Paying for Milk at Cheese-Factories

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From Bulletin by
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Paying the butter-maker’s patrons.

The Babcock test is now held to be indispensable by practically every commercial butter-maker. This simple, rapid, accurate method for determining the percentage of fat in milk tells the butter-maker exactly how much milk-fat each patron furnishes; and on this basis each is paid for his milk or shares in the returns for the butter sold. For, though butter contains other materials than fat, the amount of fat in milk is an almost perfect index to the quantity of butter that should be made from that milk.

If the cheese-maker’s product varied in yield uniformly, as does butter, with the percentage of any ingredient in milk, there can be no question that the milk would be paid for generally by some test; for, in whatever form or for whatever purpose he disposes of his milk, each producer is entitled to his equitable share of the returns from the sale of products made from his milk. The man whose milk makes more or better cheese than that of his neighbor is as justly entitled to better returns as is he whose cows give a better butter-producing milk. But cheese-makers and, especially, producers of milk for cheese-making find it difficult to settle upon a test which satisfies all.

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*This is a brief review of Bulletin No. 308 of this Station, on Methods of Paying for Milk at Cheese-Factories, by L. L. Van Slyke. Any one interested in the detailed comparisons of methods will be furnished, on application, with a copy of the complete Bulletin. The names of those who so request will be placed on the Station mailing list to receive future bulletins, popular or complete as desired. Bulletins are issued at irregular intervals as investigations are completed, not monthly.*
Cheese is a more complex product than butter, with a foundation of water, casein and mineral ingredients, with which the milk fat is thoroughly mingled. The foundation elements vary only within somewhat narrow limits; but the percentage of any one of these, as casein, or of all of them, does not make a reliable guide to the cheese-producing value of the milk. One hundred pounds of milk containing $2\frac{1}{2}$ per ct. of casein may make only $4\frac{1}{2}$ pounds of cheese if all the fat be skimmed from the milk or may make $10\frac{1}{2}$ pounds if the milk contains 4 per ct. of fat. That is to say, the yield of cheese is greatly influenced by the amount of fat in the milk, though it does not increase directly with the percentage of fat. The quality of the cheese, however, which is an exceedingly important factor in fixing the value of the product, improves with each increase in the amount of fat.

Both quantity and quality considered, milk fat is Babcock test an accurate measure of the value of milk for is most fair cheese-making. The Babcock tester is the cheese-makers' best guide in paying for milk. This belief was held and taught by the authorities of this Station sixteen years ago, after a most exhaustive study of milk and its constituents in their relation to butter-making and cheese-making; and for a time use of the Babcock test in cheese-factories gained favor.

But one pound of fat in 5 per ct. milk will not make quite so much cheese as a pound of fat in 3 per ct. milk; hence the producers of milk low in fat claimed that the method of payment by weight of fat alone is unjust to them. Such milk producers are, unfortunately, usually numerous in cheese-making sections and their influence has led to the abandonment of the Babcock test in many New York State cheese-factories.

We believe this a lamentable error in judgment. Criticism of this test because it did not measure exactly the quantity of product may have been justified when we knew less of the factors that affect cheese quality; but all recent careful investigations along this line,—at this Station and those of Wisconsin, Iowa and Minnesota, and by the best dairy students of Canada and of
the U. S. Department of Agriculture and by commercial cheese-handlers,—confirm the teaching that any deficiency in quantity of cheese made from rich milk is more than compensated for by added value of the product due to improved quality. That is, 4½ per ct. milk will not make quite one half more cheese than 3 per ct. milk, but, for 100 pounds of milk, about 0.7 of a pound less than such an increase (11.74 lbs. and 8.30 lbs. respectively, in actual yield; 12.45 lbs. and 8.30 lbs., as paid for by the Babcock test). This is, apparently payment to the seller of rich milk for 0.7 pound of cheese, say 8 cents, more than his milk makes; but, as Prof. Robertson, Canada's leading dairy authority, and others figure it, each pound of the 11½ pounds of richer cheese is worth almost a cent a pound more than that made from the poorer milk, hence the seller of rich milk adds 10 cents or more of quality to make up for 8 cents apparent over-payment for quantity.

Use of this method removes all temptation to skim or to water milk, since each producer is paid for the amount of fat he brings, whether it be in 60 pounds of milk or in 125 pounds. It encourages improvement in the character of the milk produced; and such improvement results in economy of production and increased profit. Until a very high limit is passed, it is certain that the pound cost of fat production decreases as the percentage of fat in the milk increases. Such improvement in milk means improvement all along the line and leads to better farms and better farmers.

Criticism of the method of payment on the "fat content" basis was doubly unfortunate in that it seemed, to those ignorant of the subject, to imply defects in the Babcock test itself; so that any change meant abandonment of all testing and return to the old "weight-of-milk" method, the worst possible method of paying for milk for any purpose.

This method is detrimental to almost every dairy interest; and is most unfair to those who should be most encouraged, the producers of fat-rich milk. Economy in production, good dairying and general prosperity are promoted by every movement that improves the quality of our herds.
The weight-of-milk method is inherently unfair in that it assumes that the same amount of cheese can be made from each hundred pounds of milk, while really the amount may vary from 8 to 13 pounds even with normal milk, and skimmed or partially skimmed milk may yield only 5 or 6 pounds to the hundred.

This unjust discrimination tends toward the production of milk low in fat; and not infrequently to downright criminality in lowering the fat, either by skimming or by dilution. Cheese made from milk of low fat content can not be of highest quality, so that, ultimately, both reputation and sale of the product are affected and dairy interests, generally, suffer.

The fat and other solids in milk, though they may vary somewhat in their relations one with another, have, on the whole such fixed and narrow limits of variation, that, if the fat be known, the others can be very easily determined or can be calculated with surprising accuracy. This makes possible some modifications or adaptations in methods of payment based on fat determination, any one of which is greatly preferable to the weight-of-milk method.

Probably best of these methods, and second only Paying by to the milk-fat method in simplicity, accuracy relative value and fairness, is one devised by Dr. Babcock of of cheese-solids. Wisconsin, formerly of this Station. This method considers the yield of cheese from different milks as affected by the cheese solids contained in the milks and gives to the fat a value 6.6 times as great as the casein, sugar, ash, etc. The fat content of each patron's milk is found by the Babcock test and the specific gravity of the milk determined by a simple lactometer. From careful studies a table has been made out to be used with this method which gives factors for milk with different fat content and specific gravity; so that calculation of dividends is little if any more difficult than by the simple fat-test method. The results secured in this way differ so slightly from those secured by the milk-fat method that it is difficult to see wherein the disadvantage in the use of an additional test, the lactometer, is made good. The method has, however, the general advantages of the milk-fat method in paying for the solids of the milk in proportion to their value in cheese-making.
A favorite Canadian method started as a "fat-plus-one" method, but after some study was modified to a "fat-plus-two" method. By this system the percentage of fat is increased by two, which is considered the average percentage of casein in milk, and the results used the same as in making dividends on the fat basis. This system is an attempt to approximate the yield of cheese as a basis for making dividends. It allows payment for two pounds of casein, in addition to fat, in the case of all milks. The following objections are made to this method: 

(a) It considers yield of cheese alone and not quality. 
(b) It does not recognize any casein in milk above 2 per cent., though milks richer in fat are known to contain, in general, more casein than milks containing less fat. 
(c) This method is in the interest of the producer of poor milk at the expense of the producer of richer milk. 
(d) It offers a premium on watering and skimming milk. 
(e) It is in opposition to the teachings of Robertson, Babcock and many other recognized authorities, so far as it works in favor of poor milk at the expense of richer milk.

Another method, which has been recently proposed, requires the use of a special casein test; and no really simple, wholly satisfactory test of this kind has yet been published. Under this system the percentages of fat and casein in each patron's milk are added and the figures thus obtained are used in distributing dividends. This method has the advantages of being an accurate measure of cheese yield and of removing temptation to water milk. It has the following disadvantages: 

(a) When carried out in the most complete manner, it involves making a casein test in addition to a fat test, requiring extra time, labor and cost. 
(b) It does not recognize any difference in the quality or value of cheese made from milks containing different percentages of fat. 
(c) It offers a temptation to skim milk. 
(d) It places the value of casein on a par with that of milk-fat, contrary to the teachings of Babcock, and encourages the production of milk with higher percentages of casein relative to fat. 
(e) From results obtained in applying this method to data obtained in case of a representative New York cheese-factory, the changes
made in the distribution of dividends would be insufficient to justify the extra expense involved in making a casein test, in comparison with the milk-fat basis. In this factory, half or more of the change in dividends would be consumed in the cost of the additional testing necessary, leaving the amount to be re-distributed only 1 cent on each $5.00 of dividends. Under such circumstances it is not at all likely that the 27 patrons whose dividends are lowered would vote for the change nor the 23 men benefited ask it, when the relative high cost of making a re-distribution is understood.

If casein were assigned one-fourth the value of milk-fat, in harmony with Babcock’s relative value plan for cheese yield and solids, and if this value, added to that of milk-fat, were used in making dividends, we should get results essentially like those given by the milk-fat basis. Under such circumstances, the cost of making a casein test would be practically thrown away.

The percentage of casein in milk can be approximately calculated when the percentage of milk fat is known. Casein thus estimated could be used with fat in making dividends without the cost of a casein test. Such a method considers only quantity and not quality of cheese but, apart from this fundamental weakness, possesses the following advantages: (a) It is preferable to the fat-and-casein method, in that no extra expense is required for making a casein test. (b) It is more fair than the “fat-plus-two” method, since richer milk would be credited with more casein than poorer milk. (c) All temptation to water or skim milk would be wholly eliminated. (d) No additional labor is involved in making dividends, as compared with the milk-fat basis.

On the basis of the points discussed in the preceding pages, the following suggestions are made in the interest of those dairymen in New York State who produce milk for the manufacture of cheese:

Suggestions. The exclusive use of the milk-fat basis is advised, since it is the method which takes into consideration composition and
quality of cheese in connection with yield of cheese, thus pro-
viding an equitable and simple system.

(2) The method of distributing dividends on the exclusive
basis of the weight of milk delivered should be abolished, since it
is open to many objections of the most serious character.

(3) In those cases in which it is found impossible to introduce
the milk-fat basis, any of the following methods will be found
greatly superior in fairness to the weight-of-milk system, prefer-
ence being in the order given: (a) Relative values of fat and
other cheese-solids, based on yield and composition of cheese, as
proposed by Babcock; (b) amount of fat and calculated casein
in milk; (c) fat-plus-two.

(4) The cheese-makers of New York are advised not to attempt
to introduce any method of testing for casein until its practicability
has been fully established beyond all doubt.