Fiber 1 - Milk Fat Depression

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Introduction

Milk fat depression is a sporadic problem usually encountered when the crude fiber in the total ration declines below 17% on a dry matter basis. The following discussion of fiber and its analysis is presented as a basis for several succeeding papers here today.

Fiber is the reason we use ruminants to produce meat, milk and wool. Fiber is that plant material that passes through monogastrics mostly undigested. Fiber is a collective term which includes cellulose, hemicellulose, lignanocellulose and lignin. Fiber in the case of legumes, increases as a percentage of total dry matter with maturity.

Ligninification reduces digestibility and increases both the time required for digestion and the rate of passage of ingesta in ruminants. This is of little consequence in maintenance of cattle, however, this is one of the major problems encountered in factors limiting maximum milk production. It is nearly impossible to adjust for poor forage management (in poor quality forages–mature) by adding more protein and energy to reach peak production potential.

Determining fiber content has had a long history starting with the TDN system and the measurement of crude fiber by the method of Wende. The crude fiber analysis when compared to the net energy system underestimates the energy value of high quality forage and overestimates energy value of poor quality forage. The newer system of analysis developed by Van Soest employs a detergent fiber system which basically separates the plant cell into two parts: cell contents or solubles and the cell wall. The neutral detergent fiber (NDF) is the cell contents and the ADF is the cell wall which contains all of the cellulose, hemicellulose and lignin and heat damaged protein.

Some Average Analysis

Feedstuff	TDN	CF	ADF	Lignin
Alfalfa				
Early Vegetative	68	21	28	6.4
Late Vegetative	62	24	34	8.6
Midbloom	56	33	40	10.8
Mature	52	37	44	12.4
Corn Silage	70	24	31	—
Oat Straw	48	41	47	14.0
Ear Corn	80	9	—	—
Shelled Corn	88	2	3	—
Cobs	47	7	35	—

Basis for Relationship of Fiber to Milk Fat

In a general way, the cell contents (starch and sugars) are fermented predominantly to propionic acid and the cell walls (cellulose and hemicellulose) are fermented predominantly to acetic acid. The reasons for this are the differences in fermentation that occur when starch is rapidly digested, lowering the pH and resulting in different species of microorganism to predominate. Under these conditions, propionate production is greater. Conversely, in high fiber diets digestion is relatively slower, pH is higher and more acetate is produced. Propionic acid cannot go directly to the mammary gland, but must be incorporated into long chain fatty acids and lipoproteins. These are generally deposited in fat stores or the fatty acids are incorporated into milk fat. Approximately 50% of milk fat may come from fatty acids. The remainder of the milk fat is derived from fatty acid synthesis from acetic and some beta-hydroxybutyric acid. Anything that reduces acetate production in the rumen may affect milk fat production.

The usual case of milk fat depression is associated with diets that are less than 17% crude fiber (too much concentrate or if the *effective* crude fiber is reduced). Typically, total milk production is unchanged or is even increased unless acidosis has become an additional problem. These herds will respond partially to buffering, but will not return to the original milk fat production unless the underlying problems are corrected.

Correction of the underlying causes:

1. Feed more long hay.
2. Length of chop = ¼ inch theoretical cut or more and no recuter screen.
3. Feed grain 3 times a day if on a very high grain diet.
4. Do not exceed 40:60, forage to concentrate ratio.

The Enigma

Case History #1: Fat test 3.6% declines to 2.8%. Eighty cow Holstein herd in stanchion barn, 20,000 lb. herd average. Forages include: baled hay, excellent quality, fed at the rate of 20 lbs./cow/day. Grain: high moisture ground ear corn was stored in a 20′ x 70′ stave silo. Feeding rate 1-2 inches per day.

In the fall, corn silage or haylage was being fed along with baled hay and high moisture (28% in grain) ear corn (up to 40 lbs. of feed). In January, silages ran out and all hay was being fed. In March, the milk fat test started to decline and in

a few weeks had dropped to 2.8%. The feeding rate was high, but not exceeding the 40:60, forage:concentrate ratio. The ear corn was coarsely ground with some husks present. The quality appeared very good and had a rather typical odor.

Addition of buffers resulted in only a 2 to 3 point increase in milk fat test.

Feeding 3 times a day had no effect on milk fat test.

The dairyman had ample supplies of dry ear corn and also fed steers. When he switched to ground dry ear corn, the fat test returned to normal in about 2 weeks.

It was conjectured that some sort of microbial activity was going on ahead of the unloader in the silo and 2-3 feet of HMEC was removed and either fed to steers or discarded. However, when the cows were again fed this HMEC, the fat test dropped again.

Case History #2: Fat test 3.6% declines to 2.6%. Sixty cow herd in stanchion barn, 16,000 lb. herd average. Forages include: corn silage, low moisture hay silage, and baled hay. Grain: High moisture (28%) shelled corn and about 50% of the cob stored in a bottom unloading, poured concrete silo.

The milk fat test had been going through many declines and then recover. In an attempt to alleviate the problem, all of the ensiled forages were discontinued and only long hay was fed about 20 lbs./cow/day and HMEC fed at 15-35 lbs./cow/day. This did not solve the problem. Three times a day feeding did not solve the problem. Buffering with MgO and $NaHCO_3$ partially restored the milk fat test.

A dry corn oats ration was substituted and the milk fat test returned to normal in 2-3 weeks. Gradually the HMEC was returned to the ration with buffers and the fat test dropped some but not to the previous low tests.

On the supposition that there was an ionophore effect (Monensen) a sample of the HMEC was kindly tested by Ely Lilly & Co. for any ionophore content in their artificial rumen assay. No ionophore activity was observed.

When milk fat test depression is encountered (where ensiled feeds are fed) where buffering does not effect a reasonable cure, shifting to dry feed is efficacious and may be recommended just on the basis of lost income due to price differential.

Fiber II – Displaced Abomasum as a Herd Problem

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Displaced abomasums (DA's) can be a serious herd problem. Often DA's may be preceded by other metabolic diseases at parturition such as milk fever or fatty liver syndrome. Various authors have described a variety of possible causes. Today we hear of DA's occurring pre- or post-partum most often in the first 2 months of lactation. It is not uncommon for DA's to occur at any time of the lactation cycle.

As a part of the metabolic profile test design project and our field services program, a standard approach was used to study these herd problems.

Case #1

During the previous 12 months there were 10 cows operated on for DA's. Forty Guernsey cows were housed in a stanchion barn. There were no other complaints. Nearly all of the cases occurred in the first 2 weeks of lactation.

The ration consisted of baled grass-alfalfa hay and concentrate. The concentrate (made up of ear corn and oats) was balanced in minerals, salt and vitamins and the supplemental protein was primarily urea.

There were no detectable abnormalities detected in the metabolic profile tests. For the solitary reason of poor utilization of non-protein nitrogen in cattle on a grass legume ration, the recommendation was made to balance the ration for protein with soybean meal. In the succeeding 2 years there were no new DA's. The next year there were 2 cases and in the last 3 years no new cases. Coincidence??

Case #2

This Holstein herd (with a 17,000 RHA) housed in 60 stanchions had an epidemic of DA's. Of the previous 17 cows calving, 12 had milk fever and of those 6 had surgery for DA's. Two milk fever cases became downers and died. In each case, milk fever was the initial problem followed by a DA and several developed metritis. Cows calved in stanchions and sanitation was not ideal.

The ration featured several problems. Baled hay was limit fed along with haylage and corn silage cut ¼' with a 1" screen in the chopper. Shelled corn in the ration was ground fine. The dry cow program had recently been changed to include four sources of vitamin A and D and at least 2 times the requirements for Ca and P. Metabolic profile tests revealed increased serum phosphorus.

Recommendations: 1) One adequate source of vitamins, and calcium and phosphorus to NRC recommendations 1