Practical Ration Evaluation: Things to Look For To Determine If Your Nutritionist Is Doing a Good Job

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Take Home messages:

- Observation of the dairy facility and the cows is a necessary prerequisite prior to ration formulation.
- Records and benchmarks have to be determined by the nutritionist as part of the pre-work needed for ration balancing.
- Evaluation of the management abilities and human resources available is critical to determining if the nutritionist's rations will be implemented correctly.
- The expectations of the nutritionist and the goals for the farm need to be agreed upon prior to implementation of a nutritional program.
- The nutritionist needs to include an awareness of the environmental issues facing the producer and the ration adjustments needed to help comply with water and air quality concerns.

Ration Balance

The manner in which rations are developed has changed rapidly over the past decades. Before computers were a mainstay in our society, rations were developed by hand, most notably using the Pearson square. This tedious process restricted the number of nutrients balanced and how often rations were adjusted. When computers did come on the scene, linear programming became popular. This allowed the user to examine many more nutrients and rations than could be developed on a least cost basis. Currently, the industry is moving towards computer models, which more closely predict the performance of the animal. Computer programs allow for numerous nutrients that can be

monitored and formulated. However, with all this technology, the dairy industry is still faced with nutritionally based challenges.

The number one challenge for nutritionists is that there is no perfect ration. Rations cannot be formulated "exactly" from one farm to another given the uncertain nature of forage supplies, quality parameters, the variation of feed nutrient composition and the difference in management skills and practices among producers and managers. Most nutritionists can only hope to make the ration "better" for the client given the limitations imposed.

The second challenge is that the computer software is only as good as the person's nutritional knowledge. If the formulated rations guaranteed maximum milk production, minimal health problems, and optimal reproductive performance, then nutritionists would have a very easy life. Actually, the numbers are probably the least important part of the ration. The type of ingredients, amounts of cereal grains and byproducts used, the amount of forage fed, the changes in dry matter content from day-to-day on high moisture ingredients, the particle size of diet and the effect of sorting, are some of the many factors that can affect nutrient balance. There are many inter-relationships involved in diet formulations. It is naïve to think that focusing on nutrients to a decimal place or trying to meet on paper the specific requirement for carbohydrates or protein will ensure a balanced diet for the cow.

The person formulating the ration needs to understand not only nutrition, but the capabilities of the farm and their employees. A good nutritionist commits the time for continuing education. While this is important, people skills and understanding the limitations of the farm and how the owner/manager operates the farm, is more essential. The struggle that nutritionists and consultants face is how to determine what motivates a person and why people are resistant to make change, even when a positive outcome is ensured.

Analyses of forages and feedstuffs are another area that has changed rapidly over the years. The number of nutrients analyzed has increased, the methodology has changed, and energy equations have become more complicated and involved. Again, a good nutritionist does not believe every value that is reported from a testing lab. There are issues with samples even before they get to the lab. For example, problems can exist on how and where the sample was taken, how representative the sample is, and the length of time to get the sample mailed to the lab. There can also be a quality control issue at the lab. The labs are dealing with labor and quality control problems like any other business. The nutritionist has to take the time and closely evaluate the lab reports and determine if the value(s) are reflective of what is being fed or if adjustments need to be made. It is not enough to send a sample out for an analysis and use the reported values verbatim in a ration formulation program. An understanding as to how the values are determined is paramount.

In today's milk market, rations need to be balanced based on good economics. In order for the producer to remain in business, the farm must make a profit on rations formulated by the nutritionist for all the animal groups and it should be for the long term. While economics are very important to the client and the nutritionist, the concept of using "least cost" should be replaced with "best cost" ration formulation. Another term that can be used is "maximum profit" rations. Purchased feeds should be in the ration for a reason. The idea of putting every additive, byproduct, or various protein sources in the diet with the idea that they will solve nutritional problems is incorrect. This thought process only makes an expensive ration for the producer and rarely solves any problems.

A good nutritionist does not try to fix every problem on the farm at one time. Each problem area needs to be evaluated and prioritized as far as it impacts economics, animal health, productivity etc. It is very rare that there is just one solution to a problem because more than likely there are several small issues causing the problem. Correcting nutrition may not have the biggest impact on the solution. Recently, the development of farm advisory teams is being initiated. This allows the nutritionist to get insight from other professionals and to make more informed decisions on the best course of action.

Lastly, nutritionists are now an integral part of the environmental issues on the farm. Nitrogen is the source of various emissions coming from livestock operations. Nitrogen in the form of ammonia is being evaluated for its impact on air and water quality. Phosphorus levels formulated in diets and the excess excreted in the manure is a major concern in protected watershed areas. Not only does the nutritionist need to concentrate on improving and maintaining performance in a herd, but maintaining environmentally friendly diets as well.

■ Observing Cows and Assessing the Dairy. Pre-Work: What Needs To Be Done Prior To Ration Balance?

There is a tremendous amount of work to complete before a nutritionist sits down at the computer to formulate rations. Looking at the cows involves a lot more than just body scoring. A good nutritionist evaluates the following questions for lactating cows:

- How do animals move? Is there evidence of lameness?
- Do animals have bruises, cuts, abrasions or swollen hocks?
- How do the animals interact with people and their herd mates?
- How many cows are lying down in the stalls? How many animals are at the feed bunk?
- How do animals approach the waterers? How is water quality?

- Is there evidence of overcrowding?
- How is the feed bunk managed?
- What time of day is it and do the animals have feed in front of them?
- Are the animals clean?
- Do the cows appear comfortable? How is the barn environment? How is air quality?
- Do the animals get exercise and if so, what is the condition of the exercise area?
- Where are cows housed? How are they grouped?
- Are there adequate facilities for cow treatment?

Getting an appreciation of the big picture and any nutritional problems requires evaluating herd records. This allows one to get a historical perspective of the herd and what improvements or problems have recently developed. It is ideal if the nutritionist can either take the paper records or get permission to get the herd's profile downloaded from the testing center to effectively evaluate how the herd has been doing and what the possible bottlenecks might be.

There is other important preliminary information to collect before a ration can be balanced. The first is to obtain the true body size of the cows. Many nutritionists assume an average Holstein body weight (BW) of 590 kg when formulating lactating cow diets. As mentioned earlier, every farm is different and it is a false assumption to think every herd has the same average BW. Therefore, a good nutritionist will work with their producers to get BW information. A representative number of cows would include first lactation, second lactation and adult cows in order to gain insight into the BW of different groups within the herd. This is even more important with the new NRC system of calculating energy which is influenced by cow BW and intake as a percent of the cow BW. If a farm does not have scales set-up to weigh cows, using a weight tape at time of calving could be a means of collecting data on a regular basis.

The combination of cow weight and body condition will give a nutritionist perspective on how replacement animals are being handled and how the lactating herd is responding to the current ration and feeding management scheme. For example, if heifers are underweight at calving, more attention needs to be focused on the heifer groups. If there are extremes in body condition or animals tend to be generally too overconditioned or too underconditioned, then a nutritionist will make the necessary ration adjustments to solve these problems.

After evaluating the animals and before any ration can be developed, all forages and high moisture feeds need to be sampled to ascertain their nutritional content. A good nutritionist would evaluate the storage structures and the feed coming out for quality and feed out issues, evidence of mold, rodent problems, water or air infiltration, and seepage. Observation of feed mixing and delivery to the cows is crucial. Checking that a true total mixed ration is being fed and that other ingredients are not being top-dressed every time the nutritionist goes to the farm is necessary. In conventional feeding systems, grain scoops need to be checked such that the amount being fed is close to what is recommended.

A good nutritionist observes how forages are being weighed. This can have a tremendous effect on the ration fed and cow performance. Nutritionists should work with their producers in getting them set-up to take weekly dry matters on feeds and how to adjust the ration fed accordingly. Teaching their clientele this simple procedure can avoid a lot of nutritional problems from occurring in the future.

Another important consideration is forage supply and inventory. There are several programs available that help track this information. A good nutritionist would never rely on the producer's estimate of their forage supply. Farmers seem to have plenty of forage at the beginning of the season, but this supply seems to disappear at an ever increasing rate before the next harvest season arrives. Tracking inventory early on is a benefit to the cows if they can be maintained on a consistent diet throughout the year. Switching from heavy corn silage to heavy hay crop silage and then making more changes does not accentuate animal performance. Forage supplies should be measured early in the season so realistic amounts of forages can be fed rather than run out in March or April when purchased feed is more expensive and supply limited. It is part of the nutritionist's responsibility to work with the producer or manager so that forage inventories are up to date as this impacts all aspects of ration formulation.

■ Records and Benchmarks

Part of evaluating herd performance requires examining the herd records and asking three questions:

1. How is the herd currently performing?
2. How has the herd performed in the past?
3. Is performance getting better or worse?

The five key production indicators to compare to benchmarks are milk per cow per day, days in milk, pregnancy rate, somatic cell count and cull rate. This will enable progressive dairy producers and their nutritionists to find the bottlenecks

in the herd and to help focus nutritional efforts appropriately. Milk per cow per day is what pays the bills on most farms. Maximizing production, within the limitations of the farm, is the first key to improving profitability. A benchmark to follow is herds milking twice a day and not using BST should be producing 32 kg or more. Herds milking three times per day and using BST should average 39 kg of milk or more, per cow per day.

Days in milk can provide a quick assessment of the lactation status of the herd. If days in milk are within reason (165-175 days) and milk per cow per day does not meet the recommended benchmark, then a more in-depth diagnosis is needed. The nutritionist should then evaluate milk start up, peak milk, and persistency. Production decreases from 0.07-0.09 kg of milk for every day past 150 days in lactation. Herds with average days in milk of greater than 180 days can loose 2-4.5 kg of milk per cow daily. In this situation, reproductive management should be investigated.

Pregnancy rate is a good tool in evaluating reproductive management. Pregnancy rate is defined as the percent of eligible estrous cycles that resulted in a pregnancy over a given period of time. From DHIA, this is calculated by multiplying the heat detection rate by the conception rate. The US national average is around 14-17%. To maintain a 13.0 to 13.5 calving interval, a herd must achieve a pregnancy rate of 22 to 25%. A pregnancy rate of 24% equates to a 60% heat detection rate and a 40% conception rate.

Nutritionists may not directly affect udder health, but problems in this area can affect how animals respond to nutritional changes. The benchmark for this indicator is under 200,000 for somatic cell count. Counts higher than this indicate infection within a certain percentage of the herd. Udder infections can results in higher cull rates and reproduction problems.

All of the aforementioned indicators can contribute to high cull rates. High cull rates can decrease profitability of a dairy business through increased overhead expenses, as the cost of raising or acquiring replacements are spread out over fewer years. The cull rate should be 30% or less. Even at this level cows are only in the herd for an average of 3.3 years. It is important to know why cows are leaving the herd and to work towards correcting that problem.

Benchmarks need to be established for each individual herd based on past history and goals of the particular farm.

■ Grouping of Animals

There are different philosophies on grouping cows. Grouping can be determined by many factors but the physiological stage of the animals and their required nutrient needs should be the main reasons. For example, it is popular

to balance rations as a “one group TMR.” However, unless the herd is averaging over 25,000 lb of milk annually, one or more additional feeding groups are warranted. At higher levels of production, issues of reproductive efficiency and body condition have to be resolved. Feeding a one group TMR for the entire lactation is needed to sustain high milk production, recover sufficient body condition for adequate reproduction, and for the subsequent lactation. However, even in these herds a nutritionist should consider whether a different diet prior to dry off should be implemented based on the body condition score of the cows.

When deciding on a grouping strategy, a nutritionist typically is biased towards nutrition-related parameters. However, facilities, labor, economics and cow health also factors into how many groups may be needed. They may not all require separate rations, but each group should be evaluated for nutritional adequacy, such as production, body condition, reproductive status and animal health.

While this pre-work is time consuming, it will permit ration development based on the most facts possible. Focusing on the big picture and not fixating on one little area should increase the odds for success. Still, the bottom line will be how well the ration is implemented by the owner/manager.

■ Rationale of Ration Balance

The most important nutrient component of a ration is the amount and type carbohydrate source fed. The fiber content will determine the health of the rumen and cow, and the efficiency of fermentation. The nutritionist should be using both neutral detergent fiber (NDF) as a measure of the whole fiber content and acid detergent fiber (ADF) as a measure of the mat forming ability of the diet. Both fiber measures should be evaluated as a percent of dry matter and as a percentage of forage. At least 70% of the fiber should come from a forage source. Non-fiber carbohydrates (NFC) are critical as sources of energy for optimum milk production. The nutritionist should evaluate the proportions of sugar, starch and soluble NDF that contribute to the NFC. Our knowledge of the nutritional contributions of these fractions is not sufficient for detailed manipulation on most farms; however a nutritionist can provide guidelines and references. Total starch should range between 25 to 30% of dry matter with 20 ±2% of this as fermentable starch. This will be dependent upon other NFC in the ration. Cows can tolerate a wide range of sugar from 3.5 to 8% of ration dry matter. There should be awareness that starches and sugars will provide glucose for energy while soluble fiber will provide acetate needed for milk fat production.

Ration problems related to fiber in the diet occur when there is insufficient forage to adequately produce a rumen mat (>60% of fiber from forage). It is

advisable to have sufficient forages; however, there will be areas of the country and during times of drought when this is impossible. An option for nutritionists is to add high NDF byproduct feeds (such as cottonseed hulls, beet pulp, soybean hulls, etc.) as substitute fiber sources. In this case total NDF concentrations should increase 3-5% over recommendations, and starches should be reduced accordingly. Monitoring these rations is critical for the first month or two of feeding as adverse reactions can occur depending on the previous history of acidosis in the herd.

After carbohydrates are balanced, rumen degradable protein (RDP) content of the diet is next in line. There are two systems when balancing the protein needs of dairy cattle: the degradable protein for the microbes and the metabolizable protein and essential amino acids for the cow. When degradable protein has been balanced, the nutritionist needs to pay attention to how the metabolizable protein (i.e., total quantity of amino acids) and sufficient essential amino acids are provided in the ration.

There have been several changes in how protein nutrition is addressed based on the 2001 NRC. Crude protein is a term that has outlived its usefulness and should be abandoned in favor of metabolizable protein. Undegradable protein is important to the protein/amino acid nutrition of the cow. Rumen undegradable protein (RUP) is used to balance metabolizable protein and essential amino acids. However, there is no RUP requirement. Instead, the amount of RUP required in a ration will depend on the amount of microbial protein synthesized and on the amino acid composition of that protein which contributes to the RUP.

The importance of getting NDF, NFC, RDP and amino acids reasonably close to requirement cannot be overstated. These nutrients will allow for 90% of the potential milk production to be achieved. Once carbohydrate and protein nutrition have been addressed, the nutritionist should then balance lipids, minerals, and vitamins.

Where does energy fit into the ration formulation scheme? It is important to remember that energy values are just a calculation. There have been instances when the 2001 NRC model has been used where cows are milking well, gaining condition and the model predicts an energy deficiency. Even though the new NRC calculates energy in a more consistent manner than ever before, energy is still only a prediction. If the actual nutrients, i.e. fiber, protein, have correctly been balanced, there should be enough energy in the diet, no matter what energy value is predicted. Conversely, if those nutrients are not balanced properly, there will not be enough energy. Whether this is due to the associative effects of feeds or because the science of predicting energy is still not developed sufficiently is not clear.

What is the time commitment to balancing a ration in this manner? Given familiarity with the program and reasonable nutritional knowledge, it can take 30 minutes to an hour per ration. The time consuming part is entering all the data for the first time. Once it is entered, most computer programs are flexible enough that various scenarios can be developed without spending a lot of additional time.

■ Which Ration Balancing Program?

There are many selections available in dairy ration balancing software. Each has their advantages and disadvantages when it comes to user friendliness, price, and nutrition complexity. The newer programs, i.e., National Research Council (NRC 2001), various versions of Cornell Nutrition Carbohydrate Protein System (CNCPS) and Cornell-Miner-Penn (CPM) as well as various commercial products, all predict reasonably close to each other in terms of supply and requirements when the same data are entered. Differences in requirements are due to assumptions regarding the use of the nutrients rather than in the amounts of nutrients actually supplied. All models are a work in progress and have various assumptions and errors associated with them. Experienced nutritionists will use a model (or a ration balancing program) and learn how to work within its limitations. The knowledge and the technology are available today to produce very good rations. Why is the dairy industry still plagued with acidosis and metabolic problems? Why does a "good" ration produce inferior results? The answer to these questions lies in the gray area between what was formulated and what the cow actually consumed.

■ Dry Matter Intake

It is well established that dry matter intake (DMI) is the key to milk production. However, the vast majority of producers do not monitor DMI on a routine basis. The nutritionist typically relies on faulty information provided by the producer on how much feed cows are consuming. If herds are to progress, there must be substantial effort placed by the manager and feeder on measuring DMI. There are numerous methods described for calculating DMI and a nutritionist can work with their clientele in developing a protocol that works for their management system.

If the actual DMI is not within ± 1 kg of that predicted by a program then the nutritionist should be questioning why the predicted and the actual were not in closer agreement. It should be noted that not all programs predict the DMI with equal accuracy. Two pounds more or less is about as close as we can predict DMI. If DMI is consistently high or consistently low, then there is a problem. If

DMI is inconsistent and there are swings from high to low, this is another problem. Let's examine these problems and their potential solutions.

Diagnosis of DMI Problems.

When DMI is higher than expected for the milk produced there can be many causes involved that the nutritionist has to investigate. If feeds have less dry matter than predicted it is critical that the nutritionist work with the producer to implement a program that includes a scheduled time preferably daily but at least weekly to determine dry matter of all feeds, especially silages and wet feeds. The TMR may need to be evaluated for particle size distribution; small particle size may encourage higher DMI than formulated. Forages may have to be sent away for estimates of digestibility in the event for that particular year forage harvest was better than anticipated. Manure evaluation by the nutritionist may reveal long particles coming through possibly indicating a high rate of passage but lowered digestibility of the TMR.

When DMI is lower than expected it may be that feeds have more dry matter than predicted. Dry matter of all feeds should be evaluated on a more frequent basis. Water quality or availability may be in question. The nutritionist should work with the producer on the following items: (1) Check that when the cows want to drink (after milking or after eating) that there is sufficient supply for the whole herd. (2) Check to make sure water is clean and potable. (3) Check that construction of fountains does not preclude cow access. (4) Check that there is sufficient access for the whole herd, generally from 10-20% of the group. Feeds, especially silages, need to be evaluated for mold and poor fermentation characteristics; there may be a management issue as far as fermented or heated silage removal from the bunks. Check that scales are accurate, which could cause higher than expected intakes if the paper ration and what was mixed were not similar. Feeds may be over-mixed resulting in the particle size being too small and cows going off feed. When DMI is variable, again it is critical to initially measure forage dry matter daily. The nutritionist needs to monitor times feed is delivered to cows as well as if feeding or batch sizes are irregular.

■ Cow Comfort Issues and Ration Balance

There has been a lot of attention in the popular press about cow comfort issues. A cow requires at least 8 hours a day for eating, another 8 hours for resting and another 8 hours for cud chewing. A cow needs a place to rest comfortably with sufficient lunge space to rise without injury. Likewise, standing on wet concrete is hardly conducive to promoting healthy feet and appetites. In many herds, because there is no good place to rest, cows spend much of their time standing. In this case they spend a lot less time eating and chewing—or

resting, simply because their feet are sore. When they do lie down, they don't want to get up again.

Many feet problems have been blamed on "acidosis" when in fact it is just poor management. Every animal over a year old should have their feet trimmed by a professional at least once a year and then as often as needed to keep feet healthy. Resting areas should be of adequate size, clean and soft. Feed additives may help in some situations, but the great majority of feet problems can be cured by solid basic nutrition, preventative hoof trimming and a comfortable place for the cow to rest.

While the issues of cow cooling are beyond the scope of this paper, a competent nutritionist should be familiar with these issues and management practices. The use of sprinklers over the cows in front of the feeding area is discouraged. It wets the feed, increasing the rate of deterioration and lowering dry matter intake. The cows may be cooler, but they are eating less.

■ Evaluate the Management and Human Resources

The success of ration programs depends 80% on management and 20% on the computer generated diet. Management includes the owner/operator, the herd's person and/or feeder. These people are responsible for implementing the ration on paper and can determine if a program succeeds or fails. A good nutritionist does not assume that the expectations of the nutritionist and management are one and the same.

It is sometimes assumed that all producers want high production. However, there is always a "but" included. Some producer's main objectives may be to reduce "costs" or "the vet bill". Some producers may be more interested in components and not volume. The nutritionist has to determine the goals of each farm he/she has as a client. Also, some farms do not have the labor or the skills needed to implement certain rations and feeding strategies. These skills run the gamut from labor, cow, crops, and financial management. If the manager does not have the skills, does management have the desire to learn the required skills? And lastly is it cost effective for the nutritionist to be involved in this process?

The answer to these questions will often determine the long term success of both the farm and the nutritionist and their mutual profitability. Communication is the key if rations are to be implemented successfully on farm.

Summary

Ration balance per se is not a great challenge given some of the newer nutrition programs for micro-computers. The real challenge lies in taking the time to do the pre-work and in developing clear understanding of the goals for the herd. Exhibiting a spirit of true professionalism tempered with common cow sense will enable the nutritionist and the dairy producer to enjoy a long and mutually profitable relationship.