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Milk or Cream, Which is More Profitable for South Dakota Farmers and Creameries?

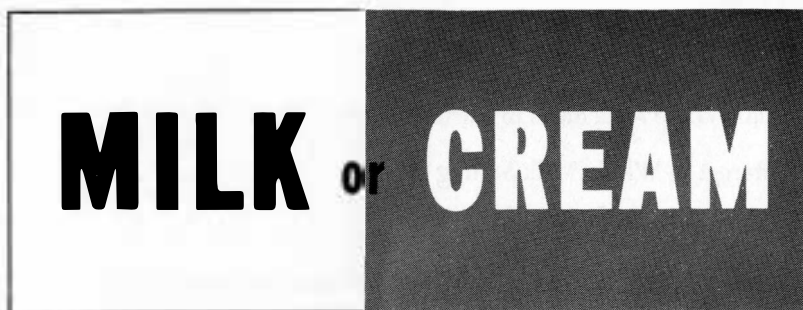
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*Which is more profitable for
South Dakota farmers and creameries?*

ECONOMICS DEPARTMENT
AGRICULTURAL EXPERIMENT STATION
SOUTH DAKOTA STATE COLLEGE, BROOKINGS

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FOREWORD

This report is one of a series of coordinated studies of dairy marketing problems in the Northern Great Plains. These studies have been made by various states cooperating in the North Central Regional Committee on Dairy Marketing Research (NCM-12) and financed partly by regional research funds. The Plains States subcommittee, consisting of representatives on the regional committee from South Dakota, North Dakota, Nebraska, Kansas, and Iowa, has had primary responsibility for this research. This research has focused on the general problem of economic adjustment in the dairy industry in areas of sparse production.

The adjustments being considered include those which can be made in farm handling practices for milk and cream, which are related to cream quality; in methods of milk and cream assembly; in price payments and price relations; in the form in which milk is sold off farms; and in the processing and merchandising of dairy products. The objective of the research is to determine the economic feasibility and desirability of these various adjustments.

The following publications have concerned one or more of the phases of this study:

"Dairy Marketing in the Northern Great Plains—Its Patterns and

Prospects," by Ernest Feder and Sheldon W. Williams, North Central Regional Publication No. 47, S. D. Agr. Exp. Sta. Bul. No. 438, May 1954. This report describes the general importance and economic role of the dairy industry in the area; points out significant differences between marketing butterfat in this and other areas of the United States; analyzes variations in marketing within the area; and appraises the future of the industry with emphasis on the problem of shifting from farm separated cream sales to whole milk sales.

"Great Plains Dairy Data," statistical supplement to "Dairy Marketing in the Northern Great Plains," mimeographed, containing about 50 tables with statistics on dairy production and marketing by states or dairy areas.

"North Dakota's Dairy Marketing Problems in Historical Perspective," by L. A. Fourn and G. A. Kristjanson, N. D. Agr. Exp. Sta. Bul. 393, June, 1954. This bulletin describes and explains the development of conditions and practices in the marketing of dairy products in North Dakota and the concentration of the marketing of butterfat in the form of farm separated cream.

"Quality Aspects of Butter Marketing in South Dakota," by E. Feder, D. F. Breazeale, and R. New-

berg, S. D. Agr. Expt. Sta., Bul. 443, April, 1955, describes and analyses the quality of South Dakota creamery butter, its relation to procurement, processing, and marketing practices, and sales agreements and prices received by plants for butter shipments of various qualities. Quality is expressed in terms of federal grades, or various physical or

chemical analyses, and the relationship between them is examined.

Other studies now under way will deal with "Costs of Butterfat Assembly through Truck Routes," "Resource Productivity in Kansas-Nebraska and Northern Dairy Plants," and "Farmers' Methods and Costs of Marketing Cream, and Their Relation to Quality."

MILK or CREAM

Which Is More Profitable for South Dakota Farmers and Creameries?

TRAVIS W. MANNING, RALPH FELBERG, and R. L. KRISTJANSON¹

Introduction

Several South Dakota creameries have shifted from farm separated cream to whole milk procurement. Others are considering such a shift. Is such a shift feasible? Will it bring more income to plants and farmers? These are the types of questions this study was designed to answer.

Only one South Dakota creamery was receiving manufacturing milk when this study was begun. Its operations were begun as a means of providing a market for surplus fluid milk in the Sioux Falls milk shed. Creameries in the area surrounding the milk shed became interested in whole milk operations because some farmers were shifting to whole milk and selling to the Sioux Falls plant. Other farmers expressed an interest in selling whole milk rather than cream.

About 20 creameries held a series of meetings in 1953 and 1954 to consider shifting to whole milk. An engineer was engaged to draw up

plans for a centrally located milk drying plant. Costs of equipment for shifting to whole milk handling within the creameries were considered. The cost estimates which emerged in these meetings were so high that the creameries decided to delay further consideration indefinitely.

South Dakota creameries have been concerned about low quality and low prices for butter for several years. The publication of a bulletin on butter quality increased interest in this problem.² This, in turn,

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The authors wish to thank the managers of the cooperative creameries for contributing so much of their time to make this study possible. The authors also acknowledge the valuable assistance given them by Leonard Benning, Extension Dairy Marketing Specialist.

²Ernest Feder, Delbert F. Breazeale, and Richard Newberg, "Quality Aspects of Butter Marketing in South Dakota," South Dakota Agricultural Experiment Station Bulletin 443, 1955.

brought about renewed interest in whole milk operations as a partial solution to the quality problem.

During 1955, the Sioux Falls milk producers' association decided to establish a milk drying plant at Sioux Falls. The management invited surrounding cooperative creameries to cooperate with them in the undertaking because the management did not feel that it had sufficient volume to operate the plant efficiently on a year-around basis,

At about the same time a Minnesota cooperative creamery decided

to expand its milk drying operations. It also sought additional volume among South Dakota creameries.

This solved the problem of an outlet for skimmilk. When this outlet for skimmilk became available many creameries immediately became more interested in shifting to whole milk. Even with an available market for skimmilk the managers of some of the creameries did not feel that this was a profitable move. However, they felt that competition among creameries for butterfat supplies was forcing them to take such action.

Objectives

Many of the events mentioned took place while this study was in progress. Because of this, the nature of the problem changed while the study was under way. Consequently, it was necessary to modify the objectives of the study after it was started. These objectives were:

- (1) To determine the adequacy of butterfat supplies for processing plants to operate on a whole milk basis of procurement in eastern South Dakota.
- (2) To compare the costs of processing whole milk with those of cream in butter plants.
- (3) To compare returns from butter and its by-products made from whole milk with those made from cream.
- (4) To determine the relative advantages to farmers of selling whole milk as compared with selling cream and using skimmilk on farms.

Scope of Study

A preliminary survey of 23 cooperative creameries in eastern South Dakota and southwestern Minnesota was made in the spring of 1955. They were selected on the basis of previously indicated interest in whole milk operations. Most of the

creameries were located within a 65-mile radius of Sioux Falls.

Information was collected concerning the current interest of the creameries' managers and patrons in whole milk operations, tentative plans for utilizing skimmilk, esti-

mated costs of converting plants for handling whole milk, patronage, butter production, procurement methods, and trucking charges and costs. Copies of annual statements were obtained where available.

Five of the 23 creameries surveyed were selected for a cost study. They were selected on the basis of volume of butter production, adequacy of cost records, and willingness to cooperate in the study. Annual butter production of the five creameries was approximately 200,000 pounds for the first, 400,000 pounds for the second, 600,000 pounds for the third and 1,200,000 pounds for the fourth and fifth. This represented fairly closely the range of business volumes among all South Dakota creameries. All of the five creameries studied had diversified operations. They handled other products such as poultry and eggs. This added to the complexity of cost analysis.

Detailed cost records were obtained from the creameries and a uniform method of cost analysis was used. Butter manufacturing costs and cream procurement costs were determined by analysis of expense records and consultation with managers regarding cost allo-

cations. On the basis of these analyses, a new operating statement was calculated for the butter department of each creamery.

An equipment plan for whole milk operations was drawn up for each creamery. The managers obtained net cost figures on needed new equipment from equipment salesmen. The lowest cost combination of equipment adequate for handling whole milk was used in each case as far as practicable. Depreciation costs, interest, repair costs, and property taxes were estimated for the new equipment. Minor building alterations were required in three of the creameries. These costs were estimated and added to annual building costs.

A careful analysis was made for each creamery of the additional costs expected to arise from handling whole milk. Costs of additional labor, supplies, fuel, electricity, water, and sewage were estimated.

New operating statements were drawn up on the basis of the estimated new costs and returns. Gross returns were estimated on the basis of prices for Grade A butter³ and net prices offered for skim milk by drying plants.

Potential Whole Milk Sales in Eastern South Dakota

The preliminary survey of creameries in South Dakota and Minnesota included one whole milk plant and 22 plants receiving farm separated cream. The whole milk plant provided much useful information

on problems of conversion and operating on a whole milk basis.

³This represents an improvement in quality. The assumption is made that creameries will be able to produce Grade A butter from whole milk.

Two Minnesota creameries were included because of their previous cooperation with the group of creameries interested in whole milk and because they were in the supply area centering around Sioux Falls.

Interest in Whole Milk Selling

Seventeen of the 22 creameries receiving farm separated cream indicated an interest in shifting to whole milk. The five creameries which had little or no interest were low volume plants without much capital. Some of the managers who were interested in whole milk operations were not enthusiastic about it. Competition for patrons was keenly felt and most managers seemed to feel that this competition was forcing them toward conver-

sion to whole milk. Furthermore, many were afraid that if they hesitated and their competitors shifted first they would lose their best patrons. This could lead to unhealthy results because of hasty planning or conversion where conditions do not warrant a change.

Many of the managers admitted to having little knowledge about their patrons' desires to sell whole milk. Eight managers believed that substantial numbers of their patrons were interested in whole milk, five managers reported some interest among patrons, four said there was no interest, and five did not know. In no case did a manager report that he could make even a rough estimate of whole milk supply.

Milk and Cream Production

The creameries surveyed received most of their butterfat from 21 counties, 18 of which were located in South Dakota and 3 in Minnesota (see figure 1). These creameries bought 8.9 million pounds of butterfat in cream in 1954 (see table 1). Farmers in these counties sold 16.3 million pounds. The creameries, therefore, handled about 55 percent of the cream sold in their supply areas.⁴

Potential whole milk sales for any given future year would be difficult to predict. Farmers in the 21-county area sold 115.1 million pounds of whole milk in 1954, most of which was for fluid milk use.⁵ If

Table 1. Cream Purchases by 22 Cooperative Creameries Compared with Cream Sales of Farmers in 21 Counties in South Dakota and Minnesota, 1954

	Cream Sales in 21 Counties (000 lb.)	Cream Purchases by Coop Creameries (000 lb.)
Pounds of		
Butterfat	16,305*	8,885†
Whole Milk		
Equivalent‡	448,592	244,547

*County data were obtained from the 1954 census of Agriculture and furnished by the South Dakota and Minnesota Crop and Livestock Reporting Services.

†Cream purchases were estimated from butter sales for five creameries.

‡Milk equivalent for 18 South Dakota counties was calculated on the basis of average 3.65 percent milk reported for South Dakota for 1954. Milk equivalent for Minnesota counties was reported for each county separately.

⁴Density of cream and milk production in the area studied is very similar to the density of production in western Minnesota, western Iowa, and eastern Nebraska.

⁵United States Census of Agriculture, 1954.

the milk equivalent of cream sold by farmers (448.6 million pounds) were added, total milk sales would be 563.7 million pounds, of which about one-fifth would be needed for bottling purposes. A 50 percent shift from cream to milk would yield about 225 million pounds of manufacturing milk. This figure might be expected given 3 to 5 years for shifting and with satisfactory prices for milk in relation to cream.

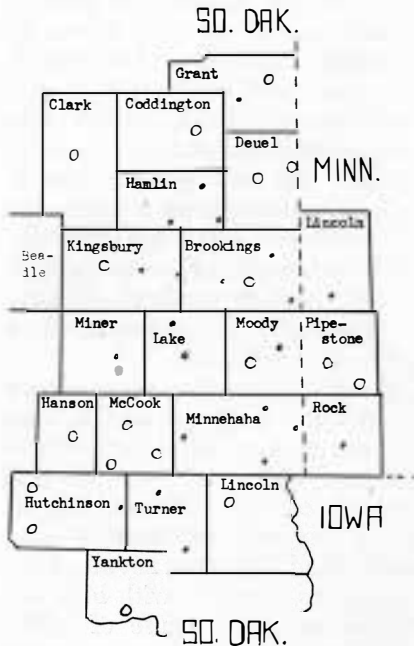
The prices of hogs and other livestock to which skimmilk is fed on the farm will affect both the rate and extent of shift from cream to milk selling.

The pattern of agricultural price relationships during 1955 apparently affected many producers' preferences for selling whole milk. Low hog prices convinced many farmers that skimmilk was worth very little for feeding hogs. According to recent reports some farmers with few cows (five or less) have discontinued dairy operations. Also, many farmers, milking several cows, have shifted to whole milk where markets for it existed. Some of the managers of creameries that shifted to whole milk reported that farmers who shifted increased their production. The labor saved by not separating cream was applied to the milking of more cows. There was a suggestion of a shift away from milking beef and dual purpose cows to specialized dairy breeds.

Changes in rate of production may very well accompany shifts to milk selling in the future. If prices of dairy cattle and milk remain favorable, a definite trend to higher

producing breeds may develop. Some shift from corn-hogs to dairy-pasture production may occur if relative prices remain favorable for such a shift over a period of 2 or 3 years. Such a shift may not be permanent but it is considerably more difficult to shift out of dairying than to shift into it. Continued price supports on dairy products with none on hogs or beef cattle may bring some shift in production as farmers attempt to lessen risks and stabilize their incomes.

Figure 1. Procurement area of the creameries studied.



• Location of creameries interviewed

○ Other creameries in area
(1 cheese plant)

Costs and Returns for Creameries Using Farm Separated Cream

The five creameries selected for cost analyses varied in volume of butter production in 1954 from about 200,000 to about 1,200,000 pounds. All of them were diversified to some extent. These variations in volume and diversification made thorough cost analyses essential. No uniform practices were followed by the creameries in allocating either joint costs or overhead costs.

In making the cost analyses a system was devised for allocating various costs. Direct costs were charged to the products involved. Joint costs were divided as nearly as possible on the basis of use (e.g. where an assembly truck was used two-thirds for cream and one-third for eggs, the costs were divided in the same proportions). Overhead costs were divided into two groups, specific and general overhead costs. Specific overhead costs (e.g. property taxes on equipment) were charged to the products involved. General overhead costs were apportioned on the basis of net sales.

A second allocation was made for comparative purposes on the basis of gross margins. The second allocation was judged inferior to the first because of the arbitrary way in which gross and net margins were determined. Most, but not all, of the creameries operated with high net margins at the expense of initial payments to patrons. Adjustments in payments were made at the end of the year by patronage refunds. Patronage refunds, as related to

either purchases or sales varied widely between different lines of products within each creamery.

Operating costs were based upon expense records and audit reports. Managers were consulted about utilization of labor, space, equipment, and supplies.

Operating Costs

Operating expenses varied from 10.45 cents per pound of butter for the smallest plant to 4.10 cents for the largest (see table 2). Several factors influenced this variation. Efficiency of labor utilization varied inversely with output. Creamery "A" had unusually high labor costs, partly because most of the butter was printed and packaged manually. Other variable manufacturing expenses varied considerably among the creameries, but for a variety of reasons. Utility rates varied by location. Fuel consumption varied by boiler efficiency and extent of utilization by other departments.

The most important element of fixed manufacturing costs was depreciation. Four of the creameries had considerable unused production capacity. However, much of the equipment had been fully depreciated on the books even though it was in good condition.

Depreciation was not estimated on any other basis because (1) original cost records were not always available, (2) prices had changed considerably since their purchase, (3) in some cases com-

Table 2. Operating Costs for Butter Made from Farm Separated Cream, Five Cooperative Creameries, South Dakota, Fiscal Year 1954

Cost Items	Operating Costs of Creameries					Simple Average
	A	B	C	D	E	
(Cents per pound of butter)						
Manufacturing expenses						
Variable						
Labor	2.98	1.70	1.86	1.47	1.22	1.85
Payroll taxes .....	.08	.04	.04	.04	.02	.04
Supplies .....	.80	1.28	1.14	.83	.82	.97
Fuel .....	.81	.26	.19	.16	.12	.31
Elec., water and sewage ...	.50	.36	.24	.16	.08	.27
Miscellaneous .....	.00	.02	.05	.06	.08	.04
Total variable mfg. exp.	5.17	3.66	3.52	2.72	2.34	3.48
Fixed						
Rent .....	.00	.01	.00	.01	.00	*
Depreciation	1.95	.78	.45	.33	.23	.75
Repairs and maintenance ..	.14	.28	.20	.14	.33	.22
Property taxes .....	.31	.12	.06	.06	.06	.12
Insurance, license & bond	.40	.13	.04	.10	.07	.15
Total fixed mfg. exp.	2.80	1.32	.75	.64	.69	1.24
Total manufacturing expense ..	7.97	4.98	4.27	3.36	3.03	4.72
General and administrative expenses						
Salaries and fees	1.36	.47	.69	.43	.53	.70
Office supplies and postage	.17	.08	.10	.12	.09	.11
Telephone and telegraph...	.07	.04	.05	.03	.05	.05
Bank exchange .....	.03	.04	.11	.12	.10	.08
Depreciation—office .....	.09	.02	.03	.02	.03	.04
Audit and tax service .....	.12	.01	.03	.04	.02	.04
Education and meetings ..	.07	.00	.15	.00	.04	.05
Quality improvement .....	.00	.04	.07	.00	.05	.03
Advertising .....	.16	.02	.05	*	.03	.05
Payroll taxes .....	.04	.01	.01	*	.01	.01
Interest .....	.14	.00	.19	.00	.00	.07
Miscellaneous .....	.23	.10	.10	.02	.12	.12
Total general and adm. exp.	2.48	.83	1.58	.78	1.07	1.35
Total operating expense	10.45	5.81	5.85	4.14	4.10	6.07
Annual butter production (000 lbs.)	200	400	600	1,200	1,200	720

*Less than .005 cent.

parable models were no longer on the market, and (4) there was no satisfactory basis for estimating the usable life of a piece of equipment.

The figures for depreciation cost shown in table 2 are accounting costs and are not very accurate in describing the efficiency of plant and equipment utilization. Creamery "E" had more equipment than creamery "D," for example, but more of its equipment was fully depreciated, which resulted in lower apparent costs. Despite these shortcomings, the effects of variations in utilization of capacity appeared in the figures. This is shown by the decline in depreciation expense from 1.95 cents per pound of butter for creamery "A" to 0.23 cent for creamery "E."

General and administrative expenses were quite burdensome for two of the creameries. Office and management salaries were high in these two cases, being 1.36 cents per pound of butter for creamery "A" and 0.69 cent for creamery "C." Costs of education, meetings, and quality improvement varied considerably. However, some of these expenses might be regarded as investments in good will and improved product quality.

Income and Returns to Patrons

Income from butter sales varied from 57.14 cents per pound for creamery "B" to 58.86 cents per pound for creamery "A" and 58.90 cents for creamery "C" (see table 3). Creamery "A" sold most of its butter in 1-pound prints, which accounts for the higher price. Creamery "C" sold a considerable propor-

tion of its butter unsalted through special outlets and received better than average prices. All five creameries reported that their butter averaged 91 score, or a high U. S. grade B.

There did not seem to be much opportunity for obtaining higher prices by improving butter quality. During most of the year grade A and grade AA butter brought little more on the wholesale market than did a high grade B (91 score). Obtaining better prices for better quality butter would require some extra effort to exploit and develop new markets. This would be a difficult undertaking for a single creamery unless it could supply a substantially larger volume than could any of the creameries studied. Such an undertaking might be achieved by two or more creameries working together and selling under a common brand.

Cost of sales were fairly uniform among the five creameries. This was expected because all operated under similar competitive conditions. Hauling costs per pound of butter were highest for the low volume creamery. The second highest was one of the larger creameries, the only creamery which operated exclusively with contract trucks and picked up only cream. All of the others picked up both cream and eggs on the same routes.

Net margins on butter operations varied from a net loss of 0.16 cent per pound for the lowest volume creamery to a net gain of 6.8 cents for one of the highest volume creameries. Net margins varied not only because of variations in oper-

ating costs but because of variations in receipts for butter and payments to patrons.

A more realistic view of the net operating results was obtained by combining net margins with payments to patrons for butterfat. This showed a strong correlation with volume. The net available for payments to patrons varied from 45.98 cents per pound of butter after hauling costs were paid for creamery "A" to 52.29 cents for creamery "E." The range was from 57.02 cents to 64.84 cents per pound of butterfat, assuming a 24 percent overrun.

The variations in operating costs and net available for payment to patrons indicated considerable room for improvement of efficiency among some of the plants. Most of the plants were operating well below capacity. It seemed that almost anything which would increase volume would contribute to efficiency. Most of the plants could ill-afford a decline in volume. This, possibly, explains the interest in whole milk operations as a means of increasing volume, thereby improving efficiency in butter production.

Table 3. Returns and Costs for Butter Made from Farm Separated Cream, Five Cooperative Creameries, South Dakota, Fiscal Year 1954

	Returns and Costs for Creameries					Simple Average
	A	B	C	D	E	
(Cents per pound of butter)						
Sales						
Butter sold	58.86	57.14	58.90	57.36	58.31	58.11
Inventory adjustment	— .40	— .19	— .02	.09	— .17	— .14
Butter manufactured	58.46	56.95	58.88	57.45	58.14	57.97
Buttermilk .....	.27	.06	.25	.16	.24	.20
Total sales	58.73	57.01	59.13	57.61	58.38	58.17
Cost of sales						
Butterfat	46.14	44.77	45.65	45.26	45.78	45.52
Hauling cost	2.30	1.73	1.81	1.41	1.99	1.85
Total cost of sales	48.44	46.50	47.46	46.67	47.77	47.37
Gross margin	10.29	10.51	11.67	10.94	10.61	10.80
Operating expenses						
Manufacturing exp.	7.97	4.98	4.27	3.36	3.03	4.72
General and Adm. exp.	2.48	.83	1.58	.78	1.07	1.35
Total operating exp.	10.45	5.81	5.85	4.14	4.10	6.07
Net margin	— .16	4.70	5.82	6.80	6.51	4.73
Annual butter production (000 lbs.)						
	200	400	600	1,200	1,200	720

Estimated Costs and Returns for Creameries Under Whole Milk Operations

In addition to the analyses of actual butter making costs of the five creameries in 1954, estimates were made of costs which might have been incurred if whole milk had been used. These estimates involved setting up models for each plant and budgeting costs.

An equipment plan was drawn up for each plant. These plans were made in consultation with the respective managers. In several cases equipment orders were actually placed according to the plans. Equipment prices were obtained from the companies selling the equipment. Models and sizes of equipment were selected which would handle an amount of milk equivalent to at least 50 percent of each creamery's 1954 butterfat receipts. Total equipment costs were minimized insofar as possible.

Operating plans were drawn up and costs of labor, fuel, utilities, supplies, and other items were estimated. Managers were relied upon to make careful estimates for each of the items. Finally, the costs were analyzed and are presented in a manner comparable to those in the previous section.

Facilities Needed for Whole Milk

All of the creameries needed some new equipment for handling whole milk. The most common items needed were dump tanks, weight cans, surge tanks, separators, plate coolers, and storage tanks. Other equipment which some of the

creameries lacked included can conveyors, can washers, pumps, piping, and pasteurizing vats. Three of the creameries needed minor alterations. This involved moving a wall in one case. In the others, it involved primarily plumbing and electrical wiring. All of the plants had adequate boiler capacity for whole milk operations.

Cost of new equipment varied from \$11,950 for creamery "D" to \$32,600 for creamery "B," with an average cost of \$24,410 (see table 4). These figures represent the cost at 1955 prices of new equipment necessary for handling a volume of milk equivalent to at least one-half their 1954 cream receipts.

Two creameries did not need building alterations except the minor changes involved in installing equipment. For the three that needed alterations, the costs were estimated at \$500, \$1,800, and \$2,500. This raised the total cost to \$25,370 for the average and \$33,100 for the maximum.

Depreciation rates were figured at 10 percent per year on the new equipment. Interest was charged at the rate of 5 percent per year on the undepreciated balance. Personal property taxes were estimated at the same percentage paid on actual equipment owned in 1954. An estimate of \$10 for repair and maintenance was assumed for every \$1,000 invested in new equipment and alterations.

Depreciation on alterations was

Table 4. Cost of New Equipment and Alterations Needed for Whole Milk Operations by Five South Dakota Creameries

Creamery	Equipment			Total Equip- ment Cost	Alterations	Total of All Costs
	Receiving	Processing	Storage and Coldroom			
A	8,300	9,100	4,700	22,100	2,500	24,600
B	9,500	14,450	8,650	32,600	500	33,100
C	8,000	12,600	5,900	26,500	0	26,500
D	0	7,300	4,650	11,950	0	11,950
E	9,500	13,400	6,000	28,900	1,800	30,700
Total	35,300	56,850	29,900	122,050	4,800	126,850
Average	7,060	11,370	5,980	24,410	960	25,370

calculated at the rate in use on the building to which the alterations were made. This varied from 2.5 to 4 percent per year.

Estimated Cost of Making Butter from Whole Milk

Estimated costs of making butter from whole milk were substantially higher than from farm separated cream. Additional costs included depreciation, interest, and taxes on added equipment and added labor, fuel, water, and miscellaneous costs. Functionally, these costs arose from expanded receiving operations, separating, cooling, and storing of milk and skimmilk.

Costs averaged 9.54 cents per pound of butter for the five plants and ranged from 5.46 for creamery "D" to 15.10 cents for creamery "A" (see table 5). Costs averaged 3.47 cents per pound of butter more for milk than for cream. Costs increased 1.32 cents for creamery "D," 4.50 cents for "C" and 4.65 cents for "A." The increase in costs for creamery "D" was low primarily because

of the smaller amount of additional equipment needed. The high costs of creamery "A" would seem to forbid whole milk operations, or, perhaps, any butter-making operations at all. The managers of both creameries "A" and "C" expected substantial increases in total volume of butterfat receipts. A 50 percent increase in total receipts for creamery "A" might lower its costs comparable to those it had with cream. However, its cost would still be almost double those of creamery "D."

The major portion of the increase in costs was in manufacturing expenses. Variable manufacturing expenses increased by 1.52 cents per pound of butter (see figure 2). Most of this was additional labor costs. Proportionally, there were considerable increases in fuel and utilities expenses, 61 and 74 percent, respectively, as compared with 57 percent for labor.

Fixed manufacturing expenses increased 1.41 cents, or 114 percent. There were substantial increases for all items of fixed expenses except

Table 5. Estimated Operating Costs for Butter Made from Whole Milk, Five Cooperative Creameries, South Dakota, 1954*

Cost Items	Operating Costs of Creameries					Simple Average
	A	B	C	D	E	
	(Cents per pound of butter)					
Manufacturing expenses						
<i>Variable</i>						
Labor	3.08	2.47	4.28	2.00	2.79	2.92
Payroll taxes .....	.08	.06	.10	.05	.05	.07
Supplies .....	.83	1.33	1.16	.85	.84	1.00
Fuel	1.12	.36	.39	.34	.30	.50
Elec., water & sewage....	.69	.51	.54	.34	.25	.47
Miscellaneous .....	.00	.02	.05	.06	.08	.04
Total var. mfg. exp.	5.80	4.75	6.52	3.64	4.31	5.00
<i>Fixed</i>						
Rent .....	.00	.00	.00	.01	.00	†
Depreciation	4.13	2.36	1.34	.55	.73	1.82
Repair and maintenance	.25	.36	.25	.15	.32	.27
Property taxes .....	.66	.39	.16	.09	.17	.30
Insurance, license, and bond .....	.63	.28	.12	.13	.12	.26
Total fix., mfg. exp.	5.67	3.39	1.87	.93	1.34	2.65
Total mfg. exp.	11.47	8.14	8.39	4.57	5.65	7.65
General and administrative expenses						
Salary and fees.....	1.42	.49	.70	.43	.55	.72
Office supplies .....	.18	.08	.10	.12	.09	.11
Telephone and telegraph	.07	.04	.05	.02	.05	.05
Bank exchange .....	.03	.04	.11	.12	.10	.08
Depreciation—office ....	.09	.02	.03	.02	.02	.04
Audit and tax service....	.12	.02	.03	.04	.02	.05
Education and meetings	.07	.00	.16	.00	.05	.05
Quality improvement ....	.00	.04	.07	.00	.05	.03
Advertising .....	.17	.02	.05	.01	.03	.06
Payroll taxes—office ....	.04	.01	.01	.01	.01	.02
Interest	1.20	.77	.55	.10	.25	.56
Miscellaneous .....	.24	.11	.10	.02	.12	.12
Total general and administrative expenses	3.63	1.64	1.96	.89	1.34	1.89
Total operating expense	15.10	9.78	10.35	5.46	6.99	9.54
Annual butter production						
(000 lbs.)	200	400	600	1,200	1,200	720

*These figures are based upon a 50 percent shift to whole milk, with all additional costs of operation charged to the whole milk operations. The costs are for whole milk only; farm separated cream is not included.

†Less than .005 cent.

repairs and maintenance. All of the fixed costs were associated with plant and equipment. Better utilization of facilities could lower these costs substantially.

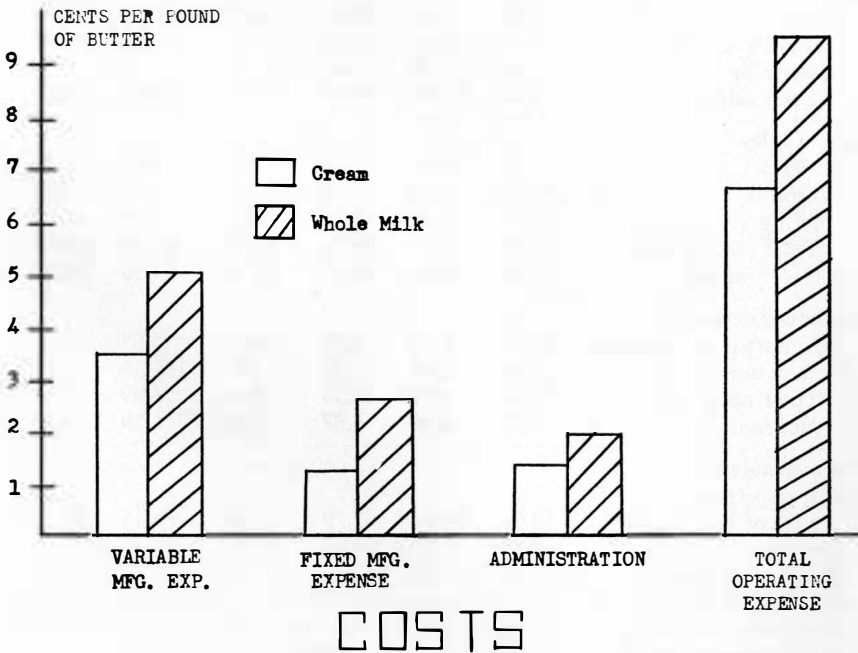
General and administrative expenses were mostly unchanged by the change in operations. The only item which changed substantially was interest expense. While usually classified as a general expense, this item would more properly be classified as a fixed manufacturing expense. In many cases, interest on new equipment might be hidden. If new equipment were financed out of members' and patrons' equities on which the cooperative pays little

or no interest, it would not appear in the expense statement. Nevertheless, the interest is a cost to the owners of the business who contribute the capital.

Estimated Income and Returns to Patrons for Whole Milk

Receipts for butter made from whole milk were difficult to estimate. A 1- or 2-cent increase per pound could not be expected for all creameries since some were already receiving grade A prices, either for unsalted butter or for printed butter sold locally. A uniform price of 59 cents per pound was estimated for all creameries (see table 6). This figure was based upon the average

Figure 2. A comparison of average operating costs in cents per pound of butter for cream and whole milk operations for five South Dakota creameries, 1954.



wholesale prices for grade A butter on the Chicago market in 1954. It ignores differences among creameries in bargaining power, types of outlets, and actual quality. It was not possible to estimate these variations from available data.

Receipts for skimmilk were based upon an estimated 75 cents per hundredweight at the plant. This was the approximate average price prevailing in the early part of 1956.

It was estimated that 100 pounds of milk would yield 90 pounds of

skimmilk, 4.4 pounds of butter, and 6.4 pounds of buttermilk. Butter yield was based upon an estimated 3.6 percent butterfat average in milk, and 23 percent overrun. (Maximum butter overrun from whole milk is slightly lower than maximum butter overrun from farm-separated cream.) This overrun is higher than might be expected with accurate weighing and testing but it is 2 percent lower than the 25 percent overrun the creameries averaged with farm-separated cream.

Table 6. Estimated Returns and Costs for Butter Made from Whole Milk, Five South Dakota Creameries, 1954

	Returns and Costs for Creameries					Simple Average
	A	B	C	D	E	
(Cents per pound of butter)						
Sales						
Butter	59.00	59.00	59.00	59.00	59.00	59.00
Skimmilk	15.24	15.24	15.24	15.24	15.24	15.24
Buttermilk .....	.68	.68	.68	.68	.68	.68
Total sales	74.92	74.92	74.92	74.92	74.92	74.92
Cost of sales						
Butterfat	47.73	46.36	46.38	45.52	46.65	46.53
Skimmilk	5.58	7.20	5.54	10.23	7.91	7.29
Hauling cost	6.78	6.78	6.78	6.78	6.78	6.78
Total cost of sales	60.09	60.34	58.70	62.53	61.34	60.60
Gross margin	14.83	14.58	16.22	12.39	13.58	14.32
Operating expenses						
Manufacturing expenses ..	11.47	8.14	8.39	4.57	5.65	7.65
Gen. & adm. exp.	3.63	1.64	1.96	.89	1.34	1.89
Total oper. exp.	15.10	9.78	10.35	5.46	6.99	9.54
Net margin*	-.27	4.80	5.87	6.93	6.59	4.78
Net available for return to patrons						
Per lb. of butter.....	53.04	58.38	57.79	62.68	61.15	58.60
Per lb. of butterfat.....	65.24	71.81	71.08	77.10	75.21	72.08
Per cwt. of milk.....	234.86	258.52	255.89	277.56	270.76	259.49

*The net margin is based on the same dollar gain as resulted from actual operations in 1954. The residual figure is shown for skimmilk in the cost of sales section.

Payments to patrons for butterfat were based upon actual butterfat payments made in 1954. The figures shown in table 6 vary from those shown in table 3 because the assumption is made that there is more accurate and uniform weighing and testing of milk than of cream.

Hauling costs for milk were estimated at 30 cents per hundredweight for each of the creameries. This seems to be in line with milk hauling costs experienced in the Sioux Falls milkshed. It would be expected to vary among the creameries, depending upon length of routes, average pickup per patron, how well routes were laid out, and various efficiency factors.

Returns to patrons for skimmilk was a residual figure. Net margins were based upon those existing for cream in 1954. Operating expenses were taken from table 5 and added to net margins to obtain gross margins. These were subtracted from estimated total sales to obtain total cost of sales. Payments for butterfat and hauling costs were previously determined. This left a residual figure which was attributed to the value of skimmilk to the operations.

The net available for payment to patrons was calculated as the total of payments for butterfat, skimmilk, and net margins. It averaged 58.60 cents per pound of butter, 72.08 cents per pound of butterfat, or \$2.60 per hundredweight of whole milk. Amounts available for payment to patrons varied from \$2.35 per hundredweight of milk for creamery "A" to \$2.78 for creamery "D." These returns are after allowance for hauling costs. The amounts

which creameries "D" and "E" could pay for whole milk are comparable to prices which prevailed for manufacturing milk in Minnesota in 1954.

Prospects for Increasing Net Returns From Whole Milk

A crucial problem for most creameries, using either milk or cream, is increasing and maintaining volume. Many creameries were established when transportation of milk and cream was difficult and small creameries could operate as efficiently as large creameries. The result was that too many creameries were established in some areas (for efficient operation under present conditions).

Technological improvements in plant equipment have made large creameries more efficient. New models of equipment, such as automatic can conveyors, straight-through can washers, automatic dumping and weighing equipment, plate pasteurizers, and new styles of churns can efficiently process huge volumes of milk or cream into butter. Very little of this equipment has been designed for small creameries; they cannot afford them.

Efficiencies in larger creameries result also from more specialization, training, and utilization of labor; better utilization of boilers, fuel, water, and other utilities; and from quantity discounts in purchasing. Larger creameries can control quality better and produce more uniform products. Larger creameries can negotiate better contracts with wholesale butter buyers. If located in or near large markets, they can develop private brands for much of

their output. Large creameries do have some disadvantages but they are far outweighed by their advantages.

Technological changes in transportation work in favor of the larger creameries. Improved roads, larger and more efficient trucks, and refrigeration enable creameries to expand supply areas to several times those which prevailed a few years ago. In shipping out manufactured products, refrigerated trucks and railroad cars are a big advantage. A creamery that can ship a whole truckload or carload at a time pays much lower freight rates.

There are two possibilities for expanding volume for creameries. One is to merge with or take business away from competitors. The other is to stimulate farm production within their supply areas. In order to attract more milk or cream either by diverting it from competitors or increasing farm production, it probably will be necessary to increase returns to patrons. And, in order to increase returns to patrons, it probably will be necessary to improve efficiency. However, in order to improve efficiency, greater volume will usually be needed.

This vicious circle is very difficult to break. Possibly the shift to whole milk will enable these creameries shifting first to expand their volumes. Where this fails the only remaining solution seems to be the merging of two or more plants. This alternative should be considered by all creameries seeking additional volume. It may involve initial losses but it should pay big dividends in the long run.

Overlapping supply areas are characteristic of creameries in southeastern South Dakota. Many creameries have tried to expand by extending their assembly routes and by developing new routes in areas already served by other creameries. The survey found that some areas were served by as many as four creameries. This duplication of truck routes has resulted in higher assembly costs for all of the creameries.

None of the creamery managers with whom this problem was discussed were willing to negotiate with others to reorganize their supply areas. Another voluntary alternative, merging creameries with overlapping areas, was unpopular also. The final alternative, squeezing the weaker creameries out of existence, seemed to be the most likely manner in which the problem would be solved.

Bulk milk handling may reduce costs. Creameries receiving only bulk milk can save in receiving costs. Bulk receiving requires only a storage tank and a milk pump as compared with the conveyors, can washer, dump tank, weigh tank, and surge tank needed for can receiving. Much less labor is needed in receiving. Also, there are savings in fuel, water, and electricity. The receiving room space not occupied by the receiving tank can be used for other purposes. Bulk milk hauling may create additional savings. Less weight has to be hauled. Milk transfer to the truck requires less heavy labor. Bulk milk remains cool and reaches the creamery in a better condition than does can milk where

routes are long. However, equipment is much more expensive.

Under ideal conditions the various savings in transferring, hauling and receiving bulk milk may enable a creamery to pay 15 to 25 cents per hundredweight more for milk. If the creamery receives only bulk milk, its receiving costs may be reduced 10 cents per hundredweight or more. In addition, there is less loss in spillage and from milk adhering to cans. Sampling may be more accurate. Quality may be improved enabling the creamery to make a better product. Hauling costs may be reduced as much as 10 cents per hundredweight if routes are laid out well and bulk milk patrons are concentrated in a small area. However, a 5-cent reduction is more probable under average conditions.

It must be emphasized that the savings are possible only under ideal conditions. Complete conversion of all patrons to bulk, large herds, and well-planned routes are a "must" for maximum savings. It is unlikely that these conditions can or will be met by South Dakota creameries.

Creameries may increase returns by manufacturing products of higher value than butter. Such products include ice cream, ice cream mix, sweet cream for bottling, frozen

cream, frozen dessert mix, evaporated milk, and concentrated milk. Various dry milk products may be found profitable. Ice cream mix is a promising product for South Dakota creameries. The state imports considerable quantities of mix from other states. It would not be difficult to develop this market. Additional markets might be developed in other states, particularly Nebraska and North Dakota.

Ice cream mix is a high value product. A creamery which utilized all of its milk in mix could return as much as \$1 per hundredweight more to patrons for milk. Fluid sweet cream should be equally profitable. Other products might add more or less to net returns depending upon markets and additional processing equipment needed. An aggressive effort by the creameryman to develop new markets can be very rewarding.

It was estimated that creameries receiving can milk and utilizing all of it in butter could return \$2.60 per hundredweight to patrons on the average. Bulk handling might raise this return as high as \$2.80. Production of higher value products might add as much as \$1, for a total of \$3.80. This figure approaches the prices received for grade A milk in the area in 1954.

Comparative Costs and Returns to Farmers for Cream and Milk

Returns available for payment to patrons for milk and cream were estimated in the preceeding sec-

tions. Available returns for cream averaged 62.31 cents per pound of butterfat (see table 3). This was

equivalent to \$2.24 per hundredweight of 3.6 percent milk. Available returns for whole milk in cans averaged \$2.60 per hundredweight of 3.6 percent milk (see table 6). This represented a gross return of 36 cents for skimmilk in a hundred pounds of whole milk. Bulk milk handling could be expected to return about \$2.80 per hundredweight. This would allow a gross return of 56 cents for the skimmilk in a hundred pounds of milk.

It is necessary to consider farm handling costs for milk and cream in order to arrive at the net benefit to farmers from selling whole milk.

Farm Handling Costs for Milk and Cream

Farmers selling cream have to maintain and operate a cream separator. Most cream sellers use electric separators. The major item of cost is depreciation on the separator. Other separation costs include labor, interest, taxes, repairs and maintenance, and electricity. Depreciation and repair costs on cream cans must also be considered.

Farmers selling whole milk have similar costs except that operation of separators is replaced by operation of a can or bulk cooler. Also, the bulk cooler does not require cans, so that cost is eliminated.

Costs were estimated for cream handling, can milk handling, and bulk milk handling. In each case separate estimates were made for producers with 10- and 15-cow herds. Annual average production per cow was estimated at 6,000 pounds of milk. No estimates were made for the costs of labor or sup-

plies. Actually, there should be some saving of both labor and supplies in shifting to milk, particularly with bulk milk.

Separating costs were estimated at 5.3 cents per hundredweight of milk for farmers with 10-cow herds and 4.8 cents for farmers with 15-cow herds (see table 7). Can costs would be about 0.7 cent, making a total of 6.0 cents per hundredweight for 10-cow herds and 5.5 for 15-cow herds.

Milk cooling in cans would require a 4-can cooler for the 10-cow herd and a 6-can cooler for the 15-cow herd. The prices of 4-can and 6-can coolers were estimated at \$250.00 and \$275.00, respectively. Total operating costs did not change as much as did volume between the two coolers. Cooling costs per hundredweight of milk were 11.5 and 10.1 cents for the 10-cow and 15-cow operations, respectively. Can costs were somewhat higher than for cream, 2.9 cents per hundredweight for both sizes of herds.

Bulk coolers were considerably higher priced than can coolers. The effect of this was to raise cooling costs considerably. Costs per hundredweight of milk were estimated at 28.3 cents for the 10-cow herd and 23.4 cents for the 15-cow herd using an ice-bank-type bulk cooler. Can costs were eliminated. Volume is very important in bulk milk handling. Difference in costs were 4.9 cents per hundredweight in bulk coolers between 10- and 15-cow herds. In contrast, the difference was 1.4 cents for can milk and 0.5 cent for cream. Bulk handling is not well adapted to small operations

because of the high costs of small coolers.

Net Gains from Milk and Cream

It is possible to determine the net returns to farmers for skimmilk by comparing gross returns and farm handling costs for milk and cream. Also, the relative advantage or disadvantage of bulk handling can be shown in the same manner.

Gross returns for cream were estimated at \$2.24 per hundredweight of 3.6 percent milk as compared with \$2.60 for can milk and \$2.80

for bulk milk (see table 8). Allowance for farm handling costs reduced the returns for cream to \$2.18 for both 10-cow and 15-cow herds, to \$2.46 and \$2.47 for can milk, and to \$2.52 and \$2.57 for bulk milk.

The net receipts for skimmilk sold in whole milk were derived by subtracting the returns from cream from the returns from milk. The net receipts varied from 28 cents for can milk with a 10-cow herd to 39 cents for bulk milk with a 15-cow herd. These figures represent returns for skimmilk per hundredweight of

Table 7. Estimated Farm Handling Costs for Cream, Can Milk, and Bulk Milk for Farmers with 10-cow and 15-cow Herds in South Dakota*

Expenses	Cream Handling Costs				Milk Handling Costs							
	Separator Operation				Can Cooler Operation				Bulk Cooler Operation			
	10-CowHerd		15-CowHerd		10-CowHerd		15-CowHerd		10-CowHerd		15-CowHerd	
	Cts. \$ per 100 lbs. Yr.	per 100 lbs. Yr.	Cts. \$ per 100 lbs. Yr.	per 100 lbs. Yr.	Cts. \$ per 100 lbs. Yr.	per 100 lbs. Yr.	Cts. \$ per 100 lbs. Yr.	per 100 lbs. Yr.	Cts. \$ per 100 lbs. Yr.	per 100 lbs. Yr.	Cts. \$ per 100 lbs. Yr.	per 100 lbs. Yr.
Separation/cooling expenses												
Depreciation†	15.00	20.00	25.00	27.50	83.33	101.10						
Repairs and maintenance	7.50	10.00	4.38	8.19	10.92	13.34						
Interest	3.75	5.00	6.25	6.88	31.25	35.40						
Taxes	1.88	2.50	3.13	3.44	15.63	17.70						
Electricity	3.65	5.50	30.00	45.00	28.83	43.20						
Total sep./cool. exp.	31.78	5.3	43.00	4.8	68.76	11.5	91.01	10.1	169.96	28.3	210.74	23.4
Can expense‡												
Depreciation	1.85	2.78	7.40	11.10								
Retinning and covers	1.75	2.62	6.98	10.47								
Interest	.70	1.05	2.80	4.20								
Total can exp.	4.30	0.7	6.45	0.7	17.18	2.9	25.77	2.9				
Total exp.	36.08	6.0	49.45	5.5	85.94	14.4	116.78	13.0	169.96	28.3	210.74	23.4

*Annual production per cow was estimated at 6,000 pounds of milk.

†Depreciation was based on 10 years for separators and can coolers and 15 years for bulk coolers.

‡Depreciation on cans was based on 10 years. It was estimated that each can would need retinning twice and that one new cover would be needed for every two cans.

Table 8. Comparative Returns to Producers and Farm Handling Costs for Cream and Milk

	Cream Handling		Whole Milk Handling			
	Separator Operation		Can Cooler Operation		Bulk Tank Operation	
	10-Cow Herd	15-Cow Herd	10-Cow Herd	15-Cow Herd	10-Cow Herd	15-Cow Herd
	(Dollars per hundredweight of milk or milk equivalent)					
Returns from cream and milk....	2.24	2.24	2.60	2.60	2.80	2.80
Farm handling costs.....	.06	.06	.14	.13	.28	.23
Net returns	2.18	2.18	2.46	2.47	2.52	2.57
Value of cream.....	2.18	2.18	2.18	2.18	2.18	2.18
Net received for skimmilk per cwt. milk.....	0	0	.28	.29	.34	.39
Net received per hundredweight of skimmilk.....			.32	.33	.39	.44

whole milk. Farm separated cream averages about 30 percent butterfat. Thus, 100 pounds of 3.6 percent butterfat milk yields 12 pounds of 30 percent butterfat cream. The farmer obtains 88 pounds of skimmilk for each 100 pounds of milk. Therefore, when he sells 100 pounds of milk, he sells 12 pounds of cream and 88 pounds of skimmilk. Net receipts for skimmilk were adjusted to a hundredweight basis on the basis of 88 pounds of skimmilk per hundredweight of milk. The range of net receipts per hundredweight of skimmilk was from 32 cents to 44 cents.

The farm feeding value of skimmilk is usually calculated in terms of the amount of corn or corn and tankage it will replace in a ration. A popular formula is 100 pounds of skimmilk equals one-fifth bushel of corn plus seven pounds of tankage for pig feeding. This is an average figure and it assumes that the skimmilk is used in a balanced ration and that all of it is utilized the year

around. Skimmilk may be worth much more if fed in small proportions in a well balanced ration. It may be worth much less if it is fed alone or constitutes a large proportion of an unbalanced ration.

Skimmilk feeding value is estimated at 60 cents per hundredweight when tankage is \$5.00 per hundredweight and corn is \$1.25 per bushel. It is doubtful that it is worth this much to most farmers. In order to utilize all of the skimmilk efficiently in feeding, the livestock feeding program must be closely geared to the seasonal variations in milk production.

Some farmers have very little use for skimmilk, so its value to them is actually negative since it may create a disposal problem. At the opposite extreme are some farmers who can utilize fully all of the skimmilk they have. The value of skimmilk to them might be 60 cents or higher. However, many farmers make good use of skimmilk during some seasons of the year but have little use

for it at other times. It might be advantageous to them to sell cream part of the year and whole milk the rest of the year.

No general recommendations can be made about selling whole milk. Each farmer must decide on the basis of his particular operations which he should do. A specialized dairy farmer having no feeding operations other than dairy calves probably would find it more profitable to sell whole milk. A livestock

producer with a small dairy enterprise probably would find it more profitable to separate and sell cream.

It seems noteworthy that few farmers who shift to milk shift back to separating cream. This may be due in part to the labor saved when milk is sold and in part to the larger amount of regular and stable income that results.

Research reported in this bulletin is summarized on page 26.

SUMMARY

A recent development among South Dakota creameries has been increased interest in buying whole milk. A survey of 23 cooperative creameries in eastern South Dakota and southwestern Minnesota was made in 1955. This survey indicated that 17 of these creameries were interested in shifting to whole milk and several had made definite plans for shifting. By September 1956, 13 creameries had shifted from cream to whole milk procurement.

A major objective of this study was to determine the relative advantages of cream and milk operations to creameries and to their patrons.

Costs Analyzed

Five creameries were selected for a detailed cost analysis. The range of volumes was from 200,000 to 1,200,000 pounds of butter per year.

The analysis showed that these creameries could pay on the average \$2.60 for 100 pounds of milk (the range was from \$2.35 to \$2.78). If the farmer sold cream, he would receive \$2.24 for the butterfat and buttermilk. If he sold milk, he would receive 36 cents for skimmilk in every hundred pounds of milk. Farm handling costs would reduce this to about 28 cents (or 32 cents per hundredweight of skimmilk). Therefore, if the skimmilk were worth less than 32 cents to the farmer, it would pay him to sell whole milk.

These figures are based upon several conditions—most important are:

- (1) That the creamery receive one-half its butterfat in whole milk;
- (2) That the net margin from butter processing is the same under both operations;
- (3) That hauling costs are 30 cents per hundredweight of whole milk;
- (4) That all butterfat is used in manufacturing butter and all skimmilk and buttermilk is sold for drying;
- (5) That with whole milk operations a high quality butter will be produced.

Each creamery manager must examine the cost and return data for his plant to determine whether it would be profitable to shift to a whole milk operation. If he substitutes the data that apply to his plant from the tables in the text, he should be able to arrive at a better conclusion about the profitability of shifting to milk for his own firm.

In general the larger the plant the more likely it will be that a shift from cream to milk will be profitable.

Increasing Returns

Both gross and net returns from milk may be increased by the production of higher valued products. Ice cream, ice cream mix, and fluid sweet cream seem promising products for South Dakota. Milk utilized

in these products may yield a net return as much as \$1 per hundredweight higher than net returns from butter and skimmilk.

Bulk milk handling may help increase net returns. It has been estimated that net returns to patrons from bulk milk may be 15 to 25 cents per hundredweight higher than returns from milk in cans under ideal procurement conditions. Bulk handling may improve quality enabling creameries to obtain higher prices for products. Substantial savings may be made in hauling costs, receiving costs, and lower losses through reduced spillage and milk adhering to cans. The amount of savings to the producer will depend on size of herd and the percentage of patrons that shift to bulk milk.

Other factors that would be favorable to whole milk operations are:

- (1) High density of milk supplies in the plant's supply area;
- (2) High average volume of milk production among patrons served;
- (3) Large proportion of patrons interested in selling milk;
- (4) Good opportunities for expansion within the present supply area or for annexing an adjoining supply area;
- (5) A well equipped plant with excess capacity, which would require a minimum of new equipment for handling milk;
- (6) Efficient management and personnel, low overhead costs and loyal patrons.