UNITED STATES DEPARTMENT OF AGRICULTURE

SYLLABUS 30

Contribution from the States Relations Service
A. C. TRUE, Director

In Cooperation with the Bureau of Animal Industry
A. D. MELVIN, Chief

Washington, D. C. ▼ August 16, 1917

ILLUSTRATED LECTURE ON COW TESTING AND DAIRY RECORDS

By

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SYLLABUS 30—ILLUSTRATED LECTURE ON COW TESTING AND DAIRY RECORDS.[1]

By Duncan Stuart, *Dairy Husbandman, Bureau of Animal Industry.*

INTRODUCTION.

View.

The dairy cows of the United States now number approximately 22,000,000. The milk, cream, and manufactured products, as butter, cheese, ice cream, condensed milk, etc., from these cows have an estimated value of nearly one billion dollars.

In nearly all herds of which records have been kept it has been found that individual cows differ widely in production, even with the same feed and care; and this difference exists among all kinds of grade and pure-bred dairy cows, as well as among cows of common stock. In 1915, in Wisconsin's 47 cow-testing associations, out of 16,700 cows tested, 3,375 were disposed of as unprofitable—about one in every five. Using this proportion in the total number of dairy cows in the United States, 4,400,000 cows would be eliminated as unprofitable. It seems only sensible, therefore, that the dairyman should make every effort to discover the unprofitable cows and weed them from the herd. Through the keeping of records the unprofitable cows can be detected and eliminated and the profitable cows kept in the herd for breeding purposes. The next step is to perpetuate these good qualities by using a registered bull of dairy merit. But that is another story.

[1] This syllabus has been prepared by direct cooperation between the Dairy Division, Bureau of Animal Industry, as regards subject matter, and J. M. Stedman, Farmers' Institute Specialist of the States Relations Service, as regards pedagogical form. It is designed to aid farmers' institute and other extension lecturers in presenting this subject before popular audiences. The syllabus is illustrated with 40 lantern slides. The numbers in the margins of the pages refer to the lantern slides as listed in the Appendix.

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View.

Many dairymen believe that they can pick out their best producing cows without keeping a record. The fallacy of this belief is demonstrated every day by the records of the
1 cow-testing associations throughout the country. Seven cows maintained on a dairy farm are taken as a basis for the record-keeping work to be illustrated. While the cows are all grade Jerseys, they possess individual characteristics that affect materially their net profit to the owner. Is it possible to tell by looking at these cows how much milk they will produce in one year, what it tests, and how much profit they will return to the owner?

KEEPING THE RECORD.

The first step in determining the efficiency of each cow is the keeping of a debit and credit account, in which the cow is charged with the cost of the hay, silage, and grain she consumes and credited with the value of the milk produced. The dairyman can keep such a record at very little expense. To begin this work he must have a milk scale and a supply of record sheets. A spring balance, or milk scale, made especially for weighing milk, may be purchased from any dairy-supply house at approximately $3. Sample record sheets may be obtained through the State extension department, or through the Dairy Division, Bureau of Animal Industry, United States
2 Department of Agriculture. On the monthly milk and feed record sheet are entered the names of the cows and the weights of the different feeds consumed and of the milk produced at each milking. A 10-day period has been found to be a convenient unit of time in the feed record, since changes in
3 feed rarely are made oftener. The milk is recorded at each milking and totaled for the month. For the period that the cow is dry it is nevertheless necessary to keep the record of feed consumed, so that the total cost of feed for the year may be considered in determining the profit or loss.

WEIGHING THE MILK.

The milk scale is graduated in pounds and tenths, so that it is easy to add the figures on the milk sheet. The dial has two hands; the black one indicates the actual weight, while the
4 red is adjustable and can be set at any desired weight. The empty pail or weighing can is hung on the scale and the red hand set at zero, and the black hand indicates the weight of the pail. When the milk is weighed in the pail, the red hand indicates the net weight of the milk, and the black hand the gross weight.

View.

By the use of an extra pail, the weight of which can be adjusted with the red hand on the milk scale, the regular milk pails need not be used for weighing the milk.

The milker in large commercial dairies usually wears a white 5
suit, but any clean, washable, outside clothing is satisfactory.

TESTING FOR BUTTER FAT.

TAKING THE SAMPLE.

The milk should be tested for butter fat at least once a month. In taking the sample the entire milking of the cow should be poured three times from one pail to another to insure an even 6
mixing of the butter fat. Immediately after this, a sample is taken by means of a small dipper, or preferably a long metal tube called a "milk thief." The tube is lowered into the milk, 7
the forefinger placed tightly over the upper end, and a portion of the milk withdrawn. The milk is allowed to flow into 8
the sample bottle by releasing the pressure on the upper end of the tube. When the milking is very small, it will be necessary to insert the tube several times in order to get a sample large enough for testing. A second sample of the following milking containing the same number of dips of milk is added to the first and mixed to form a composite sample of the day's milk. Sample bottles of about one-half pint capacity are used and they should be kept always tightly stoppered to prevent evaporation and should be marked plainly for the purpose of identification.

PRESERVING SAMPLES.

If the samples of milk must be kept for some time before testing, a preservative should be added to prevent curdling. Corrosive sublimate (a strong poison) in tablet form, containing some pink coloring matter, may be used. The color is added so that everyone may know that the milk contains a poison. One small tablet is sufficient for each sample. A few drops of formalin or a small amount of bichromate of potash may be used instead of the tablets.

THE BABCOCK TEST.

Previous to 1890 creameries and cheese factories paid each patron in proportion to the weight of the milk delivered, regardless of its butter-fat content, because no satisfactory method of determining the fat was available. The Babcock test, invented in 1890, by Dr. S. M. Babcock, of Wisconsin, is now the most satisfactory and practical method by which the

View.

dairyman can determine the quantity of butter fat produced by his cows. The equipment necessary for the Babcock test will depend somewhat on the size of the herd. For a small herd the following is satisfactory:

A Babcock tester—4 or 8 bottle capacity.
One dozen whole-milk test bottles, 8 per cent.
Two pipettes, graduated at 17.6 cubic centimeters.
9 An acid measure, graduated at 17.5 cubic centimeters.
A pair of dividers.
One dozen sample bottles, or half-pint glass jars.
One hot-water bath, or a gallon pail.
One bottle sulphuric acid, specific gravity 1.82.

MAKING THE TESTS.

If the samples are cold, they should be warmed to 60° or
10 70° F. The milk is then mixed by pouring it several times from one sample bottle to another so as to get a uniform mixture and to dissolve all the cream particles. The pipette is put into the milk immediately and sucked nearly full of milk.
11 The forefinger, which should be dry, is placed quickly on the upper end of the pipette before the milk runs down to the
12 17.6 cubic centimeter mark. A slight release in the pressure of the finger allows the milk to flow from the pipette until the
13 milk stands at the graduation mark. Next, place the point of the pipette in the mouth of the test bottle, holding both pipette and bottle at an angle so as to allow the milk to run down the side of the neck, thus allowing an exit for the air in the bottle. Write the number of the sample with a common black lead pencil on the roughened spot on the side of the test bottle.

ADDING THE ACID.

Commercial sulphuric acid, specific gravity 1.82, is added to digest or dissolve the milk curd and thus set free the fat. Since this acid will eat holes quickly in clothing and will burn the skin, the greatest care should be taken not to spill it. The acid should be about the same temperature as the milk. The
14 acid measure is filled to the graduation mark, 17.5 cubic centimeters, and the acid added carefully to the test bottle con-
15 taining the measured sample of milk, with the bottle held at an angle. The acid, being heavier than the milk, goes to the bottom at once, forming a clear layer which turns to choco-
16 late color at the junction of the acid and the milk, owing to the charring of the milk sugar. The test bottle then is shaken with a rotary motion, the mouth held away from the body, until the whole mass is a uniform dark-brown or chocolate color.

WHIRLING THE BOTTLES.

View.

Place the bottles in the Babcock tester opposite each other, so as to balance the machine properly. Whirl for five minutes at the speed indicated in the directions furnished with the machine; the number of revolutions per minute depending on the diameter of the machine. Hot soft water is then added to the bottles with a pipette, until the fat is brought up to the base of the neck. The test bottles are again whirled for a couple of minutes, after which more hot water is added to bring the fat column up into the neck between 0 and the 8 per cent graduation mark on the scale and to wash any impurities from the butter fat. The bottles are whirled again for a minute and then removed and placed in a hot-water bath at 130° to 140° F., for a period of five minutes. This insures the fat being at the proper temperature for reading. In cold weather it may be necessary to remove the bottles from the machine between runs and place them in hot water to warm the fat.

READING THE TEST.

The readings are made from the extreme bottom of the lower meniscus of the fat column to the extreme top of the upper meniscus, reading from the point D to the point A at the top of the meniscus, as indicated in the illustration. When care is taken to read to the extreme top of the meniscus the readings agree with those obtained by gravimetric analysis. If 2.5 per cent were the lower reading and 7.9 per cent the top reading, the correct reading of the test would be 5.4 per cent butter fat. A better way is to use a pair of dividers, placing the points at the top and bottom of the fat, and then, placing one point on the zero mark on the scale, read off the percentage indicated on the scale by the upper point. The percentage of butter fat then is written on the record sheet. The butter-fat column should be yellowish or amber color. Blackened fat indicates that too much, too strong, or too warm acid was used, while light, curdy material indicates that a part of the curd was not dissolved by the acid, owing to too little, too weak, or too cold milk or acid, or to insufficient mixing.

CLEANING THE BOTTLES.

Empty the test bottles while still hot, shaking the bottles so that the hot acid will rinse out the whitish sediment or ash at the bottom of the bottles. First rinse out the bottles with warm water, then wash with hot water and washing powder, and rinse again with hot water.

VARIATION IN BUTTER-FAT TESTS.

View.

The percentage of butter fat in milk can not be determined from the appearance of the cow, and it can not be changed greatly by care or feeding. Good care and feeding increase the quantity of milk given by the cow, hence the total butter fat produced is increased. The percentage of butter fat, however, remains fairly constant for each individual, except that variations may occur with the period of lactation, the first and last parts of the milking, and the age of the cow.

CALCULATION OF RECORDS.

The daily weights of milk produced by each cow are added and the total for the month multiplied by the percentage of butter fat in the milk to obtain the amount of butter fat produced during the month. For example, the cow Fannie gave
25 1,105.6 pounds of milk in January, 1915, and it tested 4.9 per cent. Then $1,105.6 \times 4.9$ per cent $= 54.17$ pounds of butter fat. The milk sheet shows the data worked out for the seven cows
26 in January. It will be noted that the cows produced from 57.4 pounds to as much as 1,105.6 pounds of milk, and that the tests varied from 4.2 per cent to 6 per cent.

The next step is the calculation of the value of the butter fat,
27 which in this case was 35 cents per pound. Thus Fannie produced 54.17 pounds of butter fat, worth $18.96. Similar calculations are made for the other cows and entered on the milk
28 sheet.

The value of the skim milk is determined by calculating the skim milk as 80 per cent of the whole milk and giving it a value
29 of 25 cents per 100 pounds. Thus, Fannie is credited with 884 pounds of skim milk, which is 80 per cent of 1,105.6, worth $2.21.

30 The value of the skim milk is added to the value of the butter fat, and the total cost of the feed consumed is deducted to obtain the profit over the cost of the feed. Thus Fannie's butter fat was worth $18.96, and the skim milk, $2.21, a total
31 of $21.17. Deducting the cost of her feed, $7.83, leaves $13.34 profit in January. You will observe that she has a good dairy conformation, a well-shaped udder, and good barrel capacity, indicating that she can turn large quantities of roughage into milk.

Diamond, No. 37, shows a profit of $6.24, or only about half
32 as much as Fannie. We must, take into consideration, however, the fact that Fannie had but recently freshened, while Diamond was well along in her lactation period.

Diana, No. 51, shows a much smaller profit, namely, $3.01, although she produced within 6 pounds of the quantity of milk

View.

produced by Diamond. This is due to the fact that her milk 33
tested 1.1 per cent less, which made a difference of 7 pounds of butter fat for the month, and that she consumed more feed than Diamond.

Pet, No. 67, produced only 451 pounds of milk, but it tested 5.6 per cent, making 25.26 pounds of butter fat. She ate less, 34
so that her feed cost was $5.13 as compared with $7.40 for Diana. With a high percentage of butter fat in her milk, and a smaller quantity of feed consumed, her profit was $4.61 for the month.

Myrtle was near the end of her lactation period, so that her feed cost was $1.55 more than the value of the milk produced. She has poor dairy conformation and judged only by her January record might have been eliminated from the herd. It 35
must be noted, however, that she was nearly dry. During the year she never produced a very large quantity of milk at a milking, but she was a persistent milker, so that in profit over cost of feed she stood second in the herd.

Ellen was dried off early in the month, and although the cost 36
of her feed was only $2.72, her loss for the month was $1.41. She is more of a beef than a dairy type, and her record for the year shows that she was dry four months and produced only 153.6 pounds of butter fat.

Blanche freshened the latter part of the month and showed a loss of 72 cents. Her profit for the year was only $19.45, 37
owing to her low production and to the large quantity of feed she consumed.

These records clearly show that one month's record is not sufficient evidence to condemn a cow, for the low production may be due to advanced lactation (the cow may be nearly dry), illness, lack of proper feed (the pasture may have dried up), etc. Too often the results shown on the record sheet fail to confirm the judgment of the owner.

YEARLY RECORDS.

Every month throughout the year the milk produced by each cow is added and a sample of the milk is tested about the middle of each month. The value of the butter fat and skim milk is calculated and the cost of the feed consumed is deducted therefrom. These monthly figures are entered on another sheet for the yearly record. Take, for example, the 38
year's record of the cow Fannie. It was noted that she freshened late in December, 1914, dried off October 25, 1915, and freshened again December 25, 1915. Her profit above the cost of feed amounted to $48.39 for the year 1915.

View.

A comparison of the yearly records of the seven cows with their photographs is interesting. With the pictures at hand it will be seen that one can not judge the production of a cow
39 for the year from her conformation alone. The cow Myrtle was a surprise to her owner, for while she had never given a large quantity of milk at a milking, her record showed her to be a persistent milker. She stood second in profit over cost of feed and returned to her owner more than the combined profits of Ellen and Blanche. The combined profits of Fannie, Diamond, Pet, and Myrtle amounted to $182.18, or an average of $45.04 per cow, while the average profit of Diana, Ellen, and Blanche was $23.76, or about one-half that of the first four cows. If this dairyman had had seven cows as good as his best four, he would have had a total profit of $317.30 instead of $253.45, a difference of $63.95. This amount would be a large return for the time spent in keeping the records.

VALUE OF DAIRY RECORDS.

The only safe way of valuing dairy cows is by the quantity of milk and butter fat they produce. This necessitates the keeping of records. These records will point out the good and the unprofitable cows; the dairyman can save the offspring of the good cows, so that he will soon have a herd of large and economical producers.

The daily milk sheet enables the feeder to prepare proper rations and feed these according to the quantity of milk pro-
40 duced. All cows should not be fed alike; the high producers require more feed than the low producers. Without records it is impossible to feed economically.

Three common rules for feeding are: (1) Feed 1 pound of grain to every 3 to 4 pounds of milk produced, or 1 pound of grain daily to every pound of butter fat produced per week; (2) feed all the roughage the cows will eat up clean; and (3) cut down on the expensive feed when the cow begins to gain in live weight.

In addition, the daily milk sheet enables the dairyman, when a drop occurs in the yield of milk, to detect and ward off or check cases of illness that might become serious if not treated promptly, and it also enables the owner to check up on the thoroughness of the milking of the different employees. Breeding records also should be kept in addition to production records.

Records are not only valuable to the owner in the above-mentioned ways, but they aid in selling his stock. One man in a cow-testing association sold his cows for $25 to $50 more because of their records.

APPENDIX.

LANTERN SLIDES.

No. of view.

1. A herd of seven cows (grade Jerseys).
2. The milk sheet for the weights of feed consumed and milk produced.
3. The milk sheet with the pounds of milk totaled at the end of the month.
4. Spring balance for weighing milk.
5. Weighing the milk.
6. Mixing the milk by pouring it from one pail to another.
7. Taking the sample with a "milk thief."
8. Placing the sample in the sample jar.
9. Babcock testing outfit.
10. Mixing the sample before making the Babcock test for butter fat.
11. Filling the pipette—sucking the milk up into the pipette above the 17.6 cubic centimeter mark.
12. Allowing the milk to flow out until the top of the milk stands at the mark.
13. Holding the bottle at an angle and allowing the milk to flow from the pipette into the bottle.
14. Measuring out 17.5 cubic centimeters of sulphuric acid.
15. Adding the acid to the test bottle containing the measured sample of milk; holding the bottle at an angle.
16. Bottle with acid added, showing the chocolate color of milk at the junction of acid.
17. Test bottles in the machine ready for whirling.
18. As the machine is whirled the bottles take a horizontal position.
19. Adding soft water at 130° F. to the test by means of a pipette.
20. The completed Babcock test ready for reading.
21. Diagram showing method of reading fat column.
22. Find the length of the fat column with the dividers.
23. Reading off the percentage of fat on the graduated scale by placing one point of the dividers at zero, the upper point representing on the scale the test in percentage.
24. Entering the percentage of butter fat on the test sheet.
25. Calculation of the pounds of butter fat in the milk produced.
26. The butter fat calculated fot the seven cows in the herd.
27. Calculating the value of the butter fat produced.
28. Value of the butter fat produced by the seven cows.
29. Calculating the value of the skim milk.
30. Sheet showing profit for each cow for the month of January.
31. Chart showing the profit on Fannie in January.
32. Chart showing the profit on Diamond in January.
33. Chart showing the profit on Diana in January.
34. Chart showing the profit on Pet in January.
35. Chart showing the profit on Myrtle in January.
36. Chart showing the profit on Ellen in January.
37. Chart showing the profit on Blanche in January.
38. Report showing yearly production of Fannie.
39. Comparison of the yearly records of the seven cows.
40. Chart. Value of dairy records.

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