18.5%	CP	16.5%
EE	6.0%	EE	6.0%	EE	4.5%
NDF	29.0%	NDF	32.0%	NDF	33.0%
Ash	9.0%	Ash	9.0%	Ash	8,0%
NFC	37.5%	NFC	34.5%	NFC	38.0%
Total	100.0%	Total	100.0%	Total	100.0%
Total CHO	66.5%	Total CHO	67.5%	Total CHO	71.0%

Figure 1. Total composition of traditional ('old') lactation diets, high NDF diets, and high carbohydrate diets. The high carbohydrate diet is preferred.

My conclusion is that diet formulation for dry cows is not nearly as important as sufficient eating space, excellent stall design and resting surfaces, minimizing pen moves near calving, allowing high dry matter intakes, delivering feed very consistently, and feeding only high quality ingredients.

The one approach to dry cow diets that most often fails is adding excessive straw (or coarse dry hay) to a pre-fresh diet for a group of cows that already has low dry matter intake (<24 lb [10.9 kg]/cow/day if a mixed parity pre-fresh pen, or <26 lb [11.8 kg]/cow/day if only 2+ lactation cows in the pre-fresh pen). In these situations, adding extra straw or hay depresses dry matter intake even further and often triggers a disastrous increase in fatty liver, ketosis, and displaced abomasum (DA). In contrast, herds with good intakes in the pre-fresh pens may benefit from lower energy density and increased bulk from the added straw.

Supplementation with anionic salts (i.e., low dietary cation-anion difference [DCAD] diets) is a good means of reducing both subclinical and clinical milk fever. However, anions should be supplemented only when feeding management is excellent, feed ingredient quality is good, dry matter intakes in the pre-fresh cows are already high (>26 lb/cow/day for mixed parity pens, or >28 lb [12.7 kg]/cow/day for pens with only 2+ lactation cows), and the producer regularly monitors urinary pH. Forage DCAD, especially K and Cl, are highly variable, and it is virtually impossible to sample the forages frequently enough to keep up with changes in K and Cl. So, it is essential to use a biological test, in this case, urinary pH, to monitor the feeding rate of the source(s) of supplemental anions. The details of this test are discussed elsewhere in these proceedings. Herds that feed supplemental anions but do not regularly check urinary pH will unavoidably run into problems with either over-acidification (which decreases pre-fresh dry matter intake and increases the risk for fatty liver, ketosis, and DA) or under-acidification (which increases the risk for milk fever and DA).

Veterinarians' Role – Evaluating Individual Feed Ingredients

Sometimes nutritionists overlook the importance of evaluation of individual feed ingredients – especially the more subjective aspects such as preservation, palatability, particle length, and sortability. I find it very helpful to see all the feeds on the farm and at a minimum do a visual appraisal of each. I am particularly interested in their smell of fermented feeds, although sniffing feeds is not recommended if you have allergy problems with feeds or molds. I am sometimes surprised to find butyric acid smell in a silage that no one else has yet noticed. Butyric acid intake is a strong risk factor for ketosis. It is easier to appreciate the butyric acid smell if the feed is at room temperature and in a clean place. Other odors on the farm may mask the butyric smell.

Silages containing butyric acid have an elevated pH – definitely over 4.8 and usually in the 5.2 to 6.0 range. So, a check of the silage pH can be helpful. This can be done by adding one tablespoon to 50 mL of distilled water, mix, and check the pH on a meter. To confirm and quantify the amount of butyric acid in a silage, have the nutritionist send a sample to a lab for a silage organic acid analysis. The test is often termed volatile fatty acid (VFA) analysis, which is an unfortunate misnomer since lactic acid is not volatile. These tests cost about $20 each and are well worth it if there is any concern at all about the quality of a silage.

The dry matter content of ensiled feeds is the major determinant of the quality of the fermentation. Table 1 lists recommended dry matter for different feeds and different silo types.

Table 1. Recommended dry matter and moisture content at harvest for different feed ingredients and silo types.

		Recommendation for	
Feed ingredient	Silo type	Dry matter, %	Moisture, %
Corn silage	Oxygen-limiting*	40 – 45	55 – 60
	Vertical (open top)	30 – 35	65 – 70
	Horizontal (bunker)	28 – 33	67 – 72
Hay silage	Oxygen-limiting*	50 – 55	45 – 50
	Vertical (open top)	35 – 45	55 – 65
	Horizontal (bunker)	35 – 40	55 – 60
High moisture corn	Oxygen-limiting*	75 – 80	20 – 25
	Vertical (open top)	65 – 70	30 – 35
	Horizontal (bunker)	65 – 70	30 – 35

*Oxygen-limiting silos include Harvestore or similar upright silos and silage bags.

Nothing practical can be done to alter feed dry matter content once it is harvested and ensiled. Someone needs to be alert to check dry matter at the time the feed is harvested. This job is typically the nutritionist's; however, veterinarians can fill in the gaps if the nutritionist leaves them open. Year in and year out, some farms harvest forages that are either too wet or too dry, and they almost always pay the price for these mistakes. Make sure your producers get the message that ensiled feeds must be harvested at the correct dry matter – at almost any cost.

It is important to accurately know the dry matter content of a feed ingredient during feedout so that the correct amount of dry matter from that ingredient can be added to the mixer. You can help dairy producers make sure this job gets done. The frequency of dry matter testing needed depends on the type of feed and the structure it is stored in. In general, corn silage and high moisture corn have fairly consistent dry matter content. However, hay crop silages can have quite variable dry matter content at harvest. These variations are particularly important if the hay crop silage is stored in a bag or narrow vertical silo, especially if top-unloading. The problem is that dry matter content can vary from load to load of chopped forage, and silage in these structures is unloaded in a manner that feed from one load to the next is not mixed. In these cases, daily dry matter monitoring may be necessary. Hay crop silages stored in bunker silos have more consistent dry matter content at feedout because feed from many different loads is fed out simultaneously. Weekly monitoring of dry matter content of the haylage coming out of a bunker silo may be sufficient. Checking forage dry matter only when feed refusals change noticeably or when the feed is visibly different is better than no testing at all. However, proactive monitoring of forage dry matter content is much better.

Particle length of forages and the particle size of grains are also important. Nutritionists often take on this task and may do it very well. Other nutritionists may not be skilled or interested in doing this, which leaves an opportunity for interested veterinarians. Whether you do this task or not, a good role for veterinarians is to make sure that it gets done.

Even without a shaker box, veterinarians can do informal evaluations of feed ingredient particle length or size by simply looking at a few handfuls of the feed on a clean, flat surface (e.g., the back of a clipboard), and then separating the coarse from the fine particles. Pay careful attention to the particle length of any dry, chopped hays if these are a part of the diet. Coarse, long hay particles (greater than about 2 inches (5 cm) in length) are easily sorted away by the cows. In contrast, cows will sort toward soft, leafy hay and eat it first – even if not chopped at all. In either case, chopping the hay about 1 to 2 inches (2.5 to 5 cm) long before adding it to the mixer will prevent most sorting.

Veterinarians' Role – Evaluating Mixes and the Total Mixed Ration

A simple visual appraisal of custom concentrate, protein, or mineral mixes can be invaluable. Take a handful or two of the feed (in this case, the mix) and separate into its different components on a flat surface. Sometimes you can catch inadvertent errors in feed mixes simply by spotting the wrong ingredients or obviously incorrect proportions of ingredients in the mix. Samples can then be submitted for wet chemistry analysis or feed microscopy for confirmation of the problem.

I find it useful to start my evaluation of total mixed ration (TMR) mixing accuracy by following the mixer as new feed is delivered and then visually inspecting the feed. Does the mix appear the same from the start to the finish of unloading? Is there more long hay in a certain part of the mix? Are there large chunks of hay that are not mixed with other ingredients? Are there more whole cottonseeds in any part of the mix? Do the whole cottonseeds appear brown and matted (an indication of over-mixing), or are they still fluffy and white? Does the corn silage or haylage in the mix appear mashed and pulverized, or are the long forage particles still intact?

Veterinarians may also become involved in evaluating TMR bunk mixes. The details of bunk sampling methodology and analysis have been previously reviewed.[1]

The greatest value in TMR bunk samples is to identify gross errors in feed analysis, mixing, or delivery. For example, omitting the salt from a custom protein mix would result in a TMR bunk sample with unexpectedly low sodium and chloride content. Omitting the trace mineral/vitamin premix from the ration would result in unexpectedly low copper, iron, manganese, and zinc results. Feeding excessive dry matter from alfalfa haylage because the haylage became drier than the nutritionist's last analysis would result in elevated dry matter, crude protein, soluble protein, acid-detergent fiber (ADF), and NDF values in the bunk samples.

Veterinarian's Role – Evaluating the Consistency and Frequency of Feed Delivery

It is difficult to evaluate the consistency of feed delivery on a farm, but a few simple questions and some careful observation will sometimes provide very revealing information. If the farm uses a feed mixing monitoring program (Feed Watch, etc.), then you can evaluate not only the accuracy of feed ingredient delivery, but also the consistency of the time of day that feed is delivered to each pen.

The feeding schedule on a dairy needs to be fanatically consistent. This is particularly true in respect to the synchrony of feeding and milking times. The first feeding of the day should coincide with the cows returning from the parlor after their first milking. This will be the biggest meal of the day for most cows. It is crucial that this be done consistently. Cows apparently learn to carefully regulate their meal patterns, both meal frequency and meal size, in order to self-regulate their ruminal pH. But if the feeding schedule is erratic, they will never accomplish this self-regulation. It seems particularly dangerous if cows receive their TMR later than usual – hungry cows may overeat when feed is finally offered. Problems with an inconsistent feeding schedule are magnified by shortages in bunk space, a shortage in free stalls (cows may be more concerned about securing a place to lie down rather than eating to regulate their ruminal pH), or inadequate availability of water immediately after milking.

It is common to offer TMR once daily to most groups of cows. Many herds increase to twice-daily feeding in the summer, which is an excellent decision. I prefer twice-daily feeding year-round, but recognize that this usually requires extra labor. Frequent pushing up feed during the day may stimulate some additional dry matter intake, but does not appear to reduce the potential for sorting when TMR is offered infrequently. Increased feeding frequency is particularly important if the TMR is already prone to be sortable (dry TMR, excessive amount of coarse particles).

Veterinarians' Role – Evaluating the Amount of Feed Offered

Each day the dairy producer makes a decision as to how much feed to offer each group of cows on the farm. The goal is to keep cows from getting hungry and overeating on a sporadic basis, and yet not waste too much feed on the farm. The ability of the farm to utilize TMR refusals often decides how much refusal they will target. If the nutritionist is not involved in monitoring the amounts of feed offered, then the herd veterinarian has an opportunity to become involved.

The decision to make "feed calls" at the start of each day should be based on the appearance of the bunk at the end of the previous feeding day. A typical goal is about a 5% daily feed refusal. More feed refusal (about 10%) is needed for pens with very dynamic populations, such as the transition cows in the pre- and post-fresh pens. Mid- and late-lactation pens can be fed to much lower feed refusal (2% or less) because pen populations are more stable. Some herds consistently run zero daily feed refusals without difficulty. However, this requires exceptionally consistent feeding management. The cows can self-regulate intakes and ruminal pH if the bunks are empty the same time each day, and if new feed is offered at the same time each day. Most dairies cannot manage their feed calls this well and need to target about 5% daily refusals.

It is very helpful if the producer records the feed offered and feed refused for each pen each day. The refusals do not have to be weighed daily; an estimation of the amount refused is usually sufficient.

The amount of feed offered to each pen daily should be an adjustment of the total batch. The producer should not lock most of the ingredients and then "float" just one ingredient, typically a forage. Severe ration imbalances can occur if only one ingredient in the mix is floated. Producers should monitor forage dry matter regularly and have the confidence to adjust the entire TMR mix recipe up or down each day.

Conclusions

Veterinarians and nutritionists bring different yet complementary consulting skills and perspectives to their dairy clients. Veterinarians can work with the herd nutritionist to make sure that feed ingredient quality is good, that feed dry matter content is monitored, and that the correct amounts of feed are offered to the cows.

Reference

1. Oetzel GR: Limited intakes, low milk and lost income: investigating the low-production dairy herd. *Proc Am Assoc Bov Pract Conf* 40:132-143, 2007.