

MILK COW NUTRITION MONITORING



BASICS

OVERVIEW

- The efficiency of milk production has increased dramatically in the last 40 years. Today's dairy cattle are capable of tremendous milk production. Nutrition programs must be adequately tailored to meet the needs of lactation. Lactating dairy cattle can eat approximately 4% of their body weight in DM daily and this amount can increase to 5 to 6% if they are milked 3 to 4 times a day. Dry dairy cattle eat approximately 1.8 to 2% of their body weight in DM daily. Often times disease processes that involve lactating dairy cattle are nutritionally based. It is important to monitor milk weights closely, preferably twice daily, to catch problems as soon as possible. A cow should not drop more than five lbs of milk from one milking to the next day's milking. If this occurs then the cow and or cows need to be checked out fully to make sure that no disease processes are occurring. Consumption of the ration measured by the refusal amount or weigh back, and milk weights are two of the most sensitive daily monitoring tools for nutrition monitoring of dairy cattle.
- The primary tool for evaluation of milk cow nutrition is the evaluation of the fatness or thinness (body condition score) of an animal. It is a very good indicator of nutritional status. The body condition score of an animal significantly influences health, productivity, reproduction, and maintenance of the cow in the herd. It is a signal of proper and/or improper nutritional management at all stages of a cow and/or heifer's life.
- There are other tools that can be utilized such as simply looking at the ration and the uniformity and the wetness of the ration. Looking to see if there is sorting of the ration and if there is enough effective fiber. There should be at least 15% of the particles in the ration that are an inch and a half in length. It is imperative to the maintenance of the rumen mat and the buffering of the rumen to have enough effective fiber. Subacute ruminal acidosis and/or ruminal acidosis will result if there is not enough effective fiber. Overmixing and over grinding the ration will pulverize the ration and decrease effective fiber again leading to ruminal acidosis. Ruminal acidosis causes gastrointestinal upset and decreases in DMI which in turn leads to decreases in milk production. It can lead to ketosis and then anorexia resulting in subclinical and clinical hypocalcemia, LDAs, or RDAs and potentially fatty liver in severe cases.
- Feeding an animal correctly goes a long way to preventing disease processes. Management protocols should be established with veterinary, nutritionist, and management input and include: vaccination programs and monitoring of body condition scoring, locomotion scoring and manure scoring.
- Balanced diets should be formulated appropriately for the lactation (first versus 2nd and greater lactation animals) and the stage of lactation that the cow is in as well as for any adjustments in body condition score that are necessary.

GENETICS

- Mammary gland development and milk production is heritable and plays a significant role in the milking ability of the animal but nutrition has a larger impact than genetics.

GEOGRAPHIC DISTRIBUTION

- Relevance is worldwide but is highly dependent on the type of management and feedstuffs available.

HERD MONITORING

The nutrition of lactating cows is best done by monitoring a number of parameters including: body condition score, cud chewing, lameness, manure scoring, sorting of the ration, weigh back of feed, percentage of Left displaced abomasums (LDA), percentage of ketotic cows, milk weights (including peak lactation and maintenance of lactation), milk protein, milk fat and milk urea nitrogen.

SIGNS

- Changes in milk production and body condition score of lactating dairy cattle are highly dependent on nutrition. Additionally, components of the milk such as the concentration and ratios of protein and fat can vary with changes in the ration. A protein fat inversion occurs when the ration causes the ruminal pH to drop. When the fat % is 0.2% less than the protein % this is termed a protein fat inversion. DHIA records will show if an inversion has occurred in each individual cow. DHIA records provide essential information to the producer.
- Lameness and laminitis are often secondary to ruminal acidosis. Decreased activity made evident by increased lying times and decreased DMI are indicative of ruminal acidosis and problems with the ration.

MONITORING TESTS

- Routine ration analysis including: energy (NET_L), ADF, NDF, crude protein, rumen bypass protein, soluble protein, fat, starch, vitamins, minerals, ash, moisture content, pH, and starch digestibility.
- Ration particle size analysis (i.e., Penn State particle separator)
- Routine milk testing including: protein and fat percentages and MUN
- Non-esterified Fatty Acids (NEFA), Ketone testing, rumen pH by rumenocentesis
- Fecal starch testing

MANURE EVALUATION

Manure evaluation for consistency and presence of feed particles helps to identify problems with the ration.

Manure Scoring: Score 1/3 of the number of manure piles as the number of cows

- 1 = Very liquid – of pea-soup consistency, showing no rings or dimples and may have bubbles of gas and may indicate too much protein and/or starch or excessive minerals or low fiber levels.
- 2 = Doesn't pile and is runny, less than 1" deep with an appearance of rings and may indicate too much protein and starch, excessive minerals, low fiber levels and/or cattle grazing lush pasture.
- 3 = Porridge consistency, stands 1½" high and shows four to six concentric rings and/or dimples and represents a balanced ration with an optimal rate of feed passage

- 4 = Thick, doesn't stick to shoes and shows no rings or dimples may indicate a lack of degradable protein, excess fiber and/or low starch.
- 5 = Firm balls and stacks 2-4" high and may indicate dehydration, a lack of degradable protein, excess fiber and low starch.
- Goals
 - **High-production cows:** fewer than 5% at score 1, fewer than 20% at score 2 and more than 80% at score 3
 - **Low-production cows:** more than 90% of samples should be score 3 and less than 10% score 2.
 - **Averages at various stages:** high-production and close-up dry cows should rate score 3, dry and late-lactation cows 3.5, and fresh cows 2.5

Manure Analyzer

- Use top 2 screens of the three-screen Nasco Digestion Analyzer (Cargill Manure Screener). Allows producers to see just how well cows are digesting their feed and/or if feeds were processed correctly before being consumed. Collect a cup of manure (500 grams) from several samples in a pen, pour it on a 1/8" screen & run warm water across it. If corn kernels remain, the corn silage or ground corn grain wasn't processed correctly.

Fecal Starch

- If 8% (fecal starch analysis) - reduce to 4% by processing corn silage correctly, grind corn finer or let the corn silage age longer. Milk production increases of 3lb/day can be expected.

BODY CONDITION SCORE GOALS

- Dry cows: 3.25-3.75
 - Cows can lose from 100 -150 lbs during the first 60-80 days of lactation (1-2 lbs/day) but losses of 3-4 lbs/day may lead to metabolic disorders.
 - Cows should neither gain nor lose more than 0.5 of a BCS during the dry period
- Early lactation: 3
 - Cows should not lose more than 0.5 BCS between calving and conception
 - Cows should be replenishing fat reserves by days 80-120 Days in Milk (DIM) and should gain 0.75-1.0 pounds per day.
 - It is important to maximize DMI and feed high energy ration to counteract negative energy balance and adequate protein to support peak milk production.
 - Very high producers may drop below 3.
 - If 3 to 3+ and production is not as high as expected then check intakes of protein, minerals, & water.
- Mid to late lactation: 3-3.25
- Scores below 3 = cows are receiving inadequate energy. Check early lactation and dry ration, because problem began there.



FOLLOW-UP

CLIENT EDUCATION

- Direct clients to utilize ruminant nutritionists, veterinarians and extension agents to assure that the ration is being mixed and fed appropriately. Teach the client monitoring techniques as stated above and how to interpret DHIA records. Provide client with access to extension publications and journals on appropriate feeding and monitoring of lactating dairy cattle.

POSSIBLE COMPLICATIONS

- Poor DMI resulting in depressed milk production and herd to reach peak and maintain milk production. Diets that do not have enough effective fiber lead to ruminal acidosis and subsequent increases in laminitis, LDAs, ketosis, and fatty liver. Failure to maintain appropriate body condition throughout lactation and the dry period will lead to numerous transition issues such as dystocias, metabolic issues, and subsequent increases in infectious processes such as metritis.

PREVENTION

- Enlisting the help of a nutritionist to formulate rations by production groups
- Regular evaluation of the ration and the aforementioned parameters will insure that problems with the ration and or the management can be quickly identified and addressed to prevent significant losses in milk production.
- Make sure that there is adequate fiber level in the ration to maintain rumen health by allowing for buffering of the rumen through appropriate cud chewing. Cows housed in free stalls should be either at the bunk eating or laying down and chewing their cuds.
- Increasing the number of feedings will increase DMI and keep rumen pH more balanced
- The ration palatability needs to be assessed by performing weigh backs and looking for sorting behavior from the cows. If sorting occurs often subclinical or clinical ruminal acidosis will occur resulting in an increase in the level of lameness, LDAs, and other digestive disturbance in a herd.
- Analysis of MUN and the ration for adequate and/or excess protein (soluble & bypass). If the MUN is above 18, reproductive losses can occur. If the MUN is below 12 then reduction in milk production can occur.
- Analysis of the ration for adequate and excess energy, minerals, and vitamins, making sure that the ration meets the NRC requirements.
- Make sure to formulate appropriate rations for each group of cows. Over feeding energy to dry cows will lead to metabolic problems (ketosis, LDA, fatty liver) during the transition period.
- Underfeeding energy will lead to milk loss and reproductive problems (i.e., decreased conception, increased early embryonic death etc.) during lactation.
- The ration should be evaluated daily for fineness of the chop and/or grind, over or under mixing of the ration, smell, & pH level. Dry matter of silages should also be evaluated at least weekly.
- Forages, silages, grain mixes and the total mixed ration should be checked for amounts of bypass protein, starch, fats, and oils routinely.

- Overstocking negatively affects milk production so make sure that facilities are adequate to maximize DMI.
- First lactation animals should be separately housed and fed to maximize DMI and help maintain body condition. Their nutritional requirements must account for body growth since their mature size has not yet been reached.

AGE-RELATED FACTORS

- First lactation animals need to be fed separately from older animals. Second or greater lactation animals are more predisposed to ketosis, LDA, fatty liver and hypocalcemia.

SEE ALSO

- Dairy Heifer Nutrition: Basics (www.fiveminutevet.com/ruminant)
- Dairy Nutrition: Ration Guidelines for Milking and Dry Cows (www.fiveminutevet.com/ruminant)
- Nutrition and Metabolic Disease: Dairy
- Nutritional Assessment(www.fiveminutevet.com/ruminant)

ABBREVIATIONS

ADF = acid detergent fiber
 BW = body weight
 DM = dry matter
 DMI = dry matter intake
 DHIA = Dairy herd Improvement Association
 MUN = milk urea nitrogen
 NET_L = net energy of lactation
 NDF = neutral detergent fiber
 NRC = National research council
 TDN = total digestible nutrients

INTERNET RESOURCES

- <http://extension.psu.edu/animals/dairy/nutrition/forages/forage-quality-physical/separator>
- <http://www.vetmed.wsu.edu/courses-jmgay/documents/DAS02421.pdf>
- <http://hayandforage.com/dairyforage-nutrition/score-manure-more-milk>
- <http://www.vetmed.wsu.edu/courses-jmgay/documents/363eng1.pdf>

Suggested Reading

- Chase, L.E. 1993. Developing nutrition programs for high producing dairy herds. *J Dairy Sci.* Oct; 76(10):3287–93.
- DeVries, T.J., von Keyserlingk, M.A., Weary, D.M., Beauchemin, K.A. 2003. Measuring the feeding behavior of lactating dairy cows in early to peak lactation. *J Dairy Sci.* Oct; 86(10):3354–61.

- Duffield, T. 2000. Subclinical ketosis in lactating dairy cattle. *Vet Clin North Am Food Anim Pract.* Jul; 16(2):231–53, v.
- Galligan, D.T., Ferguson, J.D. 1991. New approaches to nutritional monitoring. *Vet Clin North Am Food Anim Pract.* Jul; 7(2):473–82.
- Heinrichs AJ, and Ishler VA. Body Condition Scoring as a Tool for Dairy Herd Management. Department of Dairy and Animal Science. Extension Circular 363: <http://people.vetmed.wsu.edu/jmgay/courses/documents/363engl.pdf>.
- Hollmann M¹, Allen MS, Beede DK. Diet fermentability influences lactational performance responses to corn distiller's grains: a meta-analysis. *J Dairy Sci.* 2011 Apr;94(4):2007-21.
- Hollmann M¹, Allen MS, Beede DK. Dietary protein quality and quantity affect lactational responses to corn distiller's grains: a meta-analysis. *J Dairy Sci.* 2011 Apr;94(4):2022-30.
- Hu W, Murphy MR, Constable PD, Block E. [Dietary cation-anion difference and dietary protein effects on performance and acid-base status of dairy cows in early lactation.](#) *J Dairy Sci.* 2007 Jul;90(7):3355-66
- Linn, J.G., Martin, N.P. 1991. Forage quality analyses and interpretation. *Vet Clin North Am Food Anim Pract.* Jul; 7(2):509–23.
- National Research Council. 2001. Nutrient requirements of dairy cattle. 6th Rev. Ed. Washington, DC: National Academy of Sciences.
- Roseler, D.K., Fox, D.G., Chase, L.E., Pell, A.N., Stone, W.C. 1997b. Development and evaluation of equations for the prediction of feed intake for lactating Holstein dairy cows. *J Dairy Sci.* 80:681–691.
- Schingoethe DJ¹, Kalscheur KF, Hippen AR, Garcia AD. Invited review: The use of distiller's products in dairy cattle diets. *J Dairy Sci.* 2009 Dec;92(12):5802-13.
- Silveira C, Oba M, Beauchemin KA, Helm J. Effect of grains differing in expected ruminal fermentability on the productivity of lactating dairy cows. *J Dairy Sci.* 2007 Jun;90(6):2852-9.
- Studer, E. 1998. A veterinary perspective of on-farm evaluation of nutrition and reproduction. *J Dairy Sci.* Mar; 81(3):872–6.

Author Julie Gard

Consulting Editor Kaitlyn Lutz

Acknowledgment The author and editors acknowledge the prior contribution of Jim G. Linn.