Milk Pricing Bases
methods of pricing manufacturing and market milk suggested

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The following article is the second in a two-part report on a study of the pricing of milk on the basis of fat and skim milk.

Milk pricing practices followed in the dairy industry should depend on the association between milk composition—fat and nonfat solids—and the related values in utilization.

Pricing of milk, therefore, requires besides the accurate measurement of the initial milk components—the measurement of the net value of milk in a given operation. As the raw milk changes in composition, information must be available about the relationship between milk composition and physical yields as well as product prices and processing costs.

The net value of 100 pounds of milk of a given composition in a given use can be determined. It is equal to the gross sales value of the resulting products minus the associated processing and marketing costs. Since specific standards have been established by state and federal governments for the fat, nonfat solids, and moisture content of nearly all dairy products, it is possible to estimate the product yields from 100 pounds of milk when reasonably accurate measurements of the raw milk components are available.

By employing the California relationship between nonfat solids and fat in whole milk—nonfat solids \( = 7.07 + 4.44 \) fat—to estimate nonfat solids content in 100 pounds of milk of a given fat test, product yields can be expressed as simple linear functions of the original fat test.

An illustration of the development of these yield equations and their application to pricing formula is given in the box on the bottom of this page.

The milk prices developed in this report are for the plant location, but farm prices can be determined by subtracting the transportation costs per 100 pounds of milk from the plant price schedule. Although some existing hauling rates are

Concluded on page 14

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**EXAMPLE OF BUTTER-POWDER OPERATION**

The terms in the first line of the table (1.23F - 123 and 7.17 + 441F) represent the pounds of butter and dry nonfat solids that can be produced from 100 pounds of milk having a fat test of F%. These yields take into account an 80% fat standard for butter, the fat remaining in the skim milk, and reasonable physical losses. Buttermilk solids have been aggregated with the skim milk solids.

The terms \( P_b \) and \( P_n \) (Pb-Cn) are net prices for butter and dry nonfat solids—equal respectively to the plant selling price minus direct costs of processing per unit of product. The term \( C_b \) is the receiving and separating costs per 100 pounds of milk—assumed not to vary with the fat test. When the physical yields are multiplied by these net prices and \( C_n \) is subtracted from the sum of the product net values, the net value of 100 pounds of milk is obtained. This is given in the column General Results.

The equation \( P = \$4.41 + .80F \) in the column Special Results is obtained when the specific prices and costs are substituted in the general net value equation. When the value of F is known for a given lot of milk, the price per 100 pounds of this milk can be secured by substitution for F in this equation. For \( F = 5\% \), \( P = \$4.94 \).

Development of product yields in an evaporated milk operation are more complicated since the standards for the product specify both fat and nonfat solids content. By-products of dry nonfat solids or butter could result if the fat-nonfat solids ratio in the raw milk is too high or too low compared with the standard for evaporated milk. The equations in the table are interpreted in a manner similar to that explained above for the butter-powder operation. Evaporated milk yields are expressed in cases, while all other products are given in pounds.

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**Price Relationships for Manufacturing Milk**

<table>
<thead>
<tr>
<th>Operation</th>
<th>General results*</th>
<th>Special example†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butter and dry nonfat solids</td>
<td>( P = (1.23F - 123)(P_n - C_n) + (7.17 + 441F)(P_n - C_n) - C_n )</td>
<td>( P = $4.41 + .80F )</td>
</tr>
<tr>
<td>Evaporated milk</td>
<td>( BFD = .123(P_n - C_n) + .044(P_n - C_n) )</td>
<td>( BFD = $0.080 )</td>
</tr>
<tr>
<td>(a) For F less than 3.9</td>
<td>( P = (2.29F - .023)(P_n - C_n) + (7.14 - 1.85F)(P_n - C_n) - C_n )</td>
<td>( P = $4.17 + 1.13F )</td>
</tr>
<tr>
<td>By-product of dry nonfat solids</td>
<td>( BFD = .029(P_n - C_n) - 1.85(P_n - C_n) )</td>
<td>( BFD = $0.113 )</td>
</tr>
<tr>
<td>(b) For F greater than or equal to 3.9</td>
<td>( BFD = .013(P_n - C_n) + 1.24F - 4.78(P_n - C_n) - C_n )</td>
<td>( BFD = $0.082 )</td>
</tr>
<tr>
<td>By-product of butter</td>
<td>( BFD = .0013(P_n - C_n) + .124(P_n - C_n) )</td>
<td>( BFD = $0.085 )</td>
</tr>
<tr>
<td>40% cream and Separated skim milk</td>
<td>( P = (2.48F - .248)(P_{40} - C_{40}) + (99.248 - 2.48F)(P_n - C_n) - C_{40} )</td>
<td>( P = $7.94 + .85F )</td>
</tr>
</tbody>
</table>

* Symbols mean: \( P \) (price of 100 pounds of milk); \( F \) (fat test of milk); \( BFD \) (butterfat differential or the value change of milk for .1% change in fat); \( C_r \) (joint costs of receiving and separating 100 pounds of whole milk—assumed equal in all operations even though separating costs would vary slightly); \( P_b \), \( P_n \), \( P_{40} \) (selling prices for butter, dry nonfat solids, evaporated milk, 40% cream and skim milk—all on a pound basis, except evaporated milk with the 49-1/2 oz. case as its unit); \( C_{12} \), \( C_{24} \), \( C_{20} \) (direct processing costs associated with the defined products and on the same weight-unit basis).

† For the special example, the following arbitrary values for the variables were employed:

\( P_b = \$4.45 \) \( P_n = \$1.70 \) \( P_{40} = \$6.25 \) \( P_{20} = \$5.30 \) \( P_{40} = \$5.109 \) \( C_n = \$2.00 \)

\( C_{12} = \$0.50 \) \( C_{24} = \$0.70 \) \( C_{20} = \$0.05 \) \( C_{20} = \$0.008 \) \( C_{20} = \$0.010 \)

* Yields of products are given in the parenthetical expressions containing the symbol F, the specific product in each case being indicated by the subscript immediately following (thus, F followed by \( P_b \) indicates yield of butter).

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**CALIFORNIA AGRICULTURE**

Progress Reports of Agricultural Research, published monthly by the University of California Division of Agricultural Sciences.

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on a per-pound-fat basis, it is believed that such rates treat high and low fat producers inequitably and that hauling rates should be related to pounds of whole milk—or cans of whole milk—and not to pounds of milk fat.

This section deals with procedures that might be employed in establishing the Class I prices for milk fat and for the skim milk. However, the previous developments might be used in the pricing of surplus over Class I.

Accepting the established base price for 100 pounds of milk of 3.8% fat test, the price schedule for other tests of milk must be determined.

Fluid milk operations are different from plant to plant because of the diversity in the composition of output. This variability prevents one from employing a simple net-value approach to the Class I pricing problem. Consequently, one must seek some economic factors in the dairy industry which might be employed as indicators of the values of milk fat and skim milk in Class I uses. Two procedures of approaching this problem are given in the table on this page.

The first procedure assumes that the relative prices of all dairy products tend to remain fairly stable through utilization shifts and that the relative values of fat and skim milk in some other alternative dairy operation should be a fair indicator of the relative values of these components in fluid uses. The relative values of these two components could be determined for milk of 3.8% fat test when used as an alternative dairy operation and then applied to the basic Class I whole milk price to determine separate values for Class I fat and skim milk in 100 pounds of base test milk. Prices per pound of Class I fat and skim milk would be secured by dividing the latter values by the 3.8 and 96.2 pounds of fat and skim milk in a hundredweight of 3.8% milk, respectively.

If the nonfat solids content of the skim milk should be reflected in the Class I skim milk price, then the skim milk price should be converted to a nonfat solids value. The conversion factor would be .9687.90. This value could be applied to the nonfat solids content of skim milk at other fat tests to secure the entire Class I whole milk pricing schedule.

If, on the other hand, the value of skim milk for Class I uses is not affected by differences in nonfat solids content, then the initial component prices should be applied directly to the amounts of fat and skim milk per 100 pounds of whole milk to get the Class I pricing schedule.

The second procedure recognizes that sanitary and institutional barriers in the Grade A market as well as fairly rigid Class I product prices relative to other dairy products tend to reduce the validity of the first procedure. The second procedure employs a price indicator in the Grade A market which is free of administr-