PENNSTATE
College of Agricultural Sciences • Cooperative Extension

Trouble-shooting problems with milkfat depression

V. A. Ishler and R. S. Adams

DAIRY& ANIMAL SCIENCE
Department of Dairy and Animal Science
The Pennsylvania State University
324 Henning Building
University Park, PA 16802
(814) 865-5491 • FAX (814) 865-7442
www.das.psu.edu/teamdairy/

Topics Include:
Introduction
Nutritional and management factors
Other factors involved
Suggestions for control

INTRODUCTION

Monitoring the milk components of a herd can help assess the health and nutritional status of lactating cows. A herd milkfat test below 0.3% of breed average can indicate a problem situation. In the short-term milk production may be normal, but animals may be experiencing subclinical acidosis. The long-term affects can be a decline in milk production along with the onset of laminitis and other health problems (i.e. off-feeds, digestive upsets, and displaced abomasum).

Monitoring fat tests can be accomplished by checking the DHIA test day reports and especially the four monthly tests taken by the milk handler. Two or three consecutive low milkfat tests from the milk handler or from DHIA should be considered a problem. Also, check groups of cows whether the grouping is based on days in milk, production status, or another parameter. It is not uncommon to see a certain group(s) of animals affected while others may not be.

It is suggested that milk production be converted to a fat corrected basis to evaluate the energy output in milk. The formula for pounds of 4% fat corrected milk (FCM) is:
(0.4 x lbs. milk) + [15 x (%fat/100) x milk lbs.].
For example, a herd averaging 67 pounds of milk with a 3.2% fat is the same as 60 pounds of milk with a 3.9% fat. The 4% FCM value is 59 pounds for both. The producer with the lower fat test may sometimes get paid more for the milk produced depending upon the fat differential. However, in the long-term, more health related problems and decreased milk production may follow.

Nutrition plays a large role in affecting milk composition, but there are other factors involved. They include milking equipment problems, improper handling of milk or milk samples, stage of lactation, season, genetics, and mastitis.

NUTRITIONAL AND MANAGEMENT FACTORS

A. Low fiber intake

Check forage and total neutral detergent fiber (NDF) intake of the ration. Cows consume pounds, not percents. Levels of NDF that may be acceptable for cows consuming 50 pounds of dry matter may not be for animals consuming less than 42 pounds (see example box). The minimum forage NDF intake as a percent of body-weight should be 0.85. The minimum total NDF intake as a percent of bodyweight should be 1.1 to 1.2.

Example: The average cow bodyweight is 1300 pounds and the total NDF in the ration is 32% on a dry matter basis.

A cow consuming 50 pounds of dry matter would be getting 16 pounds of total NDF (50 x .32) or 1.23% of bodyweight as total NDF.

A cow consuming 42 pounds of dry matter would be getting 13.4 pounds of total NDF (42 x .32) or 1.03% of body weight as total NDF.

B. Low forage intake

Lactating cows need a minimum amount of forage in the ration. Forages should be included in the diet at no less than 1.40% of body weight. In most situations, forage should make up no less than 40% to 45% of the total ration dry matter.

C. Ration particle size that is too fine

Forages and/or total mixed rations that are too fine in particle size, coupled with inadequate forage or fiber levels can aggravate a milkfat depression problem. Cows need adequate levels of effective fiber in the diet to maintain normal rumen function. The main goal in analyzing the particle size of the total ration is to measure the distribution of feed and forage particles that the cows actually consume. Evaluate particle size from different locations along the bunk or mangers.

D. Ration particle size that is too coarse

Forages and/or a total mixed ration that are too coarse in particle size allow animals to sort feed. On paper the ration may appear fine, but in reality, cows are not consuming what is being programmed. Coarsely chopped corn silage and TMRs with considerable hay can be a problem.

E. High nonfiber carbohydrate intake

This carbohydrate fraction is highly digestible and can be quickly digested compared to NDF. Excessive nonfiber carbohydrate (NFC) can depress fiber digestibility, reduce acetic acid production, and depress fat test. Consider the grain's particle size, moisture, and processing method in addition to the level of NFC in the ration. Depending on the digestibility of the NDF present, a NFC between 30% to 40% of the total ration dry matter is usually recommended. In most instances, a NFC between 32% to 38% is considered ideal. The concentration of NFC in a feed can be calculated by subtracting ash, ether extract, crude protein (CP) and crude protein-free NDF from 100.

100- [(NDF-NDFCP)+CP+fat+ash]

Using crude protein-free NDF is especially important for heat damaged forages and heated byproducts because the NDF can contain substantial CP. If CP-free NDF is not used, the CP in the NDF is subtracted twice (once as CP and once as NDF bound CP). When NFC for feed ingredients is calculated using the following equation of *100- [NDF+CP+fat+ash]*, then the NFC of an ingredient may be considerably underestimated (see example box). This can underestimate the NFC value in the total ration dry matter by 2% to 4%.

Example calculation:
Alfalfa silage on a dry matter basis contains: CP-19.6%, NDF-48.8%, NDFCP-4.1%, Fat-2.9%, and Ash-9.3%

100- [(NDF-NDFCP)+CP+fat+ash]
100-[(48.8-4.1)+19.6+2.9+9.3] =
23.5% NFC

100- [NDF+CP+fat+ash]
100- [48.8+19.6+2.9+9.3] =
19.4% NFC

F. Excessive fat and oil intake

The source and processing method of a high fat ingredient and the amount of fat in the ration can affect the milkfat test. Feeding considerable amounts of extruded, ground, or pelleted soybeans may lower milkfat. Several experiments in the literature have shown that feeding cows diets high in polyunsaturated fatty acids or trans fatty acids leads to a low milkfat test.

This can be the result of high intake of vegetable oils from one or more ingredients. Rations high in concentrates or soluble carbohydrates (NFC) can increase the accumulation of trans fatty acids. Marine oils that may be high in some fishmeals may lower milkfat. Rations too high in fat may reduce fiber digestibility and increase the susceptibility of animals to milkfat depression.

G. Protein deficiency

A deficiency of crude protein and degradable protein can lower dry matter intake and fiber digestibility. This problem could most likely occur on rations containing large amounts of corn silage or poor quality grass silage.

H. Sulfur deficiency

Sulfur is necessary for the synthesis of essential amino acids by rumen microbes. Sulfur supplementation is important in rations containing high levels of non-protein nitrogen (i.e. urea) since rumen microbes must make several sulfur-containing amino acids. Low sulfur intake can result in an induced protein deficiency. This problem could most likely occur on rations containing large amounts of corn silage or poor quality grass silage.

I. Energy deficiency

This can be a problem particularly in early lactation when cows are unable to meet their energy requirement while producing large amounts of milk. A herd containing more than 30% thin cows (less than a body condition score of 2.75 to 3.0 on the 5-point scale) can be the result of under-feeding fresh cows, a ration imbalance, or feet and leg problems. There is a tendency for both thin and fat cows to test low once they are past early lactation.

J. Infrequent feeding

This can have an impact in conventionally fed herds. Feeding forages and grains frequently throughout the day can help improve fat test. Avoid feeding large amounts of grain at any one feeding. Grain should be fed at least four times per day to high producing cows (>80 pounds of milk). This may help minimize milkfat depression and associated health problems by avoiding low rumen pH and reducing the length of time that it may be low.

K. Poor feeding management practices

Regardless of the type of feeding system being used, feed should be in front of the cows at least 20 hours per day. Feed refusals should be cleaned out daily. Cows should have access to fresh feed, not moldy or spoiled feed. In conventional feeding systems, hay or some forage should be fed before grain is offered. A true TMR should be fed. Any forage or grain offered outside of the TMR allows cows to preferentially choose what they want to consume. Cows should be transitioned gradually when any major ration change is going to be made. Cows should have free-choice access to water. Both water quality and quantity are important.

OTHER FACTORS INVOLVED

A. Season of the year

It is not uncommon to observe lower milkfat tests in the spring and summer months. Switching to pasture can depress milkfat because of the lower fiber and higher sugar content of the pasture. Hot weather and high humidity can depress dry matter intakes and result in lower forage and fiber intakes. Also, cows tend to eat larger quantities at a time instead of taking numerous, smaller meals.

B. Stage of lactation

A cow's fat test is likely to be lowest at peak production and highest towards the end of lactation. If the majority of the herd is less than 120 days in milk, then a depressed fat test of 3.3% to 3.5% may not be a major concern. If a herd's test is low in late lactation (i.e. 3.5%), then nutrition and management should be investigated.

C. Genetics

There are many areas where producers get paid for their milk based on solids nonfat or milk protein. If fat test has been ignored in the breeding program, then it is possible that a herd may have a genetic predisposition for a low testing herd.

D. High somatic cell counts

Mastitis, both subclinical and clinical, may depress fat test. This may be a factor in low testing herds.

E. Milking equipment problems

Freezing or churning of milk in the bulk tank lowers the tank test. Clumps of milkfat seen after emptying the tank indicate such a problem. Freezing can occur if there is a malfunction in the controls and refrigeration unit or if milk is excessively agitated. Problems can also occur if the temperature is too high. This can happen when old and raw milk is blended and the temperature exceeds 45^{o}F. Excessive agitation in the pipeline or a malfunctioning pump may reduce milkfat due to churning the milk.

F. Improper milk handling

Milk samples must be collected and handled properly to give accurate results. Samples need to be kept below 40^{o}F. This usually requires ice or water-cooling. Completely fill sample bags or bottles to prevent churning if samples are not kept below 40^{o}F. Samples should not be frozen. The bulk tank should be agitated for at least five minutes and larger tanks require a longer agitation time before sampling.

G. Miscellaneous factors

There is a considerable day to day variation in fat tests in individual cows and even in herds. Individual differences usually balance out in the bulk tank in larger herds. A longer than normal period between milkings can reduce fat test. Milk pick-up schedules may result in more variation in plant test, especially in herds shipping less than a days supply due to variation between milkings.

SUGGESTIONS FOR CONTROL

1. Obtain a recent analysis on all forages currently being fed. Included in the analysis should be soluble protein, degradable protein, neutral detergent fiber, ash, fat, and sulfur. The ash and fat values are necessary to come up with a more accurate NFC value. Ideally, NDFCP should also be tested to most accurately determine the NFC content of the sample(s) being submitted.
2. In a herd feeding a TMR, take 6 to 8 grab samples. Preferably submit about 1 gallon of sample and request that the lab dry and grind the entire sample sent to them. This helps eliminate any sampling bias at the farm or lab especially when hay is mixed in the TMR or large pieces of cob is present. In addition to the standard analysis, include soluble protein, neutral detergent fiber, NDFCP, ash, fat, and sulfur. Evaluate results for any deficiencies or excesses and compare against the programmed ration.
3. Evaluate the ration for nutrient content. Check that nutrient densities for the current level of production are appropriate (Table 1).
4. Evaluate the forage NDF, total NDF, and forage dry matter intake on rations being fed to animals producing milk less than 60 pounds, 61 to 80 pounds, and greater than 81 pounds. Refer to Table 2 for suggested guidelines.
5. Evaluate the particle size distribution for the total mixed ration or for the individual forages in conventionally fed herds. See Table 3 on guidelines for both forages and the TMR.
6. Evaluate the physical form of the concentrate portion of the diet.

- *High moisture grains (ensiled)*

  Proper preparation is necessary to prevent sorting of ear corn during ensiling, to increase digestibility of the grain and the entire ration, and to minimize sorting during feeding. Ensiled grains may be prepared more coarsely than dried grains. Starch in ensiled grains is more soluble and degrades more quickly in the rumen than starches in dry grains. This can be offset by somewhat coarser preparation.

- *Dry grains*

  To increase the digestibility of the grain and the entire ration, grains need to be properly prepared and broken. Preparation usually needs to be equivalent to grinding through a 1/2 to 5/8 inch screen. Cracked poultry corn is not fine enough for good digestability on some forage rations. Starch in finely ground grains is degraded more rapidly by rumen microorganisms than coarsely processed grain. Finely ground grains are higher in digestibility because there is more surface area to which rumen bacteria can attach. The proper grain particle size will depend on the forage ration and the total level of NFC in the diet.

- *Heat processed ingredients*

  Steamed flaked grains (thin flake) are similar to finely ground dry grains in extent of ruminal starch digestion. Steamed crimped and rolled grains are usually more similar to a medium and coarsely ground dry grain. More research is needed to determine the true difference in both rate and extent in the whole animal when comparing particle size and heat treatments.

Heat processed grains should be limited to 35% to 40% of the concentrate mix to avoid milkfat depression. Heating grains enhances the starch digestion by gelatinizing the starch in a manner that increases fermentability in the rumen. In addition to cereal grains, other heat-treated starch ingredients include bakery products, hominy, and chocolate products.

- *Pelleting*

  Ingredients in a pellet generally must be finely ground (3/32 inch screen or finer) to enable efficient pelleting. High starch ingredients should be limited to 35 to 40 % of the pelleted concentrate mix.

- *Fat sources*

  Evaluate how much fat is provided by vegetable, animal, and bypass sources. Some byproduct feeds like distillers, bakery product, hominy, and chocolate can contribute a substantial amount of fat to the diet. To one degree or another, most fat is toxic to rumen microorganisms and may reduce fiber digestion when total fat from natural sources exceeds 5% to 5.5% in the total ration dry matter. Using rumen bypass fat sources may allow total fat content in the diet to reach 6% to 7%. Oils are more toxic than hard fats such as tallow. Blends of vegetable and animal fat may be intermediate in their effect on milkfat. Fats, oils, or high-fat ingredients that have been subjected to very high temperatures during processing may be more toxic to rumen microorganisms than those processed at more usual temperatures.

7. Evaluate feeding management practices. This should include feeding frequency and sequence, feed availability, amounts of refusal, and what makes up the refusals (check for sorting of feed).
8. Sometimes it helps to go back to basics of dairy cattle nutrition and simplify the rations. This may mean removing or reducing the use of feed additives, added fats, and concentrate ingredients that are being fed at very low levels. Monitor animal response when any change is made in the ration or in feeding management.
9. Use production records or data available, i.e. DHIA, to evaluate individual animals as well as groups of animals.
10. Body condition score cows and compare results to either group or production data. Evaluate whether body condition is appropriate based on production and days in milk.
11. Check the amount of buffer, such as sodium bicarbonate, that is in the diet. In problem herds, a buffer should be included in the ration at 0.80% of the total ration dry matter. Do not rely solely on offering a buffer free choice to correct a milkfat depression problem. Check that magnesium levels are adequate. It may be necessary to raise magnesium up to .36% to .40% in the total ration dry matter by including magnesium oxide at a level of 0.25% in the total diet dry matter. This helps control rumen pH.
12. Check the functioning and operation of the bulk tank and the pipeline system. Ensure milk samples are being handled properly.

Table 1. Guide to ration composition for high-producing cows

	>81 pounds	61 to 80 pounds	<60 pounds
Crude protein, % dry matter	17-18	16-17	15-16
Soluble protein, % crude protein	30-34	32-36	32-38
Degradable protein, % crude protein	62-66	62-66	62-66
NFC, % dry matter	32-38	32-38	32-38
Fat, maximum, % dry matter[a]	5-7	4-6	4-5
Sulfur, % dry matter	.23-.24	.21-.23	.20-.21

[a] Fat at over 5% should be furnished by rumen-inert or bypass fats.

Table 2. Recommended guidelines on forage and fiber intakes

A. Fiber intake as a percent of the total ration dry matter

Production	Forage NDF	Total NDF
>81 pounds	21-27	28-32
61 to 80 pounds	25-32	33-37
<60 pounds	29-36	38-42

B. Fiber intake as a percent of bodyweight

Forage NDF	Total NDF
0.75%*-0.80%	1.3 to 1.4%
0.85%	1.1 to 1.2%
0.90% to 1.00%	1.1 to 1.2%

*Use 0.75% when forages are in short supply.

C. Forage dry matter intake as a percent of bodyweight

Minimum: 1.4%

Maximum: 2.4%

Table 3. Observed forage and TMR particle sizes using the Penn State Separator

	Upper sieve >0.75”	Middle sieve 0.31-0.75”	Bottom pan <0.31”
Corn silage[a]			
	2 to 4% if not sole forage	40 to 50%	40 to 50%
	10 to 15% if chopped and rolled		
Haylage[a]			
	10 to 15% in sealed silo	30 to 40%	40 to 50%
	15 to 25% bunker silo, wetter mixture		
TMR[a]			
	6 to 10% or more	30 to 50%	40 to 60%
	3 to 6% focus on TNDF and FNDF		

[a]Particle size distribution is based on 5,395 observations of corn silage, 6,165 observations of haycrop silage, and 831 observations of TMR.

Issued in furtherance of Cooperative Extension Work, Acts of Congress May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture and the Pennsylvania Legislature. T. R. Alter, Director of Cooperative Extension, The Pennsylvania State University.