Discussion

Mr. Arthur Mensch, Sauk City: I would like to ask Mr. Knudson, do you lift your whey?

Mr. Knudson: I lift it. I run the whey into a small tank on the ground and lift it from that tank.

Mr. Ubbelohde: I would like to ask if he has any difficulty about the farmers taking each other's whey?

Mr. Knudson: No sir. I have a hole in the bottom of the tank and a string goes down and the farmer places his wagon under the hole and pulls the string and the whey drops out.

Mr. H. L. Maumann, Plain: I would like to ask Mr. Knudson how often he cleans his tank.

Mr. Knudson: I have a steam pipe connected with my tank and it goes down at the outside, down within a foot of the bottom and there is an elbow there with a nipple, and as soon as I get up steam in the morning, I send it into that pipe and that whirls the whey and stirs whatever cream I have in the bottom, and another pipe that drains into it and I clean it out every morning and scrub it out with a brush every week.

Mr. Ubbelohde: Do you skim your whey?

Mr. Knudson: No, sir, I do not.

Mr. Peter Larson, Oconto Falls: Do you pasteurize your whey?

Mr. Knudson: Only turning on the steam in the morning I get about a temperature of 140; probably it varies some.

Prof. Farrington: Do not the patrons object to the steam in the whey?

Mr. Knudson: No, they have not.

Chairman: Do you know what advantage it would be holding the temperature at 140 for a couple of hours?

Mr. Burrowes: I think the whey would be sweeter and it would not get sour, because where you raise it with a jet pump it is not as it is when it runs into the tank. But I find where the whey is kept at the temperature of 140, the patrons were well satisfied with it and they also used the whey for feeding calves with good results.

SOME CAUSES OF VARIATIONS IN THE FACTORY TESTS OF MILK

Prof. E. H. Farrington, Madison

Those of us who have had a knowledge of milk testing ever since the Babcock test was first given to the public, remember that in the early days there was more or less suspicion that possibly the difference in the tests of milk reported to the patrons at a factory from one week or month to another, were due largely to the inaccuracies of the method. This suspicion, however, was soon quieted because a great many comparisons were made in the early days of the results obtained by using the Babcock test with those found by other well established methods which had been in use for many years for estimating the per cent of fat in dairy products. The accuracy or the method itself has been so well established that very little if any question on this point is raised at the present time. We still find, however, although this test is still used at many factories throughout the country as the basis of estimating the money value of the milk delivered to it by its patrons, that there are variations in the tests that are difficult to explain to some patrons.

I am going to take a few minutes to refresh your memories on some of the factors that are likely to cause a variation in the test of a patron's milk at a cheese factory.
Suppose we divide the question into two parts: first, the human side of it, and second, the cow side. That is to say we will discuss some of the causes of the variations in the test of milk that are due to the person taking the sample and making the test, and then those that may be the result of some condition of the cows producing the milk.

**Variations in Tests Due to Changes in the Milk**

1. I suppose you all know that there is a great difference in the disposition of cows. Some of them are easily excited while others are quiet and have a mild, easy going temperament, which is not disturbed by surrounding conditions. This difference in the dispositions of cows is often responsible for a difference in the test of the milk the cows produce.

The easily excitable cow will produce milk from day to day that varies a great deal in test, sometimes as much as 6.0 per cent. By looking over some work which I did at one time on this subject, I find that the test of a certain cow's milk on different days varied from 2.5 per cent fat one day to 7.9 per cent fat the next day, while another cow in the same herd gave milk the test of which did not vary on these two days more than from 3.5 per cent to 3.7 per cent fat.

This simple illustration of the effect of a cow's disposition on the test of her milk is a point which few farmers understand. They think that if the cows in a herd are being milked each day by the same person, at about the same time, morning and night, and if the cows are all out to pasture or in the stable and receiving the same kind of feed, the test of the milk of the different cows ought to be uniform from day to day.

2. The effects which the time of the milking period has on the test of a cow's milk is generally well understood. Most farmers bringing milk to a factory understand that when the cows are strippers the milk is richer than when the same cows are fresh. I think this influence on the test does not need much discussion. It is a fact, however, that the extent to which the test of the milk increases as the cows dry up in flow of milk, varies a great deal with different cows, and I have records which show that while the milk of one cow during the first month of her milking period tested 4.5 per cent fat it tested 6.4 per cent fat during the eleventh month of her milking period.

Another cow in the same herd gave milk during the first month of her milking period that tested 3.6 per cent and during the eleventh month of her milking period it tested only 4.1 per cent fat, showing a difference in the test of the milk between the beginning and the end of the milking period of nearly 2 per cent fat in the case of one cow and only one-half of one per cent in the case of another cow. This shows that while there is a difference in the richness of the milk between the beginning and the end of the milking period, it is not so great with some cows as it is with others.

3. Every one that milks cows knows that the last milk given at one milking or the strippings are richer than the first milk, and this being true the carefulness with which the different milkers strip the cows each day will have an effect on the richness of the milk sent to the factory; for on certain days more of the strippings will be included in the milk which comes to the factory than on other days and on this account there will be a variation in the test of that patron's milk.

4. The question is often asked whether or not the night's milk is richer than morning's milk. I have heard patrons at a factory discuss this question and there are always certain ones in favor of one side of the question while others claim the opposite.

Some careful comparisons on this point have been made and it has been found that the night's and morning's milk of a cow will usually test about the same per cent fat if there are a uniform number of hours between milkings, that is to say if the cows are milked at 6 o'clock at night and at 6 o'clock in the morning, the test of the milk will be about the same per cent fat insofar as this cause of a variation is concerned,
but in summer time when the days are long, many of the farmers are haying or working in the field so that milking is not done until 8 o'clock at night; under such conditions the night's milk is thinner or tests lower than the morning's milk because the farmer gets up at 4 o'clock in the morning and the first thing done is to milk the cows, this gives from 8 o'clock at night to 4 o'clock in the morning or only eight hours between these milkings; now if we subtract this time from twenty-four, it leaves sixteen hours as the time between the morning and the night's milking and because of the longer time the milk is thinner at night than in the morning.

It is, therefore, customary to obtain a richer milk in the morning than at night because there is a shorter time between milkings in one case than in the other.

5. It has been noticed that a change of milkers often has a great effect on the test of the milk given by certain cows. One of the many observations reported on this point shows that a good milker got 18 pounds of milk testing 4.2 per cent fat from a cow, and a poor milker got 12\frac{1}{2} pounds of milk testing 2.7 per cent fat from the same cow. Such striking differences as these are not common perhaps among good dairy herds, but it is possible that a change in milkers is sometimes responsible for the variation in the tests of a patron's milk noticed at the factory.

6. The importance of milking a cow dry is well understood by nearly everyone who has milked cows for any length of time. It has been demonstrated that by the act of milking, the milk glands are stimulated to their maximum secretion of milk. If the process of milking is slighted the glands will become less active and the cow will dry up.

The difference between milking a cow dry and slighting the milking is illustrated by an observation which showed that a certain cow gave 71 pounds of milk at six milkings when she was milked dry each time, but that from the following six milkings only 44 pounds of milk were obtained when she was half milked at five of the last six milkings. This is a loss of over thirty per cent in one week, due to the failure of the milker to milk the cows dry.

Many other illustrations of the effects of certain conditions, such as a change of stable, cold weather, change in time of milking, sickness of the cows, etc., could be given to show the influence which the cow and her treatment have on the variation of the test of the milk delivered to the factory by a patron.

These factors should be kept in mind when the factory operator is discussing this question with his patrons and if they are presented in such a way as to appeal to him as reasonable, he will undoubtedly feel that he and not the cows are somewhat responsible for the variations in the test of the milk he delivers to the factory.

Variations in tests due to person doing the testing

Coming now to the human side of this question, I wish to mention a few causes of a variation in tests for which the men handling the milk are responsible.

I have heard some factory operators make, what seemed to me, marvelous statements about their ability to test milk and cream and make the results check up exactly with the figures that ought to be obtained, and while I have no evidence that leads me to doubt the accuracy of their statement or their work, I am inclined to think that from the very nature of the case there is bound to be some variation in the test of the milk and cream due to certain causes for which neither a cow nor a patron is responsible.

1. The first of these factors which I wish to mention is taking the sample, and while this is a threadbare subject discussed for many years, I am going to give some evidence collected at the dairy school this winter on this particular point.
It so happens that part of our milk supply for the cheese room this winter has been obtained from a factory in the country and shipped to us by rail. The owner of the factory has weighed and tested milk for many years and I think he is even more careful and more accurate than the average factory operator. I have made a few comparisons of his records at the factory with ours obtained at the dairy school on the same lots of milk shipped each day, and I get the following figures:

Comparison of Weights and Tests of Milk as made by the Buyer and by the Seller

<table>
<thead>
<tr>
<th>November</th>
<th>4</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>18</th>
<th>19</th>
<th>20</th>
<th>25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seller, Milk lbs.</td>
<td>500</td>
<td>1020</td>
<td>680</td>
<td>1003</td>
<td>1026</td>
<td>680</td>
<td>1085</td>
<td>1000</td>
</tr>
<tr>
<td>Buyer, Milk lbs.</td>
<td>498</td>
<td>1018</td>
<td>680</td>
<td>1001</td>
<td>1024</td>
<td>677</td>
<td>1082</td>
<td>1007</td>
</tr>
<tr>
<td>Seller, Milk test</td>
<td>3.6</td>
<td>4.1</td>
<td>3.7</td>
<td>3.9</td>
<td>4.5</td>
<td>3.6</td>
<td>4.2</td>
<td>3.7</td>
</tr>
<tr>
<td>Buyer, Milk test</td>
<td>3.6</td>
<td>4.4</td>
<td>4.0</td>
<td>4.0</td>
<td>4.4</td>
<td>3.6</td>
<td>4.3</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Now these figures, to my mind, represent about as close an agreement as can be expected under such circumstances. The samples of milk were taken at the factory in the country by dipping a small quantity of milk from each can and making a composite sample of these portions. The sample of the same milk when delivered at the dairy school was taken from the weighing-can into which the ten gallon cans of milk were emptied each day.

You will notice that there is a difference of several pounds in weight of the milk and that the tests of the same lots of milk at the two places is seldom the same figures; there being differences sometimes of .3 per cent between the dairy school test and the factory test.

I do not present these figures as a guide for anyone to follow in the future, but simply as evidence of the agreements in weights and tests that can be expected under such circumstances. It is possible that some patrons may think that such variations are evidences of inaccuracy of the method of testing or carelessness of the operator and that the test of the same lot of milk ought to be the same figures every time, but I think those of you who have had experience in this kind of work will agree with me that there is a certain amount of variation in the test that is inevitable and must be expected. An exact agreement of tests from the same lot of milk is more an accident than a certainty.

I hardly think it is worth while to discuss the reasons for this, but thought perhaps these figures might be of some help to a factory operator in discussing this question with some of his patrons.

2. There is only one more cause of the variations in the test of milk that I will take time to discuss and that is the carelessness of the operator who is taking the sample and making the test. This may be illustrated by a laboratory exercise which I suggested to our milk testing instructor at the dairy school this winter. We first examined all the different testing machines in the laboratory and placed them in first-class condition. We then had all the milk test bottles and milk measuring pipettes examined by the sealer of weights and measures so that we could supply each of the dairy students with accurate glassware as well as a satisfactory testing machine. We then placed a pail of milk at each one of the three desks in the laboratory and asked the students to report on the per cent of fat found by them in this milk. Each pail of milk was filled from the same can which had been carefully mixed by pouring, and although the students were not informed of this fact, they were supposed to know that it is always necessary to carefully mix any lot of milk before measuring a sample of it into a test bottle.
The results obtained the first time this section of forty students was in the laboratory are given in the following table, together with the results reported by another section of students after they had been instructed to carefully mix milk before testing it.

### Results obtained by different persons testing the same samples of milk

<table>
<thead>
<tr>
<th>Students</th>
<th>First Trial</th>
<th>3</th>
<th>3</th>
<th>8</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test of milk</td>
<td>4.0</td>
<td>3.9</td>
<td>3.8</td>
<td>3.7</td>
<td>3.5</td>
<td>3.3</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Students</td>
<td>Second Trial</td>
<td>1</td>
<td>3</td>
<td>38</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test of Milk</td>
<td>4.0</td>
<td>3.9</td>
<td>3.8</td>
<td>3.6</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

These figures show a greater variation in the first trial than one would naturally expect, but they illustrate the fact that it is necessary to carefully mix a sample of milk before testing it and that failing to do this will give a great variation in results obtained from the same sample.

After the milk testing instructor had reported these figures to me, I suggested that he try and impress on the class the necessity of greater care in taking a sample without telling them of the experiment which we were trying on them. He did this, and the next time the students were given this exercise the results given in the second trial were obtained.

These results show that forty men may test the same lot of milk and get approximately the same figures but in order to do this they must take notice of the necessity of thoroughly mixing the milk before measuring it into the test bottle.

The Babcock test is a simple method of estimating the richness of milk and it ought to be used in every cheese factory in the state but the figures obtained by it may be disappointing to some parties, first because of carelessness of the operator and second because the cows are responsible for some changes in the milk that are not always remembered.

### Discussion

Mr. H. White, Milwaukee: Does it make any difference if the sample is frozen?

Prof. Farrington: I don't think it does, if the sample is thoroughly mixed after it is thawed out. It is true, as you doubtless know, that it is necessary to have the ice, when milk freezes—the milk ice contains a certain amount of fat and the amount of fat in that milk ice is influenced by the amount of ice. For instance, if we have some milk that is only frozen, even a little, and we say that milk contains two per cent of ice and we take that milk ice out of the can and melt that and test it, that milk ice does not contain nearly so much fat as the milk ice in which the ice is a very much larger proportion. For instance, suppose we had milk and it froze, twenty-five per cent of the milk was ice. We take that ice out and melt it and there will be more fat in that than there was in the other, so the larger the per cent of ice in the milk, the more fat in the ice when it is melted. But, of course, you will know in testing a sample of frozen milk you want to melt the ice and mix that with the liquid part of the milk. It is true, of course, sometimes when the milk freezes with all the mixing you give it, some globules of fat separate and it is a little harder to get a more satisfactory sample, but freezing of the milk does not destroy any of the fat any more than the souring of the milk.
I know that is a question we are often asked, whether the souring of the milk eats the fat. I even get letters from people in the state and they ask, "Will sour cream give the same test as sweet cream?" Some people have an idea that souring of the cream makes it necessary to be more careful in pouring the milk and then to fill the pipette after it is mixed.

Mr. Larson: Is there any difference between the milk that comes from the cow and the milk two weeks old?

Prof. Farrington: One time I took twelve milk test bottles and I took one sample of sweet milk and filled the pipette and measured the same pipette full of milk into those bottles. Two of those bottles I tested at once and wrote down the tickets. The other ten I sat on the shelf in the cupboard and I took two of those bottles down every two weeks and tested them. Now the last two weeks, of course, that milk was about six weeks old and the milk had all turned brown and sour, but it was all in the test bottle. It was not a sample in a jar. I took that oldest bottle down, added acid, and went through the motions, and I got absolutely the same figure as I did the first time. That is what we expected to get, but that simply demonstrates that the standing or the changing or souring or moulding or rotting of that milk did not destroy the fat which was all there, even though it was old, and we got the same per cent of fat we did when the milk was fresh. But the reason why you often get a different test of very old milk, is because you have not got the sample in your test bottle, you have got the sample in a jar and you are not so careful in sampling it. It is not possible to take so fair a sample of that old milk as it is of fresh milk. I guess the reason why you don’t get quite the same result you did when your milk was sweet is because it is such a difficult operation, but it is due more to the inconvenience and not getting a fair sample, than it is to the age of the milk that the fat is destroyed.

Mr. J. Roach, Zumbrota, Minn.: I find that is where our biggest trouble is. Our patrons who are going to test will take, say, the night’s milk. They will get a sample of this milk and the same way in the morning. They have got a nice sample, and during the night they may raise cream and it will be stirred up a little in the morning. He cannot get the chance to get this sample the way the sample is taken at the farm, and it is our difficulty to convince the farmer that we are testing the same as he does. I would think if the state in their bulletins would impress this more so that the farmers could read it, it would help the cheese maker a good deal.

Prof. Farrington: That is a good deal to impress upon the farmer. The farmer takes a sample from the bottle at the farm and then when he brings that to the factory he has some difficulty in mixing that cream with the milk. One thing that would help you, first warm that milk up a little to about blood heat, and second, if that seems to have any cream globules in it, pour that through a very small sieve and that will help to mix it up so you can get a very fair sample. Perhaps some of you are aware of the fact that in the last year or two, individuals have been sending milk to us to have it tested. We immediately send blanks to the person who sent the sample and ask him to fill out this blank. This blank reads to the effect that all parties interested in this sample of milk were present when the sample was taken. We had to do that for our own protection, because sometimes a man would be testing a skim milk from a separator, and he would not go to the cheese maker, but he would take and send the sample that would give a very erroneous opinion when he tested it. If a person is really interested in finding out what the milk tested, he ought to be perfectly willing to have the farmer as well as the factory man present. Under these circumstances I think you will find that the tests all agree, but not absolutely. Maybe a variation of 3-10, but we like to have the least.

Mr. Joseph Schmuttfrantz, Madison: I would like to ask what is the best form of bottle and stopper to keep the sample in?
Prof. Farrington: A good many differ in opinion, but I think these wide mouth glass stopper bottles are very good. The Mason fruit jars are very satisfactory, but we are using the wide mouth glass stopper bottle. It is very clean and the stopper is easily cleaned. It is not a good plan to use a bottle with a cork stopper, because the milk sticks to the cork badly.

**HOW I MAKE MY PRIZE CHEESE**

Edward Termaat, Plymouth

While I do not believe that my method of making cheese is much different from that of anyone else, yet I have been quite successful in winning a good many prizes.

In the first place, I think I am fortunate in having a good bunch of patrons, who not only take an interest in producing and caring for good milk, but who are also interested in seeing me win prizes whenever I do. I need not tell you that none of us can make a first-class cheese, or a high scoring cheese, unless we have the cooperation of every one of the patrons who furnish the milk. In order to get this cooperation it is necessary for us to instruct our patrons in the best way of caring for their milk. I must say that, in taking credit for myself for having produced quite a number of prize cheese, I must also give credit to my patrons for the care they take of their milk.

Another thing, we must exhibit our cheese and enter into competition with one another to find out whether we can make prize cheese or not, and I have never hesitated to exhibit cheese at the different conventions and state fairs throughout the country. In this way I have entered into competition with my fellow cheese makers, and have secured quite a number of mighty good scores. My advice to each and every one of you is that you exhibit cheese whenever the opportunity presents itself.

My plan of making cheese is as follows: I receive my first milk about 6:30 A. M. and as soon as I have about 1,500 pounds of milk in the vat I add twenty-five to thirty pounds of pure culture starter—this for 4,000 pounds of milk. By 7:45 A. M. I have all my milk received, and by eight o'clock I have the temperature raised to 85° F. As soon as the milk has reached an acidity of 19–100 per cent I add my rennet at the rate of three ounces to the thousand pounds of milk, using one ounce of color to the thousand pounds of milk. My vat is then ready to cut in about thirty minutes, or about 8:30 in the morning. At the time of year in which I am speaking I was cutting my curd four times—once with the horizontal and three times with the perpendicular knives, so that I was really cutting it fine. I then started stirring my curd, slowly, handling it with as much care as possible, and in the twenty-five minutes after heating it to a temperature of 102° F. I then keep it well stirred in the whey until it shows about 14–100 per cent of acid, or ½ inch thread on the hot iron. Usually this takes two hours from the time it is set until it is dipped. After the whey is drawn off I throw the curd back on the racks from six to eight inches deep, cut it in strips about eight inches wide and turn it every fifteen minutes until I have it piled from five to six layers high. In about an hour the curd has about 4–10 per cent of acidity and is then ready for grinding. After grinding the curd is washed with from five to six pails of water at a temperature of 105° F. and I work this through about three times, then pile my curd on both sides of the vat and allow it to drain. After it has drained the curd is forked over and salted with three pounds of salt to the thousand pounds of milk and well worked up with the fork four or five times and left for about fifteen minutes, when I can fork it through and put it in the hoops. In about half an hour I loosen the press and dress the cheese. I use a self-pressure cheese press and take my cheese out in the morning and put them in the curing room. I hold them three days, paraffine them,