PRACTICAL MILK TESTING FOR DAIRYMEN

COMPLIMENTS OF
SUPPLEE-WILLS-JONES MILK COMPANY
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PRACTICAL MILK TESTING —FOR— DAIRYMEN

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PART I.

EXPLANATION OF MILK PRODUCTION.

A COW is essentially a manufacturing plant into which is put feed in the shape of hay, grain, silage and water and in return we get milk, a calf and a by-product known as manure or stable dressing.

Fig. 1
Diagram of Udder

The udder is a very highly specialized machine in this factory composed of glands, blood vessels, cells and canals which work over a raw material called blood and change it into a fluid called milk. The quantity of milk produced is determined by the quality and amount of rich blood as a raw material and the efficiency of the machine called the udder to produce milk. The quality of the blood is influenced by the general health of the cow and

the quantity of the blood is determined by the effective work of the digestive system.

Therefore in selecting a cow it is essential to note the general health, the size of her digestive capacity, usually determined by the size of her barrel or girth and her udder development, noting especially the size of her milk veins. But after all, the supreme test of a cow's ability to produce milk is to sit under her, milk her, and then weigh and test her milk to find out the quantity and quality of her output.

PRACTICAL MILK TESTING

CAUSES FOR VARIATIONS IN BUTTER FAT TESTS.

Introduction.—One of the most common causes of dissatisfaction among dairymen and unpleasant embarrassment to purchasers is the variation in the butter fat test. A dairyman naturally comes to the conclusion that milk or cream from the same cows, fed the same ration, pastured in the same fields, stabled in the same building, milked by the same man who used the same separator, should test or show the same percentage of butter fat. When he receives his check and notices that the test is lower than for the same month of the previous year or even for the preceding month of the same year, he feels that his test is incorrect to say the least and more than one farmer has been known to remark that the dealers were cheating him.

Causes of Variations.—The percentage of fat in normal milk varies a great deal; however, the fat content very seldom falls below 2.6 per cent. or rises above 7.5 per cent. The percentage of fat in the milk from a

whole herd of cows varies within comparatively narrow limits during the year, seldom exceeding .5 or .6 of a per cent. (Dairymen usually speak of this as a 5 or 6 point variation while in reality it is only five-tenths of a per cent.)

CAUSES FOR VARIATIONS IN BUTTER FAT TEST.

1. **THE BREED.**—One of the main differences between animals of different breeds is the wide range in the butter fat test. Jerseys are proverbially high testers, often going as high as 4 per cent. more than a low testing Holstein. (Dairymen would commonly speak of this difference as 40 points, a point being taken as one-tenth of one per cent.) Guernseys and Ayrshires test lower than Jerseys but higher than Holsteins.

2. **THE INDIVIDUAL TENDENCY.**—By careful breeding certain individuals have been developed so that they test much higher than the average of her breed. There is no doubt that there are some Guernseys or even a few Holsteins which are very high testers, even to the extent of being better testers than the average Jersey cows and this is essentially the hope of the dairyman. He can breed his cows to produce more butter fat.

3. **THE AGE OF THE COW.**—All other conditions being the same, a young heifer, during her first milking period will usually give a higher testing milk than she will at the succeeding lactation period. The quantity, however, is smaller during the first period than after her second calf.

4. **THE TIME BETWEEN MILKINGS.**—During the summer months the cows are often milked at 4 o'clock in the morning and 6 o'clock at night. The time between morning and night's milking is 14 hours, while between the night and morning's milking is only 10 hours. In this case the quantity of milk at the night's milking will be greater than the quantity in the morning, but the morning test will be more than the evening test. In winter time this is often reversed, so that the evening test will be the larger, but the quantity will be less. It also often happens that some cows give a higher testing milk in the morning and some give a higher test in the evening, irrespective of the fact that they are milked at regular intervals of 12 hours each. This variation between morning and evening's milk will often be as much as 5 points (five-tenths of a per cent.)

Table showing the variations in butter fat test between morning and night tests, all other conditions being equal so far as could be determined:

	June 20, 1917		June 21, 1917		June 22, 1917	
	Morning	Night	Morning	Night	Morning	Night
Bessie	2.9	2.9	3.2	3.0	3.1	3.2
Glory	3.3	3.6	3.2	3.6	3.3	3.7
Jane	3.8	3.8	3.9	4.1	3.9	3.9
Goldie	3.9	4.2	3.7	3.5	4.3	4.1
Jennie	2.9	3.2	3.4	3.1	3.0	3.2
Beauty	2.8	3.1	3.4	3.2	3.0	3.5
Queen	3.7	3.5	3.6	3.6	3.8	3.3

Fair weather, even temperature. Cows in pasture day and night. Cows were milked at 5 a. m. and 5 p. m. Cows were all Holsteins. Bessie, Jennie and Beauty had freshened during the first week of June; Goldie and Queen, during second week in April; Jane, during the last week of March, and Glory, during the second week in June.

5. CHANGE OF MILKERS OR SURROUNDINGS.—Just as hens fly about in a frightened manner and temporarily stop laying when a stranger is taking care of them or they are placed in a strange house, so a cow often appreciably falls off in her milk production and test when taken to another barn or when milked by a stranger. Some cows will not allow a stranger to milk them. One of the important factors of dairying is the confidence a cow has in her regular attendant. Any change is sure to be noticed in the pail.

6. LENGTH OF TIME SINCE COW HAS FRESHENED.—A cow usually gives the largest number of pounds and a lower test just after freshening. As her milking period advances she gives less milk, until she finally is dry, but her test increases as she approaches her dry period; however, if the cow has taken on any fat just before calving she will give a high testing milk for three or four weeks at the beginning of her lactation period, after which the test drops back to normal conditions. Do not try to raise your test by feeding just before calving because an over-fattened cow usually has difficulty in calving, which is often serious and her flow may fall off for the entire year.

7. EXCESSIVE CHANGES IN TEMPERATURE.—Cows shivering in a cold wind, standing in a draught coming through an open window or suffering in a cold rain as well as those annoyed by a lack of shelter from a hot sun, invariably show a diminished flow as well as a lower test.

8. WHETHER FIRST OR LAST DRAWN MILK.—The first drawn milk of each teat besides being very undesirable from a sanitary standpoint—every farmer's boy knows that he can make a cat or dog very sick if not kill it, by feeding it nothing but first drawn milk, on account of the germs which it contains—is also very deficient in butter fat, while the last drawn milk is very rich in butter fat, containing as much as 15 per cent. It is very essential to see to it that each teat is milked clean, so as to get all of the butter fat. The custom some dairymen have of letting the calf finish the milking after the cow has been half finished is excellent, from the calf's point of view, but it is rather hard on the butter fat test, as the calf gets about two-thirds of the butter fat by this process. It is better to let the calf have the fore milk. It is good dairy practice, however, to feed the milk while still warm to the calves and not let them suck at all, thereby avoiding any udder trouble caused by the calf, which often treats its mother very roughly.

9. PHYSICAL CONDITION OF THE COW.—The physical condition of a cow, affected as it is by her external surroundings, has a marked

tendency to limit the production of both milk and butter fat. The general health of a cow must be maintained if the maximum amount of butter fat is desired.

10. **SEXUAL EXCITEMENT.**—When a cow is in heat her butter fat varies, sometimes rising and sometimes falling. Much depends on how she is treated during this period.

11. **HARSH TREATMENT BY MILKER.**—Any rough treatment; such as striking with a whip, kicking or even the use of loud, harsh, language has a tendency to cause a cow to become nervous and results in a decreased flow of milk as well as a diminished butter fat test.

12. **CHASING BY DOGS AND CHILDREN.**—It probably saves a great deal of labor to go for the cows with the aid of a dog or send the children after them, but the nervous excitement through fear of the dogs and unthinking children who are apt to force the cows to run, does not tend to a maximum production of milk or butter fat. Children should be instructed and dogs prohibited from driving cows.

13. **ANNOYANCE BY THE BULL.**—The attentions of an over ambitious bull are annoying and fretful to the general peaceful disposition of a cow whose maximum capacity of both milk and butter fat are lessened by his continual attentions.

14. **GROOMING WITH BRUSH AND COMB.**—No good horseman would think of letting his horses go ungroomed because he knows the value of careful combing and brushing, both to the appearance and the endurance of his horses. Grooming a cow starts up a healthy circulation of the blood in the skin and experiments have shown that this practice helps to increase the vigor of the animal and in turn affects the butter fat production. It is one of the important practices which every good dairyman follows without fail.

15. **SHEDDING OF HAIR.**—Hens during their molting period cease laying eggs entirely, because their surplus energy goes into making a new set of feathers, and cows, because some of their energy goes into the building of a new coat, give a slightly diminished quantity of milk and butter fat during the shedding period.

16. **POOR VENTILATION AND LIGHT.**—The cow is a factory producing milk. If this factory is compelled to breathe impure air and work in a dark, damp, filthy stable, you cannot expect the maximum flow of milk or butter fat. A sluggish cow is the result of such conditions and she cannot do her best in such a stable.

17. **ANNOYANCE OF FLIES AND FLEAS.**—The annoyance of flies, fleas and lice on cows so detracts the animal that she cannot produce the greatest amount of milk or butter fat. She uses up too much of her energy trying to get rid of these pests. Grooming and spraying soon show their value in the milk pail.

PART II.

PRACTICAL MILK TESTING

EQUIPMENT.

- a. A Small Dipper for Taking Sample.
- b. Pint Fruit Jar which can be Closed Tightly.
- c. Milk Pipette (capacity 17.6 c.c.)
- d. Babcock Milk Test Bottles. (Eight per cent.)
- e. Acid Measure (capacity 17.5 c.c.)
- f. A Centrifugal Machine to Whirl the Bottles.
- g. A Water Bath to Maintain Correct Reading Temperature.
- h. Thermometer. A Floating Dairy Thermometer is Best.
- i. A Pair of Dividers With Set Screw and Sharp Points.
- j. Acid Testing Hydrometer.

INTRODUCTION.—The fact that so many letters are received daily inquiring about the Babcock Test for Butter Fat in Milk leads us to believe that this important part of milk marketing is not yet fully understood. Milk testing is not a very difficult operation, but there are abundant chances for errors. The process must be thoroughly understood, and the greatest care must be exercised from beginning to end; nevertheless, the test is simple and easily mastered by any one who will give it careful attention.

GENERAL PRINCIPLES INVOLVED.—Milk is made up of fat, other solids and water. The fat globules being lighter, tend to rise to the surface, but on their way up, they either bring with them small particles of other milk solids, or do not succeed in getting to the top at all. The first problem then is to get **all** these fat globules to the surface **without bringing any other milk solids along**, and the second is how to bring them all up **quickly**.

The first of these problems is overcome by dissolving the milk solids with sulphuric acid which does not have any effect on the fat globules, thereby allowing them to rise readily. The second problem is met by using a machine to whirl the milk around so that the heavier solids not fat are thrown to the bottom of the bottle just as the mud is thrown against the mud guards by the automobile wheels when the car is going rapidly or as the governor on the threshing engine spreads out when the engine is speeded up.

It remained for Dr. S. M. Babcock, chief chemist of the Wisconsin agricultural experiment station to discover and invent a practical method to determine the percentage of fat in milk by using these two simple facts. Dr. H. L. Russel, director of that experiment station considers this test "largely responsible for the progress in dairying and proficiency in

its use is almost synonymous with better cows, better milk and better farming." He further said, "The Babcock test has struck the shackles which bound dairy farmers to past traditions and has started them on their way to greater prosperity." (The Wisconsin legislature presented Dr. Babcock with a large gold medal in recognition of his services to the whole world by this discovery and invention.)

TAKING THE SAMPLE.—The accuracy of the test depends entirely upon the care exercised in taking a sample which truly represents the

whole quantity of milk. Several methods are employed to do this; first, by pouring from one vessel to another three or four times; second, agitating very thoroughly with a strong stirrer such as is used in commercial testing. (See figure 2.) The sample should be taken at once with a long-handled dipper which holds about an ounce of milk. (See figure 3.) A regular sampling tube or milk "thief" is often preferred to the long dipper, but in no case should you use an ordinary tin cup with a short handle.

Fig. 2
Metal
(brass)
stirrer
which
can be
cleaned
easily

COMPOSITE SAMPLES.—Commercial firms who buy on the butter fat test take a sample each day and place them in an air-tight jar (See figure 4.), and then test once a week instead of daily. Some preservative such as corrosive sublimate which may be bought from a druggist and is **exceedingly poisonous** is used in these jars and in warm weather the samples are stored in a cool place. Should the sample become sour and lumps of curd become visible, a knife point of soda lye may be added to dissolve this curd. When this is done care must be taken to add the sulphuric acid slowly because the chemical action is as violent as adding water to lime when slaking it.

Fig. 4
Bottle for
composite
sample. It
is easily
and quickly
opened, and
it is air
tight

SENDING SAMPLES FOR TESTING.—

When a dairyman sends a sample away to be tested he must bear in mind; first, that the fore milk is very poor in butter fat and the strippings are exceedingly rich in fat, **therefore milking into a bottle will not be a fair test.** Second, since the morning's milk and the night's milk varies in butter fat it is necessary to send a composite sample consisting of several small samples from a number of both morning and night milkings. And in addition, these small samples must be proportional in quantity to the total amount of each milking; that is, if a cow gives 15 pounds of milk in the morning and 30 pounds at night the morning sample must be one-half as large as the evening sample.

Fig. 3
Dipper for
taking a rep-
resentative
sample.

STEPS IN OPERATION

MEASURING THE MILK.—The milk to be tested is measured by a glass pipette of which there are several kinds in use, but the most practical for commercial work is the common pipette shown in (figure 5.) All pipettes are gauged to hold 17.6 cubic centimeters of milk which should always be at a temperature of from 60 to 70 degrees, Fahrenheit.

If the milk to be tested is a composite sample care must be exercised that no cream adheres to the inside of the jar. This can be prevented by (a) being careful to use clean jars only, (b) shaking the jar each time before a new sample is added and shaking again immediately afterward. Sometimes it is necessary to warm composite samples to a temperature of from 85 to 110 degrees, Fahrenheit, in order to obtain an even and smooth mixture of the composite sample, but it is then necessary to reduce the temperature to 60 or 70 degrees, Fahrenheit before drawing the milk into the pipette. Storage of composite sample in a warm place may also cause a thin layer of cream to stick on the sides of the jar. This must not be removed by a test tube brush because the cream will simply stick to the brush and a low test will result.

DRAWING MILK INTO PIPETTE.—After you are sure that you have mixed the fat evenly in the sample; place the smaller tips of the pipette into the milk while it is still in motion. Then suck the air out of the pipette by placing your lips at the upper end until the milk rises above the only mark on the neck. Before the milk can fall below the mark again, place your index finger on the open end of the pipette. By releasing your finger and allowing a little air into the pipette the column of milk can be lowered until it is on a level with the only mark on the upper stem of the pipette. Hold the pipette so that this mark is on a level with the eye to secure accurate results. If the sample contained corrosive sublimate as a preserving agent and you accidentally drew some of the milk into your mouth, be sure to spit it out and wash your mouth with water, as the sublimate is a deadly poison even in small quantities.

TRANSFERRING MILK TO TEST BOTTLES.—The milk is then transferred to the test bottles either by inserting the lower stem of the pipette for its full length into the neck of the test bottle and then releasing the finger and allowing the milk to drain into the bottle (See Figure 6.) while you take another pipette and get another sample; or the pipette may be emptied by inserting simply the tip into the mouth of the test bottle, holding both slanting as shown in (Figure 7.) Again release your finger cautiously so that no bubbles will form and cause you to lose some of the milk. In either case, the last drop of milk must be blown into the test bottle before removing the

Fig. 5
Standard
pipette for
milk test-
ing

pipette. While measuring or transferring the milk great care must be taken that **no milk is lost** as this test requires accurate measurements in every step.

THE ACID

TESTING.—The acid used is oil of vitriol or sulphuric acid and should be tested by allowing a hydrometer to float in a cylinder of the acid. It should test about 1.82 or 1.83 (See Figure 8) at a temperature of 60 degrees Fahr. This acid is clear and of an oily nature and **must not be spilled** on the hands or clothing, as it will eat holes in either. If any accident should happen, the acid must be washed off immediately with ammonia water. The acid must be kept in a glass bottle with a glass stopper, because it will eat the cork and become discolored. A cork stopper also allows a certain amount of moist air in the bottle and this has a tendency to weaken the acid. Do not pour the acid in anything made of metal, such as a lead sink drain or a tin cup. **It will eat holes in them.**

Fig. 7
Second method of
emptying pipette

Fig. 8
Hydrometer in
cylinder of sul-
phuric
acid

The acid
measure. Use
tested glass-
ware.

MIXING.—Fill the acid measure to the mark. (See Figure 9.) and pour the acid into the test bottle containing the milk, holding the latter in an inclined position so that the acid will flow down the sides of the bottle and because it is heavier than milk will settle under the milk and not drop through the body of it.

The bottle should be revolved so that the acid will wash all the milk down the sides of the neck and make the test more accurate. This method will prevent charring the milk and spilling the acid. If the acid has been properly added there will be two distinct layers, the

Fig. 6
Commercial
method of
emptying pip-
ette. While
one is draining
the tester goes
to work on
another to
save time

acid being below the milk without any partially mixed acid and milk between.

By shaking the bottle with a gentle rotary motion as shown in (Figure 10,) the acid and the milk will gradually mix and turn to a coffee brown color at the same time getting quite hot. This is advantageous, since the fat must be in a liquid condition to perform the test properly. It is advisable to continue this mixing for at least half a minute, so as to be sure that all of the milk solids have been dissolved except the fat which will not dissolve. Be sure to point the neck of the bottle away from the face so that no acid will be thrown into the eyes because the union of the acid and the milk is often violent enough to cause sputtering, just as water added to quicklime becomes hot and finally boils and sputters.

In making the test commercially it is best to put the milk in the test bottles, then add the acid to all before any are shaken, otherwise the first one will get cold before the last one is finished, but do not let them stand too long.

Fig. 10
Motion to be used to mix milk and acid in test bottles, but if held in this manner the acid may sputter on the hand.

SEPARATING THE FAT FROM THE OTHER SOLIDS.—All that is now needed is to separate the fat so that it can be measured. This is accomplished by whirling very rapidly in a centrifugal machine. The test bottles are now arranged in pairs at opposite sides of the center so that the machine will be properly balanced when rotated. An uneven number or when bottles are not arranged so as to balance each other will cause trouble and should not be attempted. Close the machine and whirl at the proper speed for five minutes. The proper speed depends on the diameter of the tester and is as follows:

Diameter of Tester.	Revolutions per minute.
20 inches	725—775
18 "	775—825
16 "	825—875
14 "	875—925
12 "	925—1000

Stop the machine and add soft water at a temperature of 170 degrees, Fahr. until the fat rises to the neck of the bottle. This can be done with a pipette, with a regular dipper having a slender spout, or with the device for that purpose attached to the large steam testers used by commercial factories. Be sure to use soft water because hard water may cause bubbles in the fat column. Keep machine closed while whirling.

Rewhirl at the proper speed as indicated above for two minutes and add soft water at a temperature of 170 degrees, Fahr. until the fat column rises to the 6 or 7 per cent. mark. Be sure that the bottom of the fat column is above the zero mark. Rewhirl as before for one minute. (See Figure 11.)

TEMPERING THE TESTS.—Nearly all substances expand when heated and contract when cooled. Just as a wagon wheel tire is heated to make it larger before it is put on the wheel, so that when it cools it will contract and thus bind the spokes tightly, so this fat column gets longer or shorter when changes in temperature occur. It is, therefore, necessary to keep these tests at an even temperature of 120 to 140 degrees, Fahr. This is done by placing them in a water bath (See Figure 12) of that temperature being sure to have the water

above the fat column but do not let any overflow into the bottles.

READING THE PERCENTAGES. —

Reading the results is accomplished with the aid of a pair of dividers (See Fig. 13) which have an adjustable

set screw so as to hold them rigid. Holding the bottle on a level with the eye, place one point of the dividers at the lower end of the fat column and adjust the other point to the top of the fat column with the set screw. (See Figure 15.) Lower the dividers until one point is at zero; the upper point will indicate the per cent of fat. (See Figures 16 and 17.)

COMMON CAUSES OF LOW TESTS*

1. Neglect to stir the milk in the cans while it is standing in the milk house. Good dairymen make a practice of stirring their milk occasionally because they know that a hard, leathery skin will form on the top. This is almost pure butter fat and is a total loss. When you re-

Fig. 11

The 8 per cent. milk test bottle conforms to the requirements of the U. S. Bureau of Standards. It is graduated to tenths

Fig. 12

Water bath. Test bottles are placed in a water bath at a temperature of 120 to 140 degrees Fahr. The water should reach the top of the fat column in the test bottles. Adapted from Indiana Circular No. 42

Fig. 13

Caliper with set screw. This will avoid any possibility of error when reading the test by holding the arms of the caliper rigid.

member that there are but 3 pounds or even less of butter fat to each 85-pound can of milk you will realize how important it is to save all the fat possible. (See Figure 14.) Butter fat which has been hardened by exposure to light or air will stick to the can and be lost. Save the butter-fat. It pays. Shaking the can a little does not stir the milk. Use a stirrer vigorously but do not churn it into butter.

COMPOSITION OF MILK.

40 QUART CAN. 85 LBS.

Fig. 14

MILK CAN

THE ABOVE FIGURES ARE APPROXIMATELY CORRECT FOR MILK TESTING 3.6 PER CENT. ANY DINGES OR DENTS IN THE CAN WILL CHANGE THEM MATERIALLY.

Fig. 15

The dividers in this first position for reading the test. Dividers should have a set screw.

4. **Too strong acid** will leave a dark column. **Test the acid.**
5. **Too weak acid** will result in a pale yellow or cloudy fat column with some undissolved curd. **Use the hydrometer.**
6. If the temperature of either the milk, the acid or both is **too high**, the fat column will be dark and contain charred matter.

Fig. 16

The dividers in the second position. Dividers should have a set screw. Use sharp pointed dividers.

mixing or transferring results in a low test. **Carelessness is inexcusable.**

2. The habit which many women have of going to the milk house and getting a bowl of cream from the top also materially lessens the three pounds which originally belongs in the can. Do not expect as good a test if this practice is continued.

3. **Poor testing cows** in the herd. One poor testing cow in your herd may be eating up all the profits of the remainder. (For other causes see Part I. of this booklet.)

COMMON CAUSES OF POOR TESTS

1. Incomplete mixing of acid and milk. **Shake thoroughly.**

2. **Too much acid** results in a dark fat column containing charred matter and specks. **Be accurate.**

3. **Too little acid** will leave some undissolved curd in the bottom of the fat column.

7. Running the tester at low speed results in a low test. This is a common error when hand testers are used.

8. Use of hard water causes the top of the fat column to be obscured with white foam or gas bubbles.

9. Careless reading of fat column is inexcusable.

10. Spilling some of the milk while

Fig. 17

Read from lowest point B, to highest point A

NOTE:—The fat column should be straw yellow in color. If the fat column contains any specks or particles whether they are black or white, it shows that something is wrong and the test must be performed again.

SPECIAL PRECAUTION

Freshly drawn milk should not be tested because it contains many gases which disappear after standing one or two hours.

Always add acid to water, never water to the acid.

GENERAL INFORMATION

U. S. GOVERNMENT WHITEWASH

Slake half a bushel of quicklime with warm water, keeping it covered to keep in the steam. Strain the liquid through a fine sieve or strainer. Add a peck of salt previously well dissolved in warm water, three pounds of ground rice boiled to a thin paste and stir in boiling hot a half-pound of Spanish whiting (plaster of Paris) and a pound of glue which has been previously dissolved over a slow fire, and add 5 gallons of hot water to the mixture. Stir well and let it stand for a few days. Protect from dirt. One pint of the mixture will cover a square yard if properly applied with small brushes. There is nothing that compares with it for outside or inside work and it retains its brilliancy for many years.

FLIES ANNOY THE COWS AND REDUCE THE FLOW AND THE TEST.

TO KILL FLIES ABOUT THE BARN

Spray the floor with

1. White arsenic (1 ounce.)
2. Molasses (1 pint.)
3. Water (2 gallons.)

(Use with care as it is very poisonous.)

FLY SPRAY FOR COWS

Thoroughly mix equal parts of

1. Crude carbolic acid.
2. Oil of tar.
3. Cotton-seed oil.

Apply with a pump and repeat as often as necessary. Be sure to mix thoroughly before each application.

FACTORS WHICH CAUSE MILK TO SOUR MORE QUICKLY

1. Failure to cool to 50 degrees **quickly** and immediately after milking.
2. Failure to stir occasionally during the time it is being cooled.
3. Failure to keep milk at a low temperature.
4. Failure to protect milk from air, dust and flies.
5. Failure to keep utensils clean.
6. Failure to discard a little of the fore milk.
7. Failure to shield the milk on the wagon with a blanket or canvas cover while being hauled to the station.
8. **Mixing warm milk with cooled milk. Never mix morning and night milk until both are cooled.**

DAIRY FACTS WORTH KNOWING

1. A pound of butter fat yields one and one-sixth pounds of butter because butter contains salt and water in addition to the fat.
2. To find the yield of cheese per hundred pounds of milk multiply the butter fat test by 2.6. (This is only approximately correct.)
3. A 40-quart can when new and without dents will hold 86 pounds of milk. On account of dents and dinges especially on the sides, where they may be unnoticed, a 40-quart can will hold 85 instead of 86 pounds.
4. Transportation companies consider a can of milk as weighing 110 pounds, allowing 85 pounds for the milk and 25 pounds for the can.
5. There are a little over 46 quarts in 100 pounds of milk.
6. Milk may be kept cool in a thermos bottle but never keep heated milk in such a bottle because harmful germs develop which cannot be detected by the taste.
7. A mixture of one-half sawdust and one-half cement will make a good floor for a cow stable which is **warmer** than ordinary cement and not so **slippery**. Do not mix saw-dust with cement for the gutter, because the corners will be too brittle and cause the edges to break off. This combination has the advantage of being cheaper than cork bricks or wooden blocks.

DEHORNING CALVES

As soon as the small horn beneath the skin can be located clip the hair from the spot and scratch beneath the skin over the horn with a sharp pocket knife until the blood appears. Take a stick of caustic which can be bought from a druggist, wrap it in paper because it will burn your hands and rub the end on the budding horn until a sore spot about the size of a dime is produced. It may be necessary to moisten the end of the stick of caustic with a drop or two of water. **Do not turn the calf out into the rain for the first day** because the caustic may run down the calf's face and eat the hair or get into its eyes. Caustic soda or potash will answer but in either case keep the stick in a glass-stoppered bottle, because it absorbs water from the air and melts.

THEORY OF HERD IMPROVEMENT

There are two ways of securing a herd of cattle which are **large** producers and **high** testers; first, buy them direct from a breeder or start with your best grade cows and by using a thoroughbred sire gradually improve the offspring. The first method is expensive while the second method requires years of patience.

EXPLANATION OF BREEDING CHART.

The process of breeding may be explained as follows: Let A and A represent the pure-bred sires whose ancestors are high testers and large producers. B is your grade cow. By breeding A with B we shall get C, which we trust will be a heifer. C is half grade and half pure bred. Then breed A with C and we have D which is one-fourth grade and three-fourths pure. You now use a new sire of the same type as the former but not related to him except very distantly. Breed A with D and you have E which is one-eighth grade and seven-eighths pure. The next step will produce F, which is fifteen-sixteenths pure. You now have a cow which is almost pure bred and for all practical purposes is a very desirable animal.

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