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Why Butterfat Tests Vary

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Why do butterfat tests vary? The reasons are many—some traced back to the farm itself, others occurring at the bulk plant, and still others related to sampling and testing procedures. The purpose of this publication is to discuss the major causes of fat test variation and suggest ways of minimizing those that are controllable by the dairyman, the milk plant manager, the sampler and the tester.

HERD- AND FARM-RELATED CAUSES OF VARIATION

Breed and Cow Differences
The first reason for variation is simply due to breed differences. Average percent butterfat content in milk for the different breeds of cows are: Ayrshire, 4.0 percent; Brown Swiss, 4.2 percent; Guernsey, 4.9 percent; Holstein, 3.7 percent; and Jersey, 5.1 percent.

Within each breed, however, individual cows may vary considerably from these averages. For example, about one-sixth of the Holstein cows can be expected to test less than 3.3 percent, and one-sixth more than 4.1 percent.

Also, cows will usually test higher in the first month of lactation than in the second through fifth months. After that, they will increase gradually up to the end of lactation.

Ration Deficiencies
More and more, low tests are becoming associated with ration deficiencies, particularly insufficient crude fiber intake. Here are some reasons why:

- Length and coarseness of crude fiber in the ration are as important as the amount of fiber fed; thus, chopping forage or silage too fine may be causing the low test.
- Too much corn or other high-energy feed can reduce crude fiber levels below 17 percent of the total ration on a dry basis.
- Lush pasture is low in fiber and can lead to a lower fat test, even though pounds of milk increases.
- Pelleted grain mixtures, especially when fed in large amounts, probably do not contribute enough fiber to the total ration.
- Improper ration formulation also results in a low fat test on a herd basis.

Calendar Variations
Variations may also be seasonal and daily. For example, tests usually run slightly lower in summer and higher in winter. Day-to-day fluctuations of individual cows can be from 1 to nearly 2 percent.

Milking Practices
Poor milking practices can cause fat tests to vary because of incomplete milking. The first milk drawn from the udder may test as low as 1 percent, while strippings may test from 7 to 10 percent. Also, unequal milking intervals will usually cause cows to test higher after the short interval and lower after a long one.

Health Problems
Disease and poor herd health can greatly affect fat content. Mastitis generally results in lowered tests. Cows in heat may have very erratic fat tests.
PLANT-RELATED CAUSES OF VARIATION

Causes of fat test variations at the milk plant are usually related to either milk condition or the receiving operation.

Milk Condition

Accurate tests are based on representative samples. Abnormal conditions, such as being frozen, churned, soured or curdled, result in inaccurate samples. Such milk should not be sampled, and the producer should be notified promptly to initiate corrective measures.

Receiving Operation

Mishandling of samples during the receiving operation contributes to test variations. Proper handling means that the milk samples are: (1) refrigerated at a temperature between 35° and 50°F at all times, (2) removed from refrigerated storage only long enough for sampling (never over 1 hour), and (3) subjected only to very gentle handling.

Excessive agitation can cause churning, especially when milk is warm; whereas higher temperatures speed fat digestion by enzymes in the milk and growth of spoilage organisms.

Bulk Tank Sampling Procedure and Sample Care

- All sampling must be done by a licensed sampler.
- The milk is sampled only after at least 5 minutes agitation. If the bulk tank agitator is running, agitation should be continued for at least 5 minutes. (*Precaution: If there is indication that a bulk tank is not blending properly within 5 minutes, longer agitation is necessary. To determine adequacy of blend, duplicate samples should be taken at opposite ends of the tank at as nearly the same time as possible. Duplicate samples of properly blended bulk tank milk will test the same.)*
- The sanitized dipper is drained and rinsed at least twice with milk before sampling. Care should be exercised to avoid bacteriological contamination of the milk when transferring the sample to the sample container.
- At least two dips of milk are transferred to a plainly-marked container.
- The sample is placed in a refrigerated sample case at 50°F or lower during transit (32° to 40°F preferred).
- A load sample must be taken after all producer stops have been pumped into the truck. Where agitation is not available at the plant, the load sample is best taken after the last stop has been pumped into the truck.
- The sample dipper is rinsed after each use and stored in a solution containing 100-200 ppm chlorine.
- If composite samples are used, 10 ml of the fresh sample is transferred to the composite if pickup is daily, 20 ml if pickup is every other day.

Sampling Frequency and Sample Size

- Representative samples are to be taken from each delivery of milk after blending and before any milk is drawn from the tank.
- Sample size should not be less than 40 ml for plant-pay purposes. Dairy Herd Improvement (DHI) samples for individual cows should be about .1½ ounces.
- The sample dipper should be stainless steel and hold not more than one-half the quantity of milk required for a sample. Two or more dips to obtain a sample decreases the chance of sampling error.
- The sample container shall be of such size and design as to minimize churning and meet the requirements of the Indiana State Board of Health for plant-pay purposes or of the Indiana State Dairy Association for DHI samples. For the plant-pay test, the container should not be filled to the top, since this can interfere with mixing. For the DHI test, the 1½ ounce sample bag is closed so air is excluded to minimize churning.

Testing Procedure

The specific procedure for conducting the buttermilk test is detailed in the latest edition of Purdue University Station Circular 26, available from the Creamery License Division, Indiana Agricultural Experiment Station, Smith Hall, Purdue University, West Lafayette, IN 47907. However, these are the steps where procedural errors are most likely to occur and, thus, call for special attention:

- Properly blend the samples prior to pipetting.
- Sufficiently cool the milk in the test bottles prior to addition of acid.
- Use proper amounts of acid at the proper strength and temperature.
- Start agitation of samples immediately after adding the acid.
- Operate the centrifuge at proper speed and temperature.
- Insure adequate light for the test readings.
The accuracy of Indiana dairy plant testing is checked frequently by the Creamery License Division at Purdue. In 1978, about 99 percent of all tests checked agreed within 0.1 percent, and 88 percent agreed exactly.

Sampling procedure and testing accuracy are as important in insuring accurate results for DHI records as in evaluating bulk tank milk samples. Supervisors that continue to run Babcock tests must have adequate equipment and follow all procedures. Also, proper sampling, shipping containers, and transportation systems are necessary for samples sent to the Central Lab for testing.

COMPARISON OF DHI AND PLANT TEST RESULTS

The following comparison was made of plant-pay tests and Dairy Herd Improvement average tests on more than 4500 herds. (The difference is based on the reported monthly plant test being subtracted from the DHI test period pct. fat.)

<table>
<thead>
<tr>
<th>DHI Minus Plant</th>
<th>Percent of Herds</th>
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</thead>
<tbody>
<tr>
<td>-.4 or more</td>
<td>10.0%</td>
</tr>
<tr>
<td>-.3</td>
<td>8.3%</td>
</tr>
<tr>
<td>-.2</td>
<td>15.1%</td>
</tr>
<tr>
<td>-.1</td>
<td>18.3%</td>
</tr>
<tr>
<td>0</td>
<td>19.3% 73.4%</td>
</tr>
<tr>
<td>+.1</td>
<td>13.2%</td>
</tr>
<tr>
<td>+.2</td>
<td>7.5%</td>
</tr>
<tr>
<td>+.3</td>
<td>3.9%</td>
</tr>
<tr>
<td>+.4 or more</td>
<td>5.0%</td>
</tr>
</tbody>
</table>

The figures show that nearly 75 percent of the DHI test period pct. fat values were within ±0.2 of the reported plant-pay test values. The DHI test tended to be lower than the plant test. Based on this study, a variation of as much as ±0.3 between the test period fat test and the monthly plant test is normal. Here are some possible explanations for these test differences:

- DHI tests are based on a one-day or one-milking sample. Most dairy plants sample each delivery from a producer, which can be as often as every day or at least every third day.
- Cows in the late stages of lactation are turned dry shortly after test day; thus, their higher testing milk is reflected in the herd average but only partly in the dairy composite test. Conversely, cows just fresh are not tested by the tester until the seventh day, but could be included in the milk plant sample.
- Milk taken for home use affects the plant test but not the herd average test. The same would be true for calf-feeding milk.

Future Test for Protein

In the near future, a test for protein as well as for fat content in milk will help determine the cause for some observed variations between plant and DHI test results. Furthermore, protein testing will help change the focus in milk marketing and promotion to protein content—a much more nutritionally important part of milk!