Tools for Diagnosing Nutritional Problems in Dairy Herds

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Several diagnostic tools are available to help nutritionists, veterinarians and producers discover the cause of a suspected nutritional problem and, more importantly, to help fine-tune rations for the most profitable milk production response. These tools can be used together to pinpoint a particular nutritional and/or management problem which may be the cause of suboptimal milk production, low reproductive efficiency, or metabolic diseases. This article discusses these diagnostic tools and how they can be used to pinpoint areas in ration formulation and feed delivery, which may be causing a nutritional imbalance.

Tools Discussed

1. Examine Milk Records
2. Observe cows and feeding facilities
3. Remeasure DMI
4. Forage Particle Size
5. Milk Urea Nitrogen (MUN)
6. Body Condition Scoring
7. Urine pH of Close-up Dry Cows

Examine Milk Records

Taking time to examine both the production and reproductive records can provide several leads as to when the problem started and may provide some answers as to the cause. The total amount of milk in the bulk tank should be the first area evaluated to determine how well a feeding and management program is working. Sound feeding and management programs result in little variation in milk weights between pickups. If milk production decreases by more than 3 to 5% from one pickup to the next after accounting for changes in cow numbers, changes in the amount and quality of forages fed and consistency of the overall feed delivery should be examined closely.

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Although the amount of milk in the bulk tank is important to the cash flow of the operation, it does not give the total picture as to how well a feeding program is working. Changes in the number of cows being milked and/or numbers of cows in each stage of lactation can greatly distort changes in milk production per cow. To accurately evaluate and fine-tune a feeding program, the amount of milk produced by each cow should be recorded at least monthly. These data can be summarized through a DHI program or on-farm precision technologies. However, the key here is to review these data on an on-going basis to not only detect if a problem has occurred but to catch it in the early stages.

For herds enrolled on DHI, the herd summary sheet (DHI-202 or 302) provides a summarization of not only the milk production for all cows but also provides a summary to assess the reproductive and mastitis programs in place in the herd. When trying to diagnose the cause of low milk production, mastitis and reproductive performance needs to be examined. High cell counts and long calving intervals (resulting in high days in milk) can decrease milk production. From a nutritional standpoint, two major areas to evaluate on a farmer's DHI herd summary sheet include:

- **Standardized 150-day milk production** is an estimate of what the average cow would have produced this month if she was 150-days in milk. Each month, DHI recalculates this value to reflect the current month's production data. This calculated value removes the effects of stage of lactation and allows a comparison between months. If this value decreases by more than 2 to 4 pounds of milk, changes made in the feeding and management for this month need to be reexamined.
- **Average peak milk production** for first, second, and mature cows is also summarized. The higher cows peak in milk production, the more milk they give over a lactation. For every pound higher cows peak in milk production, they normally will produce 200 to 250 lbs more milk over that lactation. First lactation heifers should peak at 75 to 80% of mature cows. If lower than this benchmark, first-calf heifers may have limited bunk space and consequently, do not compete with the mature cows or the heifer rearing program needs to be fine-tuned to ensure proper heifer growth. Second lactation cows can experience "sophomore slump" or not peak as high when they were not fed enough energy and protein during the first lactation to regain the body condition lost during early lactation. Second lactation cows should peak in milk production at greater than 85% of mature cows.

Observe Cows and Feeding Facilities

Excellent observational skills are critical in diagnosing the cause of many nutritional problems. Taking time to observe cows eating and resting can provide invaluable clues as to the subtle problems in the feeding and management scheme. Cow

comfort is necessary for optimum milk production. Free stalls need to be long enough, provide a comfortable surface for the cow to lie on, and have enough lunge space for the cow to use as she is getting up in the stall. Approximately, 60% of the cows resting should be chewing their cuds.

Fresh feed needs to be readily accessible to cows 20 hours a day for maximum dry matter intake. A simple glance into the feedbunk to see if feed is available can go a long way in explaining why cows are not milking as well as expected, especially close to the next scheduled feeding time. Insufficient bunk space often limits intake especially in early lactation cows and more timid first-calf heifers. (Recommendation is to have 24 to 30 inches of bunk space per cow when all cows are fed forage or TMR twice daily.) Feed bunks need to be cleaned out on a regular basis to prevent moldy and poor quality feed being presented to the milking herd. A clean, cool source of water needs to be within 50 feet of the feedbunk. Waterers need to be cleaned out and scrubbed with a brush and weak chlorine solution weekly.

Remeasure Actual Dry Matter Intake

The amount of dry matter a cow consumes determines the amount of nutrients she receives and ultimately the amount of milk she will produce. Too often, the amount of feed consumed by the milking herd is less than recommended amounts formulated by the nutritionist or the quality and/or type of forage being fed has changed. Use of a portable scale and/or checking weights registering on the TMR scale is invaluable in solving many nutritional-based problems. The dry matter content of wet feeds, such as silages and wet by-products, can greatly influence the amount of dry matter actually being consumed.

The dry matter content of silages stored in a trench, bunker, or open upright silos can change dramatically during periods of heavy rain. Also, the dry matter of silages can change when a different cutting or harvest date is fed. The dry matter content of these feeds can be determined using a Koster tester or microwave oven.

Forage Particle Size

Cattle require roughages in their diets to maintain normal rumen function, to allow for efficient fiber digestion, and to maximize energy intake from economical feedstuffs. Roughages are supplied by a combination of forages and/or roughage byproducts. These products stimulate the cow to chew and ruminate. This, in turn, stimulates saliva production, which buffers the rumen contents allowing for efficient microbial fermentation. Maintaining the proper particle size in forages is critical in stimulating the cow to chew her cud. Cows, which do not receive adequate amounts of effective fiber to stimulate cud chewing, often times have low dry matter intakes, reduced butterfat tests, higher incidence of displaced abomasum, and more cases of laminitis and other foot problems. The Penn State Forage Particle Separator Box can be used

to quantify the distribution of particle size within a forage and, more importantly, in a total mixed ration. Mixing of TMR mixer wagons for more than 5 minutes can result in very short particle length with most of the effective fiber in the diet being pulverized by the augers. This problem can result in displaced abomasum, feet problems such as laminitis, low butterfat test, low dry matter intake, and cows going off-feed. A large variation in particle length of chopped forages occurs between farms.

Milk Urea Nitrogen

Milk urea nitrogen (MUN) is one way to access the protein status of dairy cows. When cows consume a diet, the microbes within the rumen degrade the protein to ammonia. The microbes, in turn, use ammonia and fermentable carbohydrates to make amino acids and microbial protein, which then are degraded by the cow in her small intestine. Excess ammonia is absorbed across the rumen wall and passes to the liver via the portal vein where it is converted to urea. Urea can either be recycled back to the rumen by the saliva or be excreted in the urine. Cows have to expend 2 Mcal or more of energy to excrete the excess urea through the urine. Thus, excretion of excess urea is an energy requiring process, taking available energy away from the potential milk production. Excess concentrations of urea in the blood are believed to have detrimental effects on milk production, reproductive efficiency, embryo survivability, and immune function. In addition, excess urea excreted in the urine has an environmental impact.

- **Individual Cow Samples:** Careful collection of the composite, individual cow milk samples is necessary to ensure that the urea concentration in the milk sample is not reduced by microbial activity. Milk samples should be preserved with a fermentation inhibitor or refrigerated until analyzed. MUN values have been shown to decrease by 50% in milk samples kept at room temperature for 48 hours. Samples representing the entire milking which can be collected from milk meters or weigh jars are preferred. When this is not possible, Gustafsson and Palmquist have suggested that milk samples be collected at the end of milking rather than at the beginning. Samples should be collected from at least 10 cows within the herd or production group. Many milk companies measure the MUN context of each milk pickup and these values provide a snap shot for the entire herd, but not for groups of cows within a dairy operation.
- **Interpretation of the results:** Milk urea nitrogen (MUN) is an excellent tool to help evaluate the success of ration formulation and delivery of that ration to a group of cows. MUNs are designed to help a nutritionist determine the protein status of a group of cows, not individual cows. The concentration of MUNs do vary with stage of lactation, between cows and season of the year. MUNs do not vary with the time of feeding as greatly as blood urea nitrogen values. Scientists generally suggest the "normal ranges" for MUN's for 10 to 14 mg MUN/dl. Individual cows will range between 8 to 25 mg/dl to have

averages fall between their suggested "normal values". Low MUN values indicate limited rumen degradable protein (RDP) within the rumen for the bacteria. High MUN values indicate excess RDP or limited carbohydrate or sugar sources for rumen bacteria.

Body Condition Scoring

Body condition or the amount of fat carried around the rump, tailhead, and loin area can influence milk production, reproduction, health and longevity of cows. Cows, which are thin at calving, will not peak as high in production as cows in good body condition. On the other hand, cows that calve with too much condition and/or are not managed properly can have calving problems, milk fever, retained placenta, metritis, ketosis or other post-calving problems and will not milk as well.

High-producing cows cannot consume enough feed during the early part of their lactation to support the large amount of milk they are producing. To obtain the necessary amount of energy, they rely on their fat stores as a readily available energy source. Cows should not drop more than 0.5 point over a 60-day period in early lactation. When fresh cows drop a point in the first two to three weeks into lactation, a major feeding and management problem is indicated.

Cows should be fed to regain body condition in later lactation. A typical mature cow will gain 4 to 5 pounds of body weight weekly. To increase by one body condition score, a mature cow will need to gain 120 lbs of body stores, which will take approximately six months. First-calf heifers require 160 lbs of added body weight to regain one body condition score.

Scoring the amount of body condition cows and heifers are carrying for their respective stage of lactation is an excellent management tool for fine-tuning a feeding and management program. In herds where more than a few cows deviate from the expected body condition score, changes are necessary in the energy and protein density of the diets and/or changes are needed in management to correct low dry matter intakes. The amount of body condition a cow is carrying relates to the stage of lactation of the group of cows. Just looking at the amount of condition cows are carrying without knowing their calving date and breeding history reveals very little about how well the nutritional and management program is working. Table 1 gives the suggested body condition score by stage of lactation and some possible nutritional and management areas to address to correct the deficiency or excess body condition observed.

Table 1. Suggested body condition score (BCS) for cows at different stages of lactation with suggested areas to review if cows deviate from suggested score. Dairy cows are scored from 1 (thin) to 5 (overly conditioned).

Stage of Lactation	Ideal Score (Range)	Trouble Shooting Problems
Calving	3.25 (3.0 - 3.5)	Low BCS: Review dry cow program-low energy intake
		If going dry thin: Review energy intake in later lactation
		High BCS: Long dry period, long days open, excess energy intake in later lactation
Early Lactation	2.5 - 2.75 (2.5 - 3.0)	Cows should not lose more than 0.5 BCS in 60 day time frame
		Thin BCS first 2 weeks: Review transition into herd from dry lot and dry cow feeding program.
		Thin BC early lactation: Check energy density of diet. Check dry matter intake and feed bunk management.
		High BCS: Check for deficiency of protein, RDP and RUP
Mid-Lactation	2.75 (2.5 - 3.0)	Low BCS: Check energy density of diet. Measure dry matter intake as it related to balanced ration
		High BCS: Check protein content of diet, decrease energy density of diet
Dry Off	3.25 (3.0 - 3.5)	Low BCS: Review energy density of milk cow diet
		High BCS: Excess energy or protein intake in late lactation, long number of day open (later lactation cows may need to be grouped and fed a different diet)

Urine pH of Close-up Dry Cows

The inclusion of anionic salts in close-up dry cow diets has been shown to decrease the incidence of metabolic and other health problems associated with hypocalcemia or milk fever around the time of calving. Close-up dry cow diets formulated for a negative dietary cation-anion difference will cause a mild metabolic acidosis, which in turn, increases the mobilization of calcium from bone and may even increase the absorption of calcium from the gut. These metabolic changes will help maintain a more normal concentration of calcium in the blood and prevent milk fever and subclinical hypocalcemia (low blood calcium).

Monitoring the urine pH of close-up dry cows is an effective diagnostic tool and practical means to adjust the amount of anionic salts necessary to achieve a beneficial response. Urine pH can be measured on farm using standard pH paper or a portable pH meter. Urine should be collected mid-stream and after cows have received the diet with anionic salts for 48 hours. The target urine pH for close-up dry cows is between 6.2 to 6.5 for Holsteins (at least less than 7.0) and 5.8 to 6.3 for Jerseys. Urine pH which fall outside these ranges should be reported to your nutritionist so they can adjust the amount of anionic salts in the diet or look for management practices, i.e. cows stealing feed from other groups within the barn that might be limiting the correct intake of these anionic salts.

Putting These Tools into Practice

When trying to diagnosis the causes of a suspected nutritional problem, it is important to use a combination of discussed tools. At least 10% of cows should be evaluated. Once the problem area is determined, the ration and/or feeding management should be changed to correct the suspected problem. Once the changes are made it is imperative to continue to monitor the situation even after the desired results are obtained. Fine-tuning feeding programs for the milking herd and dry cows is a dynamic process, which must be evaluated and fine-tuned frequently to obtain the desired results.