Milk Testing: A Suggest Team Demonstration for Dairy Club Members

W.F. Kumlien

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MILK TESTING

(A Suggestive Team Demonstration for Dairy Club Members)

Prepared by
Dairy Specialist

EXTENSION SERVICE

The Milk Testing Demonstration is one of the dairy demonstrations to which reference is made in the State Fair Club Premium List.

The Object of the Demonstration is to impress upon people, especially farm folks, the advantage of knowing the production of each cow, and the comparative simplicity with which such information may be obtained. Another object is to give members of the team practice in the use of the Babcock Test and an opportunity to show people what they have learned from club work.

The Team is made up of two or three members duly enrolled in a club project relating to dairying. Each member should be able to run the test alone and thus correct any slight omissions on the part of his teammates.

Equipment needed is as follows:

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table</td>
<td>4 pails</td>
</tr>
<tr>
<td>4 pails containing whole milk</td>
<td></td>
</tr>
<tr>
<td>Stirring rod</td>
<td></td>
</tr>
<tr>
<td>4 sample jars</td>
<td></td>
</tr>
<tr>
<td>Clean cloths or towels</td>
<td></td>
</tr>
<tr>
<td>Corrosive sublimate tablets</td>
<td></td>
</tr>
<tr>
<td>Milk scales</td>
<td></td>
</tr>
<tr>
<td>Milk sheet</td>
<td></td>
</tr>
<tr>
<td>4 milk test bottles</td>
<td></td>
</tr>
<tr>
<td>Acid measure (17.5)</td>
<td></td>
</tr>
<tr>
<td>Pipette (17.6)</td>
<td></td>
</tr>
<tr>
<td>Centrifuge</td>
<td></td>
</tr>
<tr>
<td>Watch</td>
<td></td>
</tr>
<tr>
<td>Hot water</td>
<td></td>
</tr>
<tr>
<td>Thermometer</td>
<td></td>
</tr>
<tr>
<td>Dividers</td>
<td></td>
</tr>
<tr>
<td>Pencil</td>
<td></td>
</tr>
<tr>
<td>Blackboard</td>
<td></td>
</tr>
<tr>
<td>Chalk</td>
<td></td>
</tr>
<tr>
<td>Waste jar</td>
<td></td>
</tr>
</tbody>
</table>

The Uniform may be selected by the leader and demonstrators. Demonstrators of the team should be dressed alike in some attractive, neat appearing clothes.

Time Required for This Demonstration is about thirty minutes. It will require at least twenty-five minutes to run the test properly and should not be allowed to last for more than forty minutes.

A Suitable Place should be secured which provides comfort and convenience for demonstrators and spectators. If the demonstration is held outside, seek a sheltered place for the stove or else heat the water inside. If held inside have plenty of light and avoid having other attractions in the same room at the same time.

This Outline was designed to serve as a sample demonstration. It is not to be inferred that each demonstrator is to do and say exactly the things here given. If it serves as a working plan, about which you can build your own demonstration from the material at hand, its purpose will have been fulfilled. Vary it. Add to it. There is ample opportunity for individuality on the part of club leaders and demonstrators.
SUGGESTED PROCEDURE FOR MILK TESTING DEMONSTRATION

This demonstration outline has been prepared for the use of local club leaders and county agents in order that they might have a suggestive plan to follow in the training of a milk testing demonstration team. Subject matter of this demonstration is given in detail. The only sure method for the success of the demonstration is for the demonstrators to learn their talks similar to but not necessarily identical with the following. If they can give the subject matter correctly in their own words that method will prove most satisfactory.

Demonstrator No. 1 (Team Captain):

We who are dairy club members of________ County have become greatly interested in the testing of milk for butterfat and it gives us great pleasure to appear before you to demonstrate some of the things which we have learned from club work.

I wish to introduce ourselves, Demonstrator No. 2, ___________of__________, Demonstrator No 3, ___________of__________, and myself, Demonstrator No. 1, ___________of__________

We will demonstrate to you this afternoon the operation of the Babcock Test for butterfat explaining each step in detail and giving you the results as best we can. The Babcock Test was originated by Doctor Steven M. Babcock of the University of Wisconsin about 1890. The first testing outfit was of very crude construction but did the work. It was first used in creameries and cheese factories as a basis for making payment on milk and cream. Since that time the use of the Babcock Test has become almost universal throughout the civilized world.

The use of this test which we expect to emphasize at this time is the use made of it on dairy farms for determining the butterfat production of individual cows in the herd. By means of the Babcock Test, dairying has been raised from the status of a haphazard industry to an exact and attractive business enterprise. The Babcock Test has been largely responsible for the development of high-producing dairy cows and a resultant increase in dairy profits.
The operation of the Babcock Test is not so complicated as most people commonly suppose. With a little study and practice the test can be mastered by any one in a comparatively short time. We will take up the details of this test step by step and attempt to prove two important points, first, the comparative simplicity of the test and, second, its great value in distinguishing between good and poor cows and thus increasing the profits from dairying.

Demonstrator No. 2 arranges all equipment during the foregoing introductory talk. There should be two, three or four pails containing milk, preferably a pail of milk from each cow. The milk should be weighed and the weight recorded on the milk sheet. As soon as weighed the sample should be taken, Demonstrator No. 1 preforming these tasks while Demonstrator No. 2 explains.

Demonstrator No. 2:

In order to arrive at a knowledge of the production of individual cows, it is necessary to know two things. First, the amount of milk which each cow gives, and second, the average percent of butterfat which the milk of each cow contains. It requires but little time to weigh the milk from each cow and record it on a milk sheet posted conveniently in the barn.

At regular intervals samples should be taken of the milk of each cow. There are certain principles to be observed in taking these samples. First of all the cow should be milked dry and all of her milk thoroughly mixed, either by pouring from one pail to another or by vigorously stirring with a long handled dipper or a stirring rod. Unless this is done the butterfat will not be evenly distributed throughout the milk.

In order to arrive at the average test of a cow's milk, it is necessary to take samples from more than one milking. We consider that if samples are taken from four milkings, that is, two consecutive days, that the average test of these four milkings will very nearly represent the average test of that cow for the month. In doing this we would fill the sample jar one-fourth full from each milking.

Samples must be kept in covered jars and if they are to be kept longer than one day, should have a tablet of corrosive sublimate placed in them. These tablets are deadly poison and are colored pink in order that no
one will use this milk by mistake. This corrosive sub.
climate has no effect on the test but keeps the milk sweet
so that it may be tested satisfactorily.

We have here some milk test bottles. There
are other bottles made for the testing of milk, skim milk,
cream and butter. The scale of these bottles reads
from zero to eight percent.

To begin with, we measure out a definite
amount of milk, 17.6 cubic centimeters. After thoroughly
mixing the milk in the sample jar, milk is drawn up into
the pipette and the forefinger placed over the end of
the pipette. Allow the milk to run out gradually until
the top of the milk reaches the line etched on the pipette.
This measures exactly 17.6 cubic centimeters and this
amount is transferred to the milk test bottle being care-
ful that none is spilled on the outside.

If is very important that proper amount of
milk be placed in the bottles. Any variation, however
slight, would have its effect on the final reading.

Our next step is the addition of sulphuric
acid. We measure the strength of sulphuric acid by its
weight in comparison with water. The right strength of
acid to use is 1.83 times as heavy as water. Care should
be taken that this fluid does not come in contact with
articles of clothing or the flesh as it burns severely.

This acid measure has a line etched on it.
When filled to this line it contains 17.5 cubic centi-
eters, the correct amount of acid to use. If more than
this amount is used it will cause burning of the milk
and butterfat. If too little is used it will result in
undissolved curd and a faulty test. The purpose of this
acid is to dissolve the curd or casein and completely
liberate the butterfat in order that it may rise to the
surface.

You will notice that the acid is much
heavier than the milk. The contents of the bottle are
thoroughly mixed by means of a rotary motion taking great
care that no particles of milk are allowed to come up in-
to the neck of the bottle. The bottle should be rotated
until the contents assume a dark brown color throughout
with no particles of white. This mixing process develops
a great amount of heat.

It is sometimes interesting to allow a few
people in the audience to feel these bottles and testify as to
the amount of heat generated in them.
Demonstrator No. 1:

We have here a centrifuge. This is the machine that is commonly referred to as the Babcock Tester although strictly speaking it not only includes the centrifuge but also the glassware. The bottles are placed in these pockets and whirled for 5 minutes. This whirling motion acts very much as the bowl of a separator in the separation of cream. There is great pressure within the bottles and the butterfat rises to the top, the heavier contents being thrown toward the bottom. When in full motion there is a pressure of about 35 pounds per square inch on these bottles.

There are several different types of testers. First, there are the open and closed types. The closed type is much safer to use in that it prevents interference with the bottles while in motion and it also prevents the scattering of glass and acid if a bottle should be broken. The open type of tester is of advantage in that it is easily transported from place to place.

Different kinds of power are used in the operation of the centrifuge. When there is only a small amount of testing to be done the machine is turned by hand. Power is used where more testing is to be done. The centrifuge is frequently run by an electric motor or a steam turbine. These have the advantage of furnishing steady power and the steam turbine has the added advantage of keeping the chamber hot. In any tester there ought to be a steam jet to keep the temperature up to the right point. The test is always more satisfactory when it is kept hot.

After whirling the bottles for 5 minutes we will add water to them. For best results the water should be rain water or condensed steam. It should also be hot, at least 140 degrees Fahrenheit. Great trouble often arises from the use of hard water. Minerals in this water when combined with the sulphuric acid, often cause a precipitation or cloudiness which interferes with the accuracy of the test especially in the reading. Nothing but soft water should be used.

Demonstrator No. 2:

Water is added up to the bottom of the neck of the bottle. It makes no difference whether water is added from a pipette or an acid measure or a rubber tube so long as there is no milk or acid in these utensils. The butterfat can now be seen gathering at the base of the neck and it can readily be seen that the amounts of butterfat in the bottles vary considerably. Later on we shall add water sufficient to bring the butterfat column completely into the neck of the bottle. The reason for
not bringing the butterfat too high at this time is that particles of the butterfat might adhere to the sides of the test bottle if the butterfat was forced upward. We will now whirl the bottles for an additional 2 minutes in order to bring all of the butterfat up to the base of the neck.

Demonstrator No. 1:

The question might be asked why we have been particular to watch the temperature of the water used. You all know that when anything becomes hot it expands. These test bottles have been made so that they read correctly when the contents are at a temperature of 130 to 140 degrees Fahrenheit. If the temperature is any higher than that the reading will be too high. If the temperature is any lower than that the reading will be too low and the butterfat column might be broken and have a greasy appearance. If the temperature is between 130 and 140 degrees the butterfat will have a clear golden appearance, will be completely melted and will have just the right expansion for correct reading.

You see that the bottles are whirled three times, the first time for 5 minutes, the second time for 2 minutes and the third time for 1 minute. They are whirled the first time in order that all of the butterfat may be brought to the top. They are whirled the second time in order that the butterfat may be gathered into a smaller area and they are whirled the third time in order that the butterfat may be formed into a column within the graduated part of the neck.

There are several things which might result in a poor test. If too much acid is added the butterfat will have a burnt or charred appearance which will interfere seriously with the reading. On the other hand if too little acid is added, some undissolved curd will remain which will prove equally troublesome. If the centrifuge is turned too slow some particles of butterfat might escape being brought to the top. If the glassware has not been properly graduated by the makers, the reading will be faulty. If the bottles are kept too hot, the reading will be too high. If they are allowed to become too cool, the reading will be too low. Thus there are many things which might result in a poor test.

The testing of milk is somewhat different from the testing of cream. Cream is thicker and sticks to the utensils and therefore must be weighed into the test bottle. Water must usually be added to cream before whirling for the first time in order to stop the action of the acid. If it is necessary to whirl cream only twice, the first time for 4 minutes and the second time for 2 minutes. Add water between the whirling sufficient to bring the column of butterfat up into the neck.
After these bottles have been tempered at from 130 to 140 degrees for a few minutes we shall read the test. Here on the blackboard I have drawn the diagram of a form for keeping records of production for a dairy cow. We have here the amount of milk production in four consecutive milkings, the samples of milk which we tested. We call this a composite test on the basis of production for two days. We have calculated the production of each cow for one month. As soon as the tests are read we will be able to calculate the amount of butterfat production during the month.

Demonstrator No. 2:

The bottles are now at a temperature of degrees Fahrenheit and are ready for reading. For that purpose we use a pair of dividers placing one point at the extreme bottom of the column and the other point at the extreme top as illustrated here on the blackboard. Leaving the two points at that distance apart we will place one of them on zero and allow the other to show where it will. Whatever it shows is the correct reading of butterfat for that sample.

While Demonstrator No. 2 is explaining the taking of the readings Demonstrator No. 1 should be illustrating on the blackboard the appearance of the neck of the bottle and the column of butterfat and pointing out the places mentioned by Demonstrator No. 2.

Demonstrator No. 2:

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Tests</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
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<td>Percent</td>
</tr>
<tr>
<td>Sample No.</td>
<td>Tests</td>
<td>Percent</td>
</tr>
</tbody>
</table>

Demonstrator No. 1:

We now have the two factors mentioned at the beginning of the demonstration as necessary in order to know the production of a cow. First the amount of milk produced by each cow and second the average test of her milk. Multiplying these two numbers we are able to calculate very closely the butterfat production for the month.

At this point Demonstrator No. 1 will multiply these amounts on the blackboard and enter the product in last column.
Demonstrator No. 1:

We now see the very great difference which exists between the cows. Cow No. ___ has produced in one month about (1, 2, 3, 4, etc) times as much butterfat as cow No. ___. Of course this is not an absolute indication of the production of these cows for an entire year. In order to secure such figures it is necessary to conduct a test like this at least once a month. The test as we have made it here applies only to the one month which we have recorded. Twelve tests similar to this one and we would cease guessing at the production of our cows. We would know what they are producing.

Friends, we have attempted to point out two striking things in regard to the testing of dairy cows. First, the simplicity with which the test may be conducted and records kept, and second, the great benefits resulting from continued testing. If our demonstration has given rise to questions in the mind of any one, we shall do all we can to clear up these questions.

The captain of the team should repeat any questions asked and either answer them himself or call upon his teammate to do so.

Demonstrator No. 1:

Are there any further questions? If not, we thank you for your kind attention.

THINGS TO REMEMBER

1. Train! Train! Train!
2. Call on State Leaders for information and assistance whenever necessary.
3. Give as many public demonstrations locally as is possible.
4. Limit the length of demonstration to not more than 40 minutes.
5. Every member of team should always be working and one should always be talking.
6. Have something interesting in opening and closing. Make demonstration "brisk".
7. Plan every step carefully.
8. Avoid bluffing.
9. Face your audience throughout the demonstration; let them see what you are doing.
10. Be careful to avoid grammatical errors.
11. Avoid argument. Be as diplomatic as possible.
12. Be dignified and courteous.
13. Emphasize club work done in your county. Tell some of your club's interesting experiences.
14. Repeat questions asked so that every one in the room may hear them.
15. Summarize at the end.
### Chart I

**Monthly Production of Milk and Butterfat (Before Testing)**

<table>
<thead>
<tr>
<th>Name or Cow</th>
<th>Weight of Milkings</th>
<th>Total Milkings</th>
<th>Total Percent for Butterfat</th>
<th>Total for Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Cow:First:Second:Third:Fourth: Milkings: Month</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>7.0 : 8.0 : 7.5 : 7.5</td>
<td>30.0</td>
<td>450</td>
<td>4.1</td>
</tr>
<tr>
<td>2</td>
<td>10.5 : 11.5 : 11.2 : 10.8</td>
<td>44.0</td>
<td>660</td>
<td>3.6</td>
</tr>
<tr>
<td>3</td>
<td>5.8 : 6.0 : 6.2 : 6.0</td>
<td>24.0</td>
<td>360</td>
<td>4.3</td>
</tr>
<tr>
<td>4</td>
<td>14.5 : 16.0 : 14.2 : 15.3</td>
<td>60.0</td>
<td>900</td>
<td>3.9</td>
</tr>
</tbody>
</table>

### Chart II

**Monthly Production of Milk and Butterfat (After Testing)**

<table>
<thead>
<tr>
<th>Name or Cow</th>
<th>Weight of Milkings</th>
<th>Total Milkings</th>
<th>Total Percent for Butterfat</th>
<th>Total for Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Cow: First:Second:Third:Fourth: Milkings: Month</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
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<td>1</td>
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<td>900</td>
<td>3.9</td>
</tr>
</tbody>
</table>
QUESTIONS AND ANSWERS

Why must the test bottles be kept hot?

In order that the acid may complete the action on the curd. When the reading is being taken, the bottles must be kept hot because they are made to read at a temperature of 130 to 140 degrees Fahrenheit. It is also necessary that they be kept hot so that the butterfat will remain in a molten condition.

What is the difference between testing milk and testing cream?

The main difference is that milk is taken by measure and cream is taken by weight. We use 17.6 cubic centimeters of milk which equal 18 grams by weight. Cream cannot be measured accurately because it varies in thickness and a great deal of it is sure to stick to the pipette. Another difference is that cream requires less centrifuging. There is more butterfat and less curd in proportion so that butterfat is more easily brought to the top.

Does rich feed cause a cow's milk to test higher?

Feed has practically no effect upon the test of the cow's milk except in special cases and then only temporarily. The amount of butterfat may be increased by proper feeding but this is done by increasing the flow of milk rather than the percent of butterfat. The test of a cow's milk will vary considerably some times from day to day, but it is due to conditions over which there is no control. A change in the weather, a shortage of water or a change of feed will all have their effect on the test but it causes a decrease just as often as it causes an increase.

Why must the bottles be whirled three times instead of only once?

Milk test bottles must be whirled three times because the butterfat must be brought up into the neck a step at a time. Furthermore, the addition of water before the first whirl would interfere seriously with the complete action of the acid.

What is the purpose of adding acid in the test?

The purpose of the acid is to dissolve the curd or casein and thus liberate the butterfat in order that it may rise to the top in a free condition.

Why does our cream buyer whirl the bottles only once or twice instead of three times as you did?

The test which we have run is for milk. Your cream buyer was testing cream of course. Cream requires only two whirls, milk always requires three. It is more difficult to separate the butterfat from milk than it is from cream.
Is it practical for a farmer to attempt this testing himself?

Many farmers are testing their herds and find it is a very profitable practice. The small amount of work which it requires is more than repaid in the form of cream checks and better cows. The test is not so complicated but what any farmer can operate it if he will only take the time to do so. Yes, it is practical and many farmers are following it up.

How often should a cow be tested in order to get an accurate calculation of her production?

A cow should be tested at least once a month in order to secure accurate results. If it is possible and convenient to test oftener it will be that much better.

Does a cow’s test vary from milking to milking?

Yes, a cow’s test will vary some times very greatly from one milking to the next. These variations may be caused by sudden changes in the diet, the weather, the water or treatment. A cow given good care and uniform feed will vary less than a cow not so treated.

Does a cow’s test vary according to the stage in the lactation period?

Yes, the test will vary from month to month according to the length of time from freshening. When a cow is fresh she will usually test high for two or three weeks. Then comes a period of two or three months of slightly lower testing but higher milk production. After the third or fourth month there is a gradual decrease in the amount of milk and a gradual increase in the percent of butterfat. A cow usually tests highest just before going dry.

Is it all right to draw a few streams from a cow to use as a sample for testing?

No, such a method would not be satisfactory. In order to secure a fair sample, the cow should be milked dry and all of her milk thoroughly mixed. The sample should be taken immediately after this mixing. The first milk which a cow gives is very poor in butterfat. The strippings are very rich in butterfat. It is not uncommon for the last few streams of milk to test as high as 10 percent.

How high must a cow test in order to be profitable?

The value of a cow does not depend upon the percent of butterfat which her milk contains. It depends upon the amount of butterfat which she produces. A cow may test as low as 3 percent and yet be a good cow. On the other hand she may test as high as 6 percent and yet be a poor cow. We must consider not only the percent of butterfat but also the amount of milk produced. A good cow will produce 200 pounds of butterfat or
more in one year.

What breed of cows test the highest?

As a rule Jerseys test the highest.

Which is the best breed of cows to keep?

Your question is somewhat like asking which make of automobile is the best. Nearly everyone has different ideas in regard to the breed of dairy cows to keep. The breed you like best and which you can find satisfaction in keeping is the best for you. There are good and poor cows in all breeds. There is more importance attached to the selection of individual cows than in the selection of a breed.

Where can a Babcock Test be bought?

Most creamery supply houses keep these testers in stock. If the local dealer does not have them in stock, the nearest places to secure them are Kennedy, Parsons Company, Sioux City, Iowa; J. G. Cherry Company, St. Paul, Minnesota; and the Creamery Package Manufacturing Company, Minneapolis, Minnesota.

What does these outfits cost?

The open type 4-bottle tester complete with glassware but without a case for it, costs from $6 to $8 and a closed type 8 or 12-bottle tester complete with glassware costs from $18 to $20.

How many boys does it require to form a milk testing club?

It requires 5 members to form a standard club.

Who may belong?

Any boy between the age of 10 and 18 who will keep records of production on from 5 to 20 cows and who will live up to the rules and regulations of the club.

What is a cow testing association?

It is an organization of 26 farmers employing a man to spend one day a month at the farm of each member and weigh and test the milk of each cow to determine her production.
Skill

<table>
<thead>
<tr>
<th>Ease of procedure</th>
<th>15</th>
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</thead>
<tbody>
<tr>
<td>Speed</td>
<td>15</td>
</tr>
</tbody>
</table>

Subject Matter

<table>
<thead>
<tr>
<th>Accuracy</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completeness</td>
<td>10</td>
</tr>
<tr>
<td>Presentation</td>
<td>10</td>
</tr>
<tr>
<td>Clearness, conciseness</td>
<td></td>
</tr>
</tbody>
</table>

Quality of work done or result

| Team as a whole | 30 |

Team organization and division of work
| Preparation, arrangement, use of equipment | 5 |
| Neatness      | 5 |
| Replies to questions | 5 |
| Accuracy, conciseness, completeness | |
| Appearance of team | 10 |

Uniformity, suitability, attractiveness of costume, personal appearance

Total

100

CIRCULARS AND BULLETINS

which will prove helpful in further study of milk testing and its results.

Milk Testing in Practice, Bul. 197, Agricultural Experiment Station, Brookings, South Dakota.

How to Use the Babcock Test, Cir. 27, Extension Service, College of Agriculture, Madison, Wisconsin.

Cow Testing Pays, Cir. 67, Extension Service, College of Agriculture, Madison, Wisconsin.

Keeping Records of Dairy Cows, Cir. 57, Agricultural Experiment Station, Columbia, Missouri.

Cow Testing Associations, Cir. 196, Agricultural Experiment Station, Urbana, Illinois.


Testing Milk and Cream for Butterfat, Cir. 78, Agricultural Experiment Station, Purdue University, Lafayette, Indiana.


Common Questions about Cow Testing Associations, Extension Leaflet No. 20, State College, Brookings, South Dakota.