

Evaluating Rations from a Whole Farm Perspective

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■ Take Home Messages

- To properly evaluate a ration, you need to look at more than the ration formulation on paper. Appraise all things that can affect how well the ration is being used by the cows for production. Change what you must to make sure that whole farm system supports healthy, productive cows.

■ Introduction

If you're going to evaluate how a ration is working in a herd, prepare to get manure on you. Much of the focus on ration evaluation has been on herd production and health records and feed analyses. These are very valuable tools, but you cannot properly evaluate rations without getting out among the cows that are eating them. An important part of evaluating a ration is actually assessing the feeds, management, and interaction of the cows and what they are fed. This involves looking at cow behavior, bunk management, manure evaluation, water availability, rumination, cow appearance, body condition, cow comfort, feed availability, feed quality, and on. As you walk the herd, keep your senses (all of them, maybe excepting taste) open so you notice what is going on, and pick up on things that are normal and out of the ordinary. Use the information you gather in the barn to build a case: do the variety of pieces of information point the same direction, suggesting what should be changed or not changed in the ration, feeds, and management? Staying in the milk house or office won't give you all the information you need. So, let's get out there

■ The Barn and Laneways

After checking to find out which groups have bulls in them, we go out to the barn. Take the route the cows have to go from the parlor to the barn or paddock. Take the time to be quiet and watch and listen:

- Do the cows appear to have comfortable, non-skid footing?
- Many rocks in the laneways? How deep is the mud?
- How far do the cows have to walk from the parlor to their barn/corral?
- Is ventilation in the barn good?
- Are the cows using the stalls comfortably?
- Is the barn comfortable / are fans and cooling systems working?
- How many hours a day are the cows in the barn?

If cows can't breathe, rest, or walk, they are likely to milk less. A comfortable cow can put her energy towards making milk, rather than surviving her environment. Slick surfaces that make cows do a four-footed shuffle, rough surfaces that have them tip-toeing on sore feet, or deep mud that could suck the boots off of an unwary extension specialist make it more likely that the cows will make fewer trips to the bunk. Rocks in the laneways make for bruised feet and lameness. If you can't reasonably traverse the path from the parlor to pen, the cows are being asked to expend more energy than they should. Watch the cows as they move: they will tell you what's comfortable. The distance from the milking parlor to where the cows rest and eat determines how much additional energy they have to devote to walking over and above the base level included in maintenance requirements. That must be subtracted from the energy available for milk production. Cows may not be as sensitive to ammonia as people are, but the humidity and odor can give an indication of whether the air exchanges are adequate.

Giving a cow a comfortable place to lie down, get off her feet, ruminate, and rest is crucial to keeping healthy, productive cattle. If cows are not using the stalls, if they are lying half in – half out of stalls, if they just stand in the stalls, reassess whether the stall design and dimensions are what they should be.

Heat-stressed cows are more prone to ruminal acidosis, sorting their feed, and slug feeding. Just think: at the very least, if cows are panting or breathing heavily, they are not chewing their cuds, and this does not help rumen health. Keeping fans and sprinklers in good working order is the only good way to deal with heat stress. We do recommend that heat stress rations contain more potassium, sodium, and magnesium, and as much if not more forage, but any ration changes to deal with heat stress are just band-aids – you need to cool

the cows. About forage and heat stress: feeding more concentrate during heat stress is a bad idea. The research information does not support it. Since heat stress makes cows more susceptible to rumen acidosis, feeding them adequate fiber, more and more palatable forage, and possibly less starch can keep them healthier, they won't lose more milk than they would normally, but they'll be better prepared to perform when cooler weather comes.

There's a difference between cooler weather and downright cold! In cold weather, cows use more energy just to stay warm. Keeping them in lots or stalls where they can stay dry and not wet or mud-caked can help to keep them warmer, and let them use less energy for warmth. Wind breaks are a good idea, rather than letting wind chill have its way with your cows.

If cows spend much time away from the barn, they have that much more time where they can't eat, drink or rest. Generally, the suggestion is that cows be grouped so that they spend no more than 2 hours per milking away from their barn. Anecdotally, the more time cows spend standing on concrete with no chance to lie down, the greater the chance of hoof problems.

■ Water

- ▶ Waterers near the exit to the parlor?
- ▶ Are the waterers working, filling adequately, clean?
- ▶ Is the water of good quality?

Milk is 87% water. No water, no milk. Period. Cows are lazy. The more convenient we can make it for them to have good, fresh water and feed when they want it, the better they will produce. Water intake can be affected by level of production, feed, sodium, and protein intake, and environmental temperature, not to mention the base amount of water that cows need for maintenance. Cows require about 01.36 litres of water per .45 kg of milk (NRC, 2001). That water can come from feed or drinking water. Water intakes under heat stress can increase by more than half, as temperature increases.

■ Feed Management

- ▶ Is there feed in the bunk? Is it well mixed? Particle size?
- ▶ Does the feed in the bunk look like the formulation on paper?
- ▶ Has the feed heated? Is it musty? Apparently palatable?
- ▶ Are there clumps of spoiled silage in the bunk?

- Is there adequate bunk space?
- Do cows have fresh feed available when they come back from the parlor?
- Is feed pushed up several times a day?

With the exception of those few managers who have figured out how to properly feed to an empty bunk, no feed means less milk. Granted you need to have animals to feed the weighback to, but having 3-5% of the feed leftover that looks and smells like the feed you originally fed will help to assure that the cows get the feed they need to make milk, grow, breed, and gain body condition. Total Mixed Rations should be well mixed, or what's the point? If the particle size is too fine, the animals may not get enough effective (chewable) fiber to keep their rumens functioning well, too coarse, and they will sort feed. You can get an idea if the cows are sorting by watching them eat: If they nudge feed back and forth with their muzzles and then dive towards the floor, they are usually pushing forage out of the way and eating grain. Moistening the feed with water or a liquid feed (molasses? wet brewers' grains?) so it holds together, and then making sure most of the forage is cut so they are 2 to 5 cm long at most will help to prevent sorting. The feed in the bunk should resemble the formulation on paper. Check mixer weights and feed dry matters against the formulation.

If the feed has problems with heating or mustiness, you need to go look at the individual feeds to find the source of the problem. More on that later. If the feed is unpalatable, the cows will eat less of it. If it contains molds, you may be in for problems from mycotoxins. The clumps of spoiled silage that make it to the bunk, often from not cleaning the spoiled material from the top of the silo, can cause cows here and there in the herd to come down with diarrhea, as not all cows consume the spoilage.

If feed bunk space is limited, your cows may slug feed, eating large meals in short periods when they think that the getting is good. That could lead to ruminal acidosis, or lower feed efficiency. Making sure that fresh feed is available in the bunk each time the cows come back from milking, and pushing up at least once between feedings can help to increase and even out the intakes. Just consider, when a cow comes back to the barn, if there is feed, she'll likely stand there and eat, if not, she'll probably go lie down. Once she lies down, it takes active effort for her to get up and eat once the fresh feed is delivered – she may not do it. If possible, adjust cow numbers per pen for adequate bunk space per cow.

Many of those questions don't have to do with the ration, per se, but can affect their maintenance requirements, how well the cows eat, and their health.

■ The Cows

- How many cows are lying down ruminating?
- Do the cows appear to be sorting their feed? What are they sorting for?
- Are cows eating dirt? Eagerly eating buffer or salt?
- Do the animals look dull, or bright and healthy?
- Are the cows nervous or calm?
- Is the average body condition score acceptable for the group? Is there much variation in condition score within a group?
- Are there many lame cows?
- Are there many cases of milk fever or ketosis?

The rule of thumb is that (except for cows that are eating, sleeping or drinking, or if they are heat stressed) 4 to 5 of every 10 animals should be chewing their cuds. Cows may ruminate up to 10 hours a day, so don't tell yourself that it's long enough since feeding that they don't have to. If they are not ruminating, look further for the cause be cows sorting? Low effective fiber in the ration?

Cows have very few hobbies – checking fences, checking gates, leaning on people who step into their stalls, and sorting their feed. See the first section of this paper for more description on what to do to decrease sorting. If the cows are sorting their feed, and if they are sorting for grain, the manure will be variable in a group receiving the same feed (possibly from stiff to diarrhea) and you will have no idea of what ration individual animals are actually eating. If cows are sorting, you've just hired every single animal as its own nutritional consultant. Cows are lousy nutritionists. Ruminal acidosis and digestive upset may be the consequence. So you need to find a way to come up with an appropriate ration that the cows can't sort to resolve this problem.

Cattle often eat dirt, or start consuming more salt or buffer when they have some form of digestive upset, or during heat stress.

Calmness, appearance and body condition: These are a matter of considering general animal health and how well the current ration and feeding system are meeting their requirements. Very variable body condition scores in a group raise questions about the management of moving cattle in the herd, or whether all animals are getting enough of the desired, unsorted ration. Could the diet be related to the cows' dull or bright appearance (excesses, deficiencies, or acidosis)? The nervous cows may relate to ration, but more often it relates to how the employees work with the animals. Calm cows are easier to work with, and I would bet that they make more milk than nervous animals with the same potential. Screaming, yelling, running the animals, and general carrying on and

cowboying (worst sense of the term) are counterproductive. Don't tolerate them.

Lameness suggests problems with ruminal acidosis, walking surfaces, warts, or how much time animals spend standing on concrete. Find out which is the root of the problem, and see what needs to be done to fix it. Sore-footed cows will not be as likely to walk to feed, mount, etc. That can leave you with animals who prefer to slug feed and lay down, or just eat less. This is a great place to apply the lameness scoring system to get an idea of just where a herd stands, so to speak.

■ Manure Evaluation

Manure evaluation is a simple way to find out what a cow is doing with her ration. Changes in manure consistency and particle size can offer information about how well the rumen is working. If the rumen is working properly, there's enough forage/fiber in the ration, and feed/feeding management is good, the manure will be slightly stacked with two to three dimples on top, the fiber particles in the manure will be quite small, and there won't be lots of identifiable, undigested feed to be seen. If the rumen is not working well, such as during ruminal acidosis, the feed may pass undigested to the large intestine where it will ferment leading to foamy manure, diarrhea, mucin casts, and possibly a fair amount of identifiable, undigested feed in the patty. If there is no disease going through the herd at the time, the manure can tell a great deal about the ration.

In the barn or lot:

- ▶ Is the manure foamy with many trapped air bubbles?
- ▶ Is the manure very loose (diarrhea)?
- ▶ Is there much variation in manure consistency within a feeding group?

Foamy or very loose manure usually suggest that the rumen is not working well, such as during ruminal acidosis and more feed is being fermented in the large intestine. The gas produced by the hindgut bacteria is trapped in the manure and makes it foamy; the acid they produce (same acids as produced in the rumen) may be part of the cause of the diarrhea. Diarrhea can also be caused by cattle eating spoiled or moldy feed. If the manure consistency varies within a group, the cows are probably sorting their feed, and/or only certain animals consumed spoiled material.

- ▶ Are there pieces of "mucous" in the manure?
- ▶ Is whole or ground grain apparent in the manure?

The “mucous” sometimes seen in the manure are actually mucin or fibrin casts. They look a bit like sausage casings, ranging in length from short shreds less than a centimeter long, to tubes of material a meter or more long. They are not actually part of the intestine. If the lining of the intestine is damaged, the cow secretes mucin or fibrin over the damage. The mucin or fibrin takes the form of the section of gut it was in, and is eventually shed out into the manure. One reported cause of these casts is increased acidity in the large intestine – excessive fermentation in the large intestine would cause this. Mucin casts are taken as a sign of acidosis in the feedlot industry. These casts can show up in manure of any consistency. When you do a “toe test” and drag the tip of your boot across a cow patty, if something in the pile moves after your foot has moved past, it is likely a mucin cast.

Whole grain (corn, barley, wheat) that has not been properly processed before feeding often shows up in the manure. Unless the outer hull is cut, crushed, or otherwise damaged by processing or rumination, neither bacteria nor enzymes may digest it well. And it will show up in the manure. Back in the early 1900’s, they used to have recommendations about how many hogs to stock with cattle if the cattle were fed unground corn.....

If appreciable ground grain is seen in the manure, it may be escaping the rumen too fast. A high producing cow may have a bit more ground grain in her manure because of a higher intake and higher rate of passage, and “a bit” may not be a problem. However, that grain does represent feed that never had the chance to support milk production. If the source of the undigested ground grain appears to be corn, and corn meal is fed, sieving the corn may give an idea of whether it should be ground finer so that it is better digested. Ground corn that does not pass through a number 4 or number 8 standard sieve represent partial kernels or coarsely ground corn. These are the particles that seem most likely to be visible in the manure. Finding much of them in a sample of ground corn suggests that the corn should be ground more finely.

- Is the manure very dry/stiff?

You expect manure like this in dry cows, not in cattle that are producing well. It may be due to not feeding enough protein, or rumen degradable protein.

How To: Evaluating Particles in Manure

The particles in manure tell how well things were digested in the rumen and the rest of the gut, but can be difficult to see, unless you rinse them clear of the rest of the manure.

- For each group of cows, take 4 or 5 samples of feces from individual cow pies: try to select for variation in appearance representative of the group.

Make sure the samples are not contaminated with feed. Eight ounce sample cups with lids are very good sample holders.

- ▶ Fill the cup completely and cap. Filled cups can be placed in a sleeve to be carried.
- ▶ Get a screen or kitchen strainer (do not return it to the kitchen) with 1 - 1.5 mm openings. This is a qualitative, on farm evaluation, so getting very specific about mesh size is not crucial. A strainer that is 18 cm in diameter and 10 cm deep works well.
- ▶ Transfer a manure sample into the strainer, using a steady stream of water to rinse the cup into the strainer. Rinse the sample gently but thoroughly until the water runs clear. Squeeze the water out of the sample and transfer it back to the sample cup so that all of the samples taken can be compared side by side.

Does fiber in the sample appear to be coarse (more than 1 cm long, whole pieces of corn stalk)? Does any cottonseed present still have the lint still on it? Does the feed retain its color (grass that's still green, citrus that's still orange, etc.)? Is there much (relative term) whole grain in the sample? Much ground grain? These things suggest that the rumen isn't working well – feed left before it was well digested. Manure evaluation is qualitative, so you will need to assess whether there appears to be too much or an acceptable amount of coarser fiber or undigested grain in the manure. There is no common, on-farm way to evaluate the proportion of manure your samples represent, so do not try to over-interpret the information they offer.

MBH Observation: Effectiveness of fiber to keep the rumen working well is not only related to particle size, but to a variety of factors that affect rate of digestion. For example, grass neutral detergent fiber (NDF) tends to ferment more slowly than does that in legume forages. Additionally, the particles from grass tend to be more needle-shaped, and those from legumes to be more square. In my experience, grass has tended to be a more effective NDF source than legume forages possibly because the fiber is retained in the rumen for a longer period of time. Long pieces (2.5 to 5.0 cm) of very tender or pliable grasses can sometimes be found in the feces - they seem to be able to bend and escape the rumen. The NDF has to be in the rumen to be effective. A greater amount of NDF from a more rapidly fermented NDF source would have to be fed to provide the same amount of effective NDF as from a more slowly fermenting source. Take as an example that a small amount of chopped straw included in a ration can quickly resolve problems due to effective NDF inadequacy of the ration. Alfalfa can be an excellent feed, but it can be a poor choice as a major source of effective fiber. The need to provide adequate effective NDF to allow for proper rumen function and ration digestion is a balancing act with providing adequate nutrients. This is best done with high quality forages and feeds in adequate quantities.

■ Feeds and Feed Mixing

- ▶ Are any of the feeds apparently moldy or spoiled?
- ▶ Do the feeds appear to contain any undesirable foreign material?
- ▶ Are older shipments of feed being rotated forward when a new shipment is brought in?
- ▶ Are feeds being fed in a timely manner so they do not spoil?
- ▶ Is the silo managed to keep a clean, undisturbed face?
- ▶ Can adequate amounts of silage be fed relative to the width of the silo to keep the face fresh and non-moldy?

These points all cover the points of management needed to avoid feeding toxins, spoiled feed, or unpalatable feed to the cows. Your cows' intake, health, and production can depend upon it.

- ▶ Are the correct feeds being mixed in the right amounts and order?
- ▶ Are the mixer wagon scales accurate?

These simply verify that the ration on paper is translated into the ration the cows receive. Accurate weights are needed or else you've got no way to know what is being fed, what direction to consider changing the ration, or that the changed ration is actually what is being fed.

- ▶ How different is the particle size of silage in the silo from silage in the mixer?

Over-mixing, or adding the silage too early in the mixing sequence can grind the fiber and reduce particle size, not a good thing if it means that the ground ration does not meet the cows' effective fiber requirements. On the other hand, hay may have to be added earlier in the mixing sequence to chop it finely enough so that the cows do not sort it.

- ▶ Are the feeds of adequate quality and quantity to meet cow requirements over the course of a lactation/year, or will something run out?

Plan ahead for feed and forage supplies so that the cows can get a properly balanced ration year round.

■ Pulling It Together

So, what do you do with the information from evaluating a herd? Combine all the information on cow health (digestive upset, acidosis, laminitis, etc.), cow

performance (milk and milkfat yields), rumination (at least 40% of cows not eating or sleeping should be chewing their cuds), cow observations (sorting the ration or not, comfortable or not), manure evaluation, ration & feed evaluation, etc. The story it tells adds to a body of evidence that something within the ration or in cow and feeding management may need to be modified.

