A STUDY OF COMPARISON OF METHODS AND EFFICIENCY FACTORS IN PROCUREMENT OF BUTTERFAT AND WHOLE MILK BY COOPERATIVE CREAMERIES IN KANSAS

by

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B. S., Kansas State College of Agriculture
and Applied Science, 1936

A THESIS

submitted in partial fulfillment of the

requirements for the degree of

MASTER OF SCIENCE

Department of Agricultural Economics

KANSAS STATE COLLEGE
OF AGRICULTURE AND APPLIED SCIENCE

1948

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PROBLEM AND ITS IMPORTANCE

Fifty-nine creameries and milk plants in Kansas procure cream or milk direct from the farmer through truck routes. This milk is delivered to the plant where it is processed. These plants are concentrated in two areas of the state as indicated by Fig. 1. The first area of major importance lies east of the Flint Hills and extends across the state from north to south. Manufacturing milk predominates in this area, but the urban groups of Kansas City, Lawrence, and Topeka create a demand for considerable fluid milk. In the south end of the state a considerable quantity of fluid milk is utilized in Parsons, Coffeyville, and Independence.

The second area is west of the Flint Hills, extending to highway 14. Wichita, Hutchinson, and Salina are the principal fluid milk markets in this area. Manufactured milk and butter production are both important in this area.

The varied demand for dairy products in both areas complicates the procurement program, and increases the duplication of farm routes. Therefore, the efficiency of the procurement system is important to the individual plant. First, because milk is a bulky product, resulting in an expensive operation, and second, because it is highly perishable necessitating rapid movement and adequate protection enroute to preserve the quality.

The shortage of trucks, tires, and gasoline during the war resulted in the industry becoming acutely conscious of the

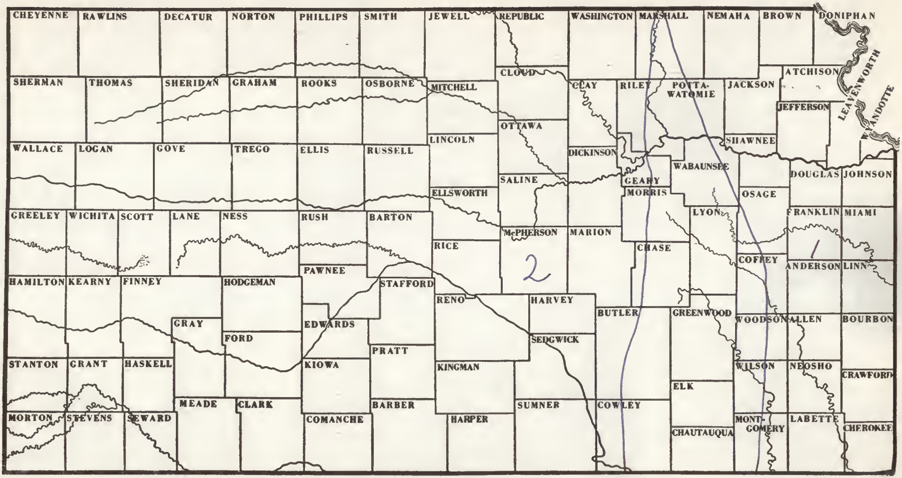

Fig. 1. Milk production areas included in the study.

duplication of effort. Plant managers became aware of the opportunities for savings by reorganizing their truck routes.

Cooperative creameries have been organized so that they now operate in practically all of the territory in the two important dairy areas of Kansas. There are 11 cooperative creameries operating 133 trucks which traveled 3,804,000 miles annually in 1945 in the procurement of milk and cream. Seventy percent of the roads traveled were dirt with no all-weather surfacing. Five of the creameries handle only cream for butter manufacture. The other six buy whole milk, three of which are set up to handle grade A milk. Producers selling to these three plants have a choice of selling cream, milk for manufacture, or grade A milk. The procurement operation has been given careful consideration by most of the plants because the creameries in Kansas operate over rather large areas with truck routes covering from 3 to 10 counties, and with plants making from 1,500,000 to 5,000,000 pounds of butter annually.

It is important that the routes be organized in a manner to get the greatest efficiency of operation in the plant. For example, one plant has its trucks scheduled to unload at regular intervals beginning at 7 o'clock in the morning and finishing by 11 o'clock. In this way dumping, pasteurizing, and churning can begin in the plant early in the day, and the cream can be unloaded promptly upon arrival at the plant. This is important in protecting the high quality of the cream as picked up from the farm. It is important that truck routes be organized in such a manner that the greatest possible amount of produce is picked up per mile and per man hour, because the miles traveled by trucks and the hours involved in procurement of milk or cream are the two most costly items. The shorter the distance and the less time on the road the greater the opportunity of protecting the quality of the milk.

The creameries have organized their procurement program along different lines. Five of the plants operate plant owned trucks, while two plants have a majority of plant owned trucks, but hire additional truckers on a contract basis. The other plants depend entirely on contract haulers for procurement transportation. Where the plant owns its trucks the manager has full control over the routes which permits him to schedule the arrival of the trucks at the plant. He can readily adjust the miles traveled on each route to facilitate the timeliness of the arrivals. He can shift producers from one route to another thus evening up the size of the load. He can operate a garage in which the trucks are serviced, resulting in savings from quantity buying of parts and tires as well as bulk purchasing of gasoline and oil. In contrast to these advantages the plants using contract haulers need not worry about the carelessness of the drivers resulting in abuse of the trucks. The driver owns his own truck and is paid according to the amount of products he hauls. Some managers argue that this gives the driver added incentive to secure additional patrons, but other managers have found that by hiring their drivers on a commission basis they can overcome this disadvantage.

Combination pickups on farm routes have also received consideration by several of the managers. Two of the plants pick up both cream and eggs on the routes. It is immediately apparent that this increases the amount picked up per stop or per mile. These three methods of procurement were the basis for the study, namely, plant owned trucks, contract haulers, and combination pickups.

REVIEW OF LITERATURE

Robotka and Laughlin (6) found that creameries operating their own trucks had definitely cheaper procurement cost than the creameries hiring contract haulers. The rates paid contract haulers ranged between 1 and 3 cents per pound butterfat, with 7 creameries paying less than 2 cents, 38 paying 2 cents, 31 paying 2.5 cents, and 10 paying more than 2.5 cents. The net cost for the creamery owned trucks was 1.5 cents per pound of butterfat or less. Only four of 95 creameries that did not operate their own trucks had hauling rates as low as 1.5 cents per pound of butterfat. Robotka and Laughlin pointed out that there are two distinct possibilities of saving through operation of plant owned trucks; (1) to reduce the expense of operating the trucks themselves, and (2) the possibility of the association to control the hauling and organize its territory for efficient transportation.

Quintus and Robotka (5) make the following comments: A number of creameries in other parts of Iowa have found creamery ownership of trucks an effective means of controlling truck drivers and truck routes, but the Butler county managers interviewed seemed to feel that it would not be advisable for the creameries to purchase or operate trucks. The contentions were borne out and perhaps influenced to a large extent by one creamery in the territory which had had a costly experience in this respect. The authors in this study indicate that conditions peculiar to Butler county probably would make it inadvisable for creameries to own trucks. This is partially due to the way that routes are organized and to present trade area arrangements. A rather serious competitive situation exists in Butler county, resulting in truck drivers resorting to questionable practices in order to secure additional patrons.

Cotton, Lundy, and Brown (2), in a study on "Cooperative Creameries in South Dakota" emphasized the advantage of plant owned trucks over contract haulers from a cost of procurement standpoint. A cost study on 24 creameries indicated that trucks owned and operated by creameries are the most efficient means of procuring butterfat, and that hired trucks are the most costly means of transportation. It cost 12 creameries $36,664 to procure approximately two million pounds of butterfat by 20 hired trucks. Eight creameries procured about 4.5 million pounds of butterfat, with 20 of their own trucks for $36,704 showing a procurement cost for contract haulers of 1.75 cents per pound butterfat compared with .82 cents per pound with plant owned trucks.

Montgomery and Caulfield (4) pointed out that a study of two plants showed that the cost of procuring cream was less than two cents per pound butterfat. At one of these plants the cream trucks also handled poultry and eggs, while at the other plant cream was the only product hauled by the creamery trucks. The cream procurement cost was slightly less at the plant which used its trucks exclusively for hauling cream. The concentration of production of butterfat in the area served by the two creameries is not indicated in this study. However, in later research work done in preparation for this thesis it was found that when concentration of production factor was considered, the plant with the combination pick-up (Plant 2) from 1940 through 1945, had only slightly higher procurement costs than did the plant hauling cream only; namely, (Plant 5) as indicated in Table 25. However, the plant with the combination procurement has a concentration of production factor of 85 compared with 112 for the plant handling cream only.

The cost of procurement conditions of contract haulers is not closely related to the actual cost, but is more of a competitive price situation, according to the study of Bartlett and Caskey (1) entitled "Milk Transportation Problems in the St. Louis Milk Shed." The study showed that rates for haulers are not related to the type of roads or to the size of the load.

They also pointed out that depreciation and repairs are main cost differences and of course these items would be closely related both to size of the load and type of road. The following conclusions as to ways to reduce hauling costs were noted: (1) reducing the distance that milk is hauled, (2) increasing the volume per load under present seasonal production conditions, (3) increasing the volume per load by narrowing the present range in seasonal production, and (4) avoiding unnecessary delays in unloading milk at the receiving station. It would appear that all four of these ways to reduce hauling costs can be accomplished more readily were plants to own and operate their own trucks.

The study of MacLeod and Geraghty (3) entitled "The Transportation of New Hampshire Milk" indicates the greatest saving in procurement costs could be made by reorganization of truck routes eliminating duplication of routes traveled by competing trucks, and by reduction of hauling charges where rate is above competitive levels.

COLLECTION OF DATA

The plants selected for this study were chosen after careful consideration regarding size of operation, type of procurement, efficiency and management. Due to the small number of cooperative creameries in Kansas, a case study of representative plants with contrasting procurement programs was decided upon as the logical approach. The plants selected are all efficiently operated, managers are capable, records are reliable and the plants are all in strong financial condition. The plants use the same auditor except Plant 7, and cost of cream procurement was not shown for this plant; first, because it has become principally a milk operation and second, figures used in determining procurement costs were not comparable.

The size of operation of the selected plants is comparable, with all of them large enough to enjoy the economies of large scale operation. Plant 3 has the smallest butter operation varying from one and one-half million pounds of butter in 1943, to about one and one-third million pounds in 1944 and 1945 since more cream producers changed over to the sale of whole milk. Plant 5 has the largest butter department making between four and five million pounds of butter annually. The other four plants are uniform in size ranging from one and two-thirds to two million pounds of butter a year. Volume of production handled is shown on Tables 25, 26, and 27.

Procurement methods used by the plants make an excellent basis for study of the three possible ways of procuring cream. Two plants use a combination pick-up system with plant owned trucks. Three plants pick up cream only using plant owned trucks. Two plants employ contract haulers handling cream only.

The other three cooperative creameries were not used in the study. Two of these plants were too small to be comparable, making only about one-quarter million pounds of butter a year. The third plant employed contract haulers using trucks varying in size from one-half ton to one and a half tons. A different auditor is employed by this plant. These factors made it desirable to exclude those plants from the study.

The data used in the study were obtained from plant records through interviews. The comparative data on truck operation are for the month of March, 1946. First, the purpose of the study was outlined to managers to give them background information as well as to interest them in the results of the study. The plant records on volume of cream, and number of patrons, were made available and these data were copied for use in this study. Information concerning number of hours on the road and miles traveled was secured from the drivers of each truck where plant records did not include these items. Each manager was asked to enumerate advantages and disadvantages of his particular program. Truck conditions during the war as well as ODT regulations made the managers conscious of their trucking operations and many valuable comments were made concerning the merits of various types of procurement. Each manager also was asked to describe his method in handling the volume during the flush. In this way comments were obtained regarding possibility of adjusting routes, use of relief trucks, and averaging out the load between the slack and flush seasons.

The data received from the plants were supplemented with other pertinent data which are necessary in evaluating the merits of the various procurement programs. Fig. 2 is a map of Kansas showing location of milk plants according to type of operation. This is valuable in indicating the amount of competition of each plant for the milk and cream in the area. Fig. 3 is a map of Kansas showing the density of production factor and the area from which milk and cream is procured for each plant used in this study.

DISCUSSION OF DATA

In the discussion of data showing the procurement operations of each of the cooperative creameries and milk plants, two very important factors must be kept in mind at all times which materially affects the amount of milk picked up per mile. These are: (1) competition from other milk plants and (2) the concentration of milk production.

Competition from other milk plants can be divided into three categories:

1. Competing plants buying grade A milk.
2. Competing plants buying whole milk for manufacturing.
3. Competing plants buying cream for butter production.

Fig. 2 shows the location of milk plants and creameries in the state, with the type of operation indicated by the color of the dot. Plants indicated by blue dots have a diversified operation with equipment enabling them to make a wide variety of dairy products. The plants indicated by green dots as indicated in Fig. 2, purchase whole milk but are limited in most

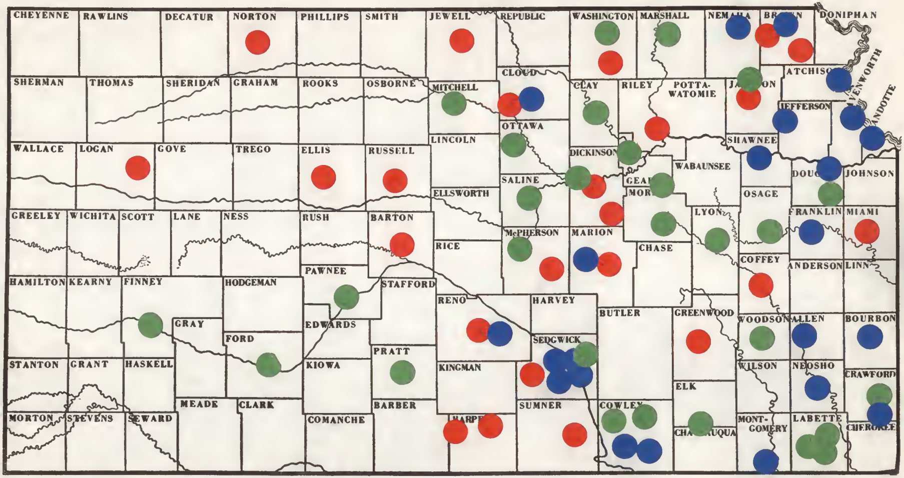

Fig. 2. Location of milk plants and creameries in Kansas

Diversified milk plants.

Plants equipped to manufacture whole milk, but limited to two products.

Plants manufacturing butter only.

cases to the production of Cheddar cheese and possibly cottage cheese and butter. The red dots refer to plants which handle butter.

Location of Plants

Fig. 3 shows the area serviced by each of the plants in the study, with the red numeral indicating the plant number as identified by the data. By comparing Figs. 2 and 3, it becomes evident that Plant 7 probably has the keenest competition, for in addition to the plants shown on the map there is a cheese plant at Blackwell, Oklahoma, which is just across the state line to the south. Plant 4 has some competition on the outskirts of its trade area, and Plant 6 is in the Wichita milkshed with a small number of grade A producers scattered throughout its trade area. Plant 3 also has considerable competition both from cheese plants and condenseries.

The degree of competition for milk supplies is greatest among grade A milk plants with less competition among manufacturing milk plants and with the least from butter plants. Plant 7 has more competition from graded milk plants than any of the other plants studied, with Plants 1, 4, and 6 having a small amount of competition. Competition from manufactured milk is keen with Plant 3 having more competition from this source. Plant 7 probably ranks second. Competition for cream is a problem only in the areas where plant operations overlap as indicated in Fig. 3. This is largely due to the fact that the cooperative creameries

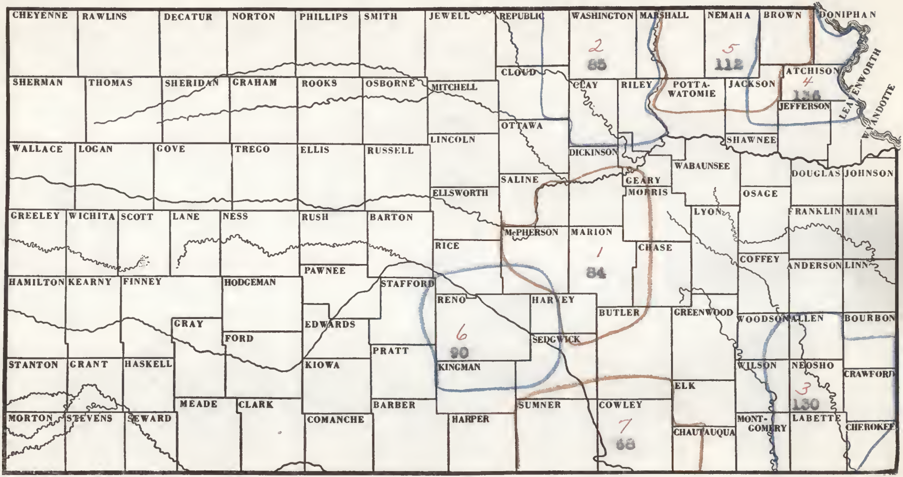

Fig. 3. Area serviced by each plant in the study.

are the only ones that have direct procurement by farm routes, with one or two minor exceptions. Therefore, the quality of the butter churned scores above that made by centralizers and a higher price is paid than is the case where farmers sell through cream stations. Table 1 summarizes the relative degree of competition from various sources with plants according to the intensity of competition from each source.

Table 1. Competitive ranking of plants by type of competition.

Plant no.	Grade A	Manufacturing	Cream	Composite total	Plant rank
1	4	4	3	11	4
2	7	7	6	20	7
3	5	1	4	10	3
4	2	3	1	6	1
5	6	6	2	14	5
6	3	5	7	15	6
7	1	2	5	8	2

Fig. 3, in addition to showing the area serviced by each plant, shows the concentration of production in each area. The concentration of production factor was determined by computing the pounds of milk produced in 1945 per acre in farm land for each county in the state, see Fig. 4. These figures were obtained from Kansas Crop and Livestock Statistics 1945. This concentration of production factor was then used to determine the concentration of production factor for the plant area. Figures were weighted according to the portion of each county covered and the concentration factor for that county. According to the computed concentration of production factor the plants would

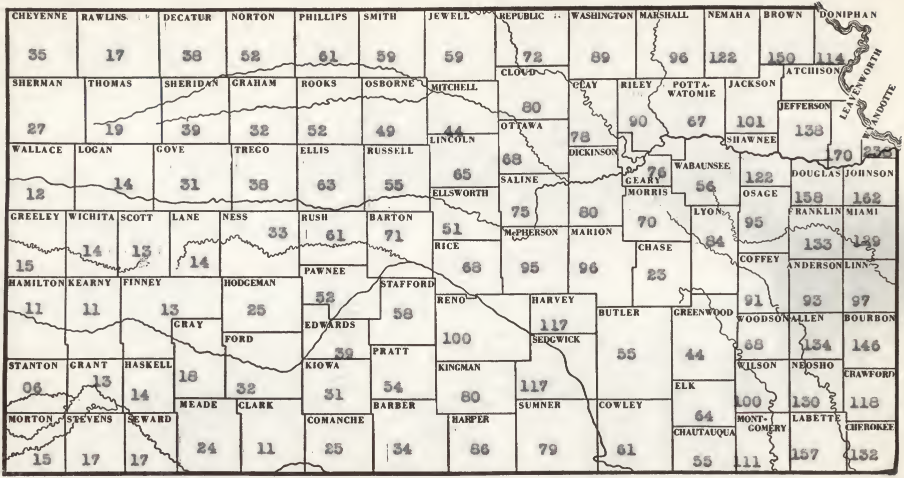

Fig. 4. Pounds of milk produced annually per acre in farm land (1945).

Source: Kansas Crop and Livestock Statistics 1945.

rank as follows:

Plant 4 - 136

Plant 3 - 130

Plant 5 - 112

Plant 6 - 90

Plant 2 - 85

Plant 1 - 84

Plant 7 - 68

Cream Procurement Operation

Comparison of the size of load hauled on the basis of type of procurement is shown in Table 2.

Table 2. Average number of pounds of cream per load by type of procurement.

Type of procurement	Plant	Pounds of cream per load	Average*
Combination cream and egg pick-up with plant owned trucks	1	1549	
	2	1151	
			1310
Cream only, plant owned trucks	3	1379	
	4	2071	
	5	2146	
			1845
Cream only, contract hauler	5a	2770	
	6	1915	
			2310

*Weighted by total number of trucks and total volume

Contract haulers have the heaviest load of cream as shown by the table with an average of 2,310 pounds. Plant owned trucks picking up cream only average 1,845 pounds compared with 1,310 pounds per truck with combination pick-up. Plants 1 and 2 use a system of combination pick-up. More than half of the load in each case is made up of eggs. This necessarily causes a smaller load of cream to show in the table. The total net weight per load of cream and eggs for Plant 1 is 3,520 pounds with Plant 2 averaging 2,635 pounds per load. On this basis, Plants 1 and 2 would rank first and third in total load hauled. Comparison of size of payload is shown in Fig. 5. It should be kept in mind that Plants 1 and 2 have a low concentration of production factors as shown in Fig. 3. This brings out the desirability of a combination pick-up as well as the accomplishments that can be attained in an area of relatively low concentration by use of a combination system.

Plant 3 is located in a high concentration of production area as indicated by the factor of 130. However, these trucks are hauling a low average load of 1,379 pounds. This is due largely to the fact that Plant 3 is located in an area that has had good whole milk markets for a number of years, and Plant 3 itself buys milk both for manufacturing purposes and for grade A bottle milk. Therefore, generally speaking, the larger milk producers switched over from the sale of cream to the sale of whole milk and the producers on the all weather roads as well as those nearest the plant were encouraged to switch over to whole milk during the war period when the demand for total milk solids was great and

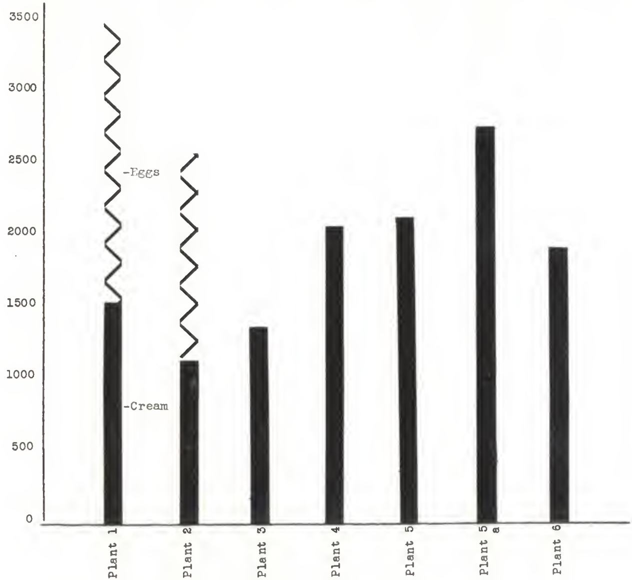

Fig. 5. Comparison of loads hauled by cream trucks.

the ceiling price on butter was unfavorable compared with ceilings on whole milk products.

It is interesting to note that the contract haulers of Plant 5a haul the heaviest load of cream which is considerably heavier than the average load hauled by the plant owned trucks of Plant 5. Plant owned trucks of Plant 5 have a monopoly on the 15 mile radius around their plant with the contract haulers of Plant 5a forced to get their pay load outside of this 15 mile zone. Later tables will show that the contract haulers of Plant 5a travel considerably greater distance and concentrate on the larger producers which apparently enable them to get a heavy pay load.

Table 3. Average number of miles traveled per load by type of procurement.

Type of procurement	Plant	Miles traveled per load	Average*
Combination cream and egg pick-up with plant owned trucks	1	145	
	2	96	
			116
Cream only, plant owned trucks	3	110	
	4	90	
	5	66	
			92
Cream only, contract hauler	5a	138	
	6	126	
			131

*Weighted by total number of trucks and total miles traveled.

There is little relationship between the miles traveled per load and the average number of pounds of cream per load. This is due to the difference in the concentration of production factor and competition among the plants. Table 3 shows that contract haulers traveled 131 miles compared with 92 miles for plant owned trucks hauling cream only, and 116 miles for plant owned combination pick-up.

Plant 1 traveled the most miles (145) per load, but this plant handles both cream and whole milk. Milk routes were developed on all weather roads and among nearby patrons. This results in the cream patrons being scattered in an area that already has a low concentration of production factor (84). Plant 2 is in strictly a cream territory and is hauling about 900 pounds less per load than Plant 1. Plant owned trucks picking up cream only have the lowest average mileage per truck due to combination of high concentration of production and high efficiency in organizing routes.

The number of pounds of cream picked up per mile is a good indication of efficiency of procurement. Table 4 indicates that plant owned trucks hauling cream only excell in this respect with an average of 23 pounds per mile compared with 18 pounds per mile for contract haulers and 12.5 pounds per mile for trucks with combination pick-up.

Plant 3 lowers the average considerably for plant owned, cream only trucks. This would indicate the need for careful study of the problem of cream procurement for Plant 3. Since the concentration of production (130) is relatively high, competition from whole milk would seem to be the problem in this instance. This competitive situation probably will continue; therefore, some other solution will be necessary. There is a possibility that a combination pick-up would improve the procurement problem for cream in this plant. At the time the data were collected, the manager was aware of this problem and was considering the possibility of handling eggs which would give him a combination load and increase the pay-load picked up per mile.

Table 4. Average number of pounds of cream per mile by type of procurement.

Type of procurement	Plant	Pounds of cream per mile	Average*
Combination cream and egg pick-up with plant owned trucks	1	10.9	
	2	13.5	
			12.5
Cream only, plant owned	3	13.7	
	4	23.7	
	5	33.5	
			23.0
Cream only, contract hauler	5a	20.5	
	6	15.8	
			18.0

*Weighted by total number of miles and total volume of cream.

The low pick-up per mile existing in Plants 1 and 2, with an average of only 12.5 pounds, emphasizes the need for combination load. When the egg portion of the load is added to the cream, the pick-up per mile in Plants 1 and 2 is 24.3 pounds and 27.5 pounds, respectively. This brings the average load above that of any of the other plants, except Plant 5 where there is a low competitive factor and above average concentration of production. Plant 6 with 15.8 pounds hauled per mile reflects the relatively low concentration of production factor (90) in this area, suggesting the need for a combination pick-up.

Table 5. Average number of cream patrons per load by type of procurement.

Type of procurement	Plant	Cream patrons per load	Average*
Combination cream and egg pick-up with plant owned trucks	1	48	
	2	46	
			47
Cream only, plant owned trucks	3	51	
	4	65	
	5	64	
			60
Cream only, contract hauler	5a	74	
	6	63	
			68

*Weighted by total number of patrons and total pounds of cream.

The number of cream patrons required to get a pay load is shown in Table 5. The combination pick-up trucks service only 47 patrons compared with 60 for the plant owned, cream only, trucks and 68 patrons for the contract haulers. The advantage of this combination pick-up is shown by comparing Table 5 and Fig. 5. Fewer stops are necessary to obtain a large pay load.

This should result in fewer miles traveled and larger pick-up per mile and per patron under comparable conditions of production and competition. Plant 5a (contract haulers) trucks make many stops and travel many miles as shown in Tables 3 and 5, but the result is a good load of cream, Fig. 5. These truck drivers are hard workers and are doing a good job for the plant.

Table 6. Average number of miles per cream patron by type of procurement.

Type of procurement	Plant	Miles per cream patron	Average*
Combination cream and egg pick-up with plant owned trucks	1	2.94	
	2	1.92	
			2.22
Cream only, plant owned trucks	3	2.04	
	4	1.35	
	5	1.01	
			1.39
Cream only, contract hauler	5a	1.85	
	6	1.89	
			1.87

*Weighted by total number of miles and total pounds of cream.

Table 6 emphasizes the importance of concentration of production and the competitive factor in the efficiency of cream procurement as would be expected. The plant owned, cream only, trucks travel the lowest number of miles per cream patron, with 1.39 miles compared with 1.84 for contract haulers and 2.22 miles for patrons for combination pick-up.

Plants 1 and 3 show the effect of a plant operating both cream and milk routes in the same territory increasing the miles traveled per cream patron. Low concentration of production factor is the cause of Plants 1, 2 and 6 being high in miles traveled per patron. Plant 5a is high in miles traveled per patron as a result of having to dead haul through the zone reserved for plant owned trucks.

Plant 5, with 1.01 miles per patron, indicates the high regard of the patrons enjoyed by the plant. The plant has paid high prices for fat over the years and has little competition from other sources for butterfat. The loyalty of the patrons has made it difficult for whole milk plants to invade the territory. This plant started processing whole milk in September, 1945. The advantage enjoyed by the truckers of this plant probably will not continue to be as great as it has in the past. Plant 5a trucks travel 1.84 miles per patron, showing that the loyalty of patrons is greater in the area closer to the plant. Also the contract haulers are concentrating on the larger producers.

Table 7, on pounds of cream per patron, indicates that the contract hauler looks for bigger producers, being interested first in the pay load, and not so much in building up good will for the cooperative. Plants 5a and 5 have largest volume per patron due to lack of competition from whole milk, and a high concentration of production factor.

Thirty-three and three tenths pounds of cream per patron for contract haulers compares with 31.1 pounds for plant owned, cream only, trucks and with 27.9 for combination pick-up. Trucks using the combination pick-up system can afford to stop for a smaller cream pick-up because they also pick up eggs which makes a stop worthwhile.

Table 7. Average number of pounds of cream per patron by type of procurement.

Type of procurement	Plant	Pounds of cream per patron	Average*
Combination cream and egg pick-up with plant owned trucks	1	31.0	
	2	25.8	
			27.9
Cream only, plant owned trucks	3	28.1	
	4	31.8	
	5	34.0	
			31.1
Cream only, contract hauler	5a	37.2	
	6	29.9	
			33.3

*Weighted by total number of patrons and total volume of cream.

There is a close relationship between the miles traveled as indicated in Table 3 and the hours per load shown in Table 8. Plant owned, cream only, trucks averaged 7.0 hours on the road per load compared with 8.3 hours per load for contract haulers and 8.6 hours on the road per load for combination pick-up.

The amount of hustle and the kind of roads are important factors affecting the number of hours required to obtain a load of cream. Plant 5 with plant owned trucks is getting above average loads in the shortest time. High concentration of production and low competition factors are both important in accomplishing the low average.

A third factor is the time in which cream is picked up from the farms. The trucks from Plant 5 start picking up cream at 2 o'clock in the morning and are ready to unload at about 7 a. m. Thus they are not bothered with traffic and delays visiting with the producers while loading cream. Plants 2, 5, and 5a have a definite unloading schedule for each truck.

Table 8. Average number of hours on the road per load by type of procurement.

Type of procurement	Plant	Hours on the road per load	Average*
Combination cream and egg pick-up with plant owned trucks	1	10.1	
	2	7.6	
			8.6
Cream only, plant owned trucks	3	7.0	
	4	7.7	
	5	6.1	
			7.0
Cream only, contract hauler	5a	8.3	
	6	8.4	
			8.3

*Weighted by total number of trucks and total hours on the road.

This schedule appears to help keep the truck drivers on their toes, reducing the amount of time on the road. This scheduling of truck arrivals also facilitates the orderly unloading of trucks at the plant, thus reducing the chance for quality deterioration especially in the summer. Scheduling of the plant work can be accomplished more accurately, resulting in more efficient use of plant labor.

Combination pick up of Plants 1 and 2 utilizing relief trucks during the flush, slows down the operation slightly. Bigger loads tend to offset this factor, but 10.1 hours required of Plant 1 trucks per load suggest that over loading and excessive use of relief trucks may be overdone.

Table 9. Average number of pounds of cream picked up per hour by type of procurement.

Type of procurement	Plant	Ave. no. lbs. of cream per hour	Average*
Combination cream and egg pick-up with plant owned trucks	1	155	
	2	158	
			157
Cream only, plant owned trucks	3	209	
	4	273	
	5	356	
			274
Cream only, contract hauler	5a	341	
	6	229	266

*Weighted by total pounds of cream and total hours on the road.

The pounds of cream picked up per hour emphasizes the concentration of production and competition factor. Table 9 shows a wide variation in pounds of cream picked up by type of procurement. Plant owned, cream only, trucks rank highest with 274 pounds picked up per hour, compared with 266 pounds per hour for contract haulers and 157 pounds per hour for combination pick-up.

Combination pick-up Plants 1 and 2 are low because more than half of the load by weight is eggs. On the basis of pay load per hour their pick-up would be as high as Plant 5, in spite of lower concentration of production factor in their areas.

Plant 5a (contract haulers) shows high pick-up per hour, which indicates little loss of time in driving through the zone serviced by plant owned trucks. They also enjoy high concentration of production in the area as well as big producers on their routes. Plant 3 is still low in pounds of cream picked up per hour, indicating a problem exists which needs the manager's attention.

The same trend is shown in Table 10.

Table 10. Average number of cream patrons serviced per hour by type of procurement.

Type of procurement	Plant	Ave. no. patrons per hour	Average*
Combination cream and egg pick-up with plant owned trucks	1	4.8	
	2	6.1	
			5.6
Cream only, plant owned trucks	3	7.4	
	4	8.6	
	5	10.5	
			8.7
Cream only, contract hauler	5a	9.2	
	6	7.6	
			8.3

*Weighted by total number of patrons and total hours.

Plant 1 ranks low servicing 4.8 cream patrons per hour and Plant 5 services 10.5 cream patrons per hour. Trucks of Plant 5a travel nearly as many miles as trucks of Plant 1 (138 vs. 145) indicating that using relief trucks as well as the combination pick-up may hamper somewhat the efficiency of Plant 1's procurement program.

However, when egg patrons are added, both Plants 1 and 2 compare favorably with the other plants studied, with 8.3 and 10.1 patrons serviced per hour respectively. Plants 5 and 5a are high in patrons serviced per hour, indicating the high concentration of production in that area, and the lack of competition for butterfat producers.

Milk Procurement Operation

Four of the cooperative creameries have a milk department. Plant 7 was studied and the milk procurement data compared with Plants 1, 3 and 5. Plants 2, 4, and 6 are strictly butter plants. Plant 7 was in the area of lowest concentration of production as indicated by Fig. 3, with 68 as the production factor. Also in Table 1, ranking the plants according to amount of competition, Plant 7 ranks second.

Plant 5 has been handling milk the shortest length of time, starting its whole milk operation in September, 1945. This plant was still developing its milk routes when these data were collected which shows the operation for March, 1946. Therefore, this plant had not experienced the milk operation through the flush season at the time these data were collected.

Plants 1 and 3 opened their cheese department and started handling whole milk in February, 1942, in response to the war time demand for increased cheese production. Plant 7 has been operating the whole milk department since 1936. All four plants have definite plans for modernizing or building new milk plants which will give them a completely diversified milk processing operation. Plant 1 was constructing a new building which was not quite completed. Upon completion of this building it will have the most modern and completely equipped plant in Kansas.

Plant 3 had been in its new building only a few weeks when these data were collected. Plant 5 was making cheese in a building that had been used for dry storage and has applied for a building permit which will give it a modern and diversified plant.

Plant 7 has been remodeling and building additions to its plant which upon completion will give it a diversified operation. All of the plants will have evaporating pans; Plants 3 and 7 have roller driers, and Plant 1 has a spray drier. All of the plants are equipped to make American cheese and cottage cheese.

Table 11. Average number of pounds of milk per load by type of procurement.

Type of procurement	Plant	Pounds of milk per load	Average*
Plant owned trucks	1	4890	
	3	4450	
	5	4298	
	7	2434	
			4042
Contract hauler	5a	3836	
	7a	2796	
			3174

*Weighted by total number of trucks and total volume.

The two types of procurement compared in procuring milk are plant owned trucks and contract haulers. Table 11 compares the average size load hauled by type of procurement. Plant owned trucks hauled 4,042 pounds per load, compared with 3,174 pounds average load for contract haulers.

Plant 1 is hauling the heaviest load (4,890 pounds) in spite of a low concentration of production factor (84). Plant 7 is lowest with a 2,434 pound average load. Plant 7 has the lowest concentration of production factor (68) and ranks highest in amount of competition among the milk plants studied, which partially accounts for its small load.

However, since this plant has been in operation for 10 years, it would appear that the plant is having some trouble in meeting competition at least to the extent that it has not been able to consolidate its territory efficiently. It should be pointed out, however, that this task is especially difficult because of the location of another diversified milk plant in the same city.

As shown in Table 11, the trucks of Plants 1 and 3 were heavily loaded which required the managers to use relief trucks in the flush period. Plant 5a (contract haulers) trucks averaged 3,836 pounds per load, which is considerably higher than 7a trucks. This is at least partially due to high concentration of production of 5a (112) and low concentration of production (68) of 7a and the high degree of competition that exists in the 7a area.

Table 12 shows that plant owned trucks travel farther than contract haulers (111 miles to 91).

Table 12. Average number of miles traveled per load by type of procurement.

Type of procurement	Plant	Miles per load	Average*
Plant owned trucks	1	129	
	3	96	
	5	106	
	7	113	
			111
Contract hauler	5a	106	
	7a	83	
			91

*Weighted by total number of trucks and total miles traveled.

Plant 1 hauled the biggest load but traveled more miles (129). Plant 7 traveled 113 miles, or the next greatest distance to pick up the smallest load, reflecting the low concentration of production factor (68).

The contract haulers for Plant 7a traveled 83 miles compared with 113 miles for the plant owned trucks of Plant 7 and picked up 14 per cent more milk than the plant owned trucks. This suggests the possibility of a problem existing in a plant using both plant owned trucks and contract haulers unless the territory is definitely zoned.

In Table 13, comparison of the average number of pounds of milk picked up per mile by type of procurement is shown. Plant owned trucks have a slight advantage of one pound a mile over the contract haulers. Considering the concentration of production factor, Plants 1, 3 and 5 were nearly the same. Plant 7 was low even when the concentration of production factor (68) was taken into consideration, thus lowering the average.

Table 13. Average number of pounds of milk per mile by type of procurement.

Type of procurement	Plant	Pounds of milk per mile	Average*
Plant owned trucks	1	39.1	
	3	44.8	
	5	45.2	
	7	22.8	
			37.6
Contract hauler	5a	36.2	
	7a	36.6	
			36.5

*Weighted by total miles traveled and total volume of milk.

Plant 7a was considerably better than 7 in this respect, picking up 36.6 pounds of milk per mile, compared with 22.8 for the plant owned trucks.

The average pounds of milk per patron are shown in Table 14.

Table 14. Average number of pounds of milk per patron by type of procurement.

Type of procurement	Plant	Pounds of milk per patron	Average*
Plant owned trucks	1	109	
	3	117	
	5	116	
	7	84	
			106
Contract hauler	5a	110	
	7a	76	
			88

*Weighted by total number of patrons and total volume of milk.

Plant owned trucks have larger producers (106 pounds per patron to 88 pounds) than contract haulers. Plants 7 and 7a have smaller producers with 84 and 76 pounds per patron respectively, indicating the need for some work by the fieldman in increasing the size of the dairy enterprise on farms selling whole milk.

An average of one can of milk per day is not an economic unit on a farm and will not justify the investment cost for equipment necessary for efficient use of labor, and production of high quality milk. Plant 7a (contract haulers) has smaller producers than Plant 7 in spite of the fact that 7a trucks travel fewer miles and haul bigger loads. Apparently the contract haulers for this plant have done a better job of consolidating routes than the plant owned trucks of Plant 7.

The number of producers serviced per load is shown in Table 15. Plant owned trucks are servicing more patrons per load on the average than the contract haulers (39 to 37).

Table 15. Average number of milk patrons per load by type of procurement.

Type of procurement	Plant	Milk patrons per load	Average*
Plant owned trucks	1	46	
	3	40	
	5	38	
	7	30	
			39
Contract hauler	5a	35	
	7a	38	
			37

*Weighted by total number of patrons and total trucks.

Plant 1 appeared most aggressive in this respect since it has a low concentration of production factor (84) yet it serviced the most producers (46), hauling the biggest load and traveling the most miles.

Plant 7 (plant owned trucks) was servicing 30 producers, indicating the need for special attention by the manager. It would appear that the small load hauled and the small number of patrons serviced by the trucks of Plant 7 might be improved by rerouting the trucks, consolidating some of the routes, and reducing the number of trucks on the road.

This problem is emphasized again in Table 16, comparing the average number of miles traveled per milk patron.

Table 16. Average number of miles per milk patron by type of procurement.

Type of procurement	Plant	Miles per patron	Average*
Plant owned trucks	1	2.77	
	3	2.50	
	5	2.70	
	7	3.70	
			2.86
Contract hauler	5a	3.03	
	7a	2.13	
			2.38

*Weighted by total number of patrons and total miles traveled.

Again Plant 7 was high with 3.70 miles per patron. The average distance traveled for plant owned trucks was 2.86 miles per patron to 2.48 miles for contract haulers. Plant 7a has a low mileage rate per patron of 2.13, which again indicates the point made previously that the policy of this plant seems to be to favor the contract hauler over the plant owned truck, thus creating a rather serious problem as far as the efficiency of the plant owned trucks is concerned.

Plants 1, 3, and 5 were expanding the milk department and apparently were willing to drive farther to pick up a milk patron, hoping later to get more new ones in between stops. The contract hauler appeared to be watching present costs more closely.

The time element in procuring milk is important since the quality of the milk is closely related to the number of hours on the road, especially in the summer months, making the amount of milk picked up per hour an important factor. The time element is shown in Tables 17, 18, and 19.

Table 17. Average number of hours on the road per load by type of procurement.

Type of procurement	Plant	Hours per load	Average*
Plant owned trucks	1	8.9	
	3	5.7	
	5	5.8	
	7	5.0	
			6.4
Contract hauler	5a	5.1	
	7a	5.4	
			5.3

*Weighted by total hours on the road and total number of trucks.

Table 17 compares the number of hours on the road per load of plant owned trucks and contract haulers. This reflects the concentration of production factor as well as the volume of the load hauled. Plant owned trucks were on the road longer than contract haulers (6.4 hours to 5.3), but were hauling bigger loads as indicated in Table 11. There was a close relationship between hours on the road and concentration of production factor as indicated in Plants 1, 3, 5, 5a and 7a. Plant 7 was the exception in this respect.

Table 18. Average number of pounds of milk picked up per hour by type of procurement.

Type of procurement	Plant	Pounds of milk per hour	Average*
Plant owned trucks	1	582	
	3	837	
	5	746	
	7	501	
			666
Contract hauler	5a	762	
	7a	535	
			617

*Weighted by total number of hours and total volume of milk.

Table 18, showing the pounds of milk picked up per hour, is a better indication of efficiency of the procurement program. Plant owned trucks appeared more efficient here with 666 pounds of milk picked up per hour, compared with 617 pounds for contract haulers. Plant 3 was doing a good job, as indicated by 827 pounds of milk picked up per hour, and Plants 5 and 5a were still improving due to relatively new routes.

The low concentration of production factor (84) handicapped Plant 1, but extensive use of relief trucks, reducing the number of hours each patron's milk is on the road, reduced the quality problem.

Table 19 reflects about the same situation in comparing the number of milk patrons serviced per hour. Contract haulers serviced more patrons per hour. One of the main reasons was the fact that they do not use relief trucks. Miles traveled per patron (Table 16) and patrons serviced per hour (Table 19) emphasizes the same problem. Plant 7 was low considering the light load hauled. The heavier loads slowed the trucks somewhat, requiring more shifting of cans and a slower rate of speed.

Table. 19. Average number of milk patrons serviced per hour by type of procurement.

Type of procurement	Plant	Milk patrons serviced per hour	Average*
Plant owned trucks	1	5.3	
	3	6.7	
	5	6.6	
	7	6.0	
			6.1
Contract hauler	5a	7.0	
	7a	7.0	
			7.0

*Weighted by total patrons and total number of hours.

Plant 1 with 5.3 patrons per hour indicates an excessive amount of shifting of cans in the trucks as well as shifting to relief trucks may be required, reducing the efficiency of this method of procurement.

SUMMARY

Procurement cost of milk and cream is an important expense in the marketing of dairy products. Direct farm route truck procurement is more efficient both from the standpoint of cost and quality than indirect procurement methods. Comparisons of the three truck procurement systems used in Kansas have shown conditions under which each operates most efficiently. They are:

1. Combination pickup of cream and eggs with plant owned trucks.
2. Plant owned trucks picking up cream only.
3. Contract haulers picking up cream only.

Efficiency factors studied were:

1. Size of load hauled.
2. Miles traveled per load.
3. Hours required per load.
4. Patrons serviced per load.
5. Pickup per mile, per hour, and per patron.

The competitive situation in the area serviced by a plant affects the efficiency factors in varying degree depending on the type of competition. Degree of competition depends on the kind of product the competing plants process. Ranked according to degree of competition they are:

1. Plants buying grade A milk.
2. Plants buying whole milk for manufacturing.
3. Plants buying cream for butter production.

In evaluating the efficiency factors the amount of competition and concentration of production must be taken into consideration.

Combination pickup of cream and eggs in plant owned trucks showed a definite advantage in areas of low concentration of production and under most severe competition. Plants 1 and 2 use this system and in spite of the low concentration of production factor for these two plants, when the combination load is considered, they had heavier average loads, heavier pick-up per mile, and serviced more patrons per load and per hour. Plant 3 needs this system because of severe competition and Plant 6 needs this system because of low concentration of production.

Plant owned trucks picking up cream or milk only showed more efficient procurement than contract haulers under conditions of average to high concentration of production. However, this was not true of Plant 3 because of keen competition from grade A and manufacturing milk.

Contract haulers have no advantage over the other systems except in a case where the plant manager has been unable to give sufficient supervision to the truck operation.

ACKNOWLEDGMENTS

Indebtedness is acknowledged to Professor George Montgomery, Head of Department of Economics and Sociology, for counsel and guidance in this study; to Paul Kelley, Assistant Professor of Agricultural Economics and major instructor, for assistance and suggestions; and to managers of the cooperative creameries who supplied the data.

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APPENDIX

APPENDIX

Supplemental information concerning the procurement programs of the various plants is shown in Tables 20 - 28. Tables 20, 21, 22, 23, and 24 show the egg phase of the procurement program for Plants 1 and 2.

Table 20. Average number of dozens of eggs per load.

Type of procurement	Plant	Dozens of eggs per load	Average*
Combination cream and egg pick-up with plant owned trucks	1	1314	
	2	989	
			1119

*Weighted by total number of trucks and total volume of eggs.

Table 21. Average number of dozens of eggs per mile.

Type of procurement	Plant	Dozens of eggs per mile	Average*
Combination cream and egg pick-up with plant owned trucks	1	8.9	
	2	12.2	
			10.9

*Weighted by total miles and total dozens of eggs.

Table 22. Average number of egg patrons per load.

Type of procurement	Plant	Patrons per load	Average*
Combination cream and egg pick-up with plant owned trucks	1	35	
	2	31	
			33

*Weighted by total number of patrons and total trucks.

Table 23. Average number of dozens of eggs picked up per patron.

Type of procurement	Plant	Dozens of eggs: per patron	Average*
Combination cream and egg pick-up with plant owned trucks	1	38.4	
	2	33.9	
			35.7

*Weighted by total number of patrons and total dozens of eggs.

Table 24. Average number of dozens of eggs picked up per hour.

Type of procurement	Plant	Eggs picked up per hour	Average*
Combination cream and egg pick-up with plant owned trucks	1	132	
	2	136	
			134

*Weighted by total volume of eggs and total hours.

These plants owned their trucks and used combination cream and egg pick-up. The operation was similar in each plant. Both plants were in a low concentration of production area (84 and 85) as far as milk production is concerned. However, both plants were located in good poultry areas. The heaviest poultry populated counties in the state were located in the two areas serviced by these plants. The egg operation was about the same size as shown in Table 28. The one difference in the egg operation was the fact that Plant 1 buys, processes and merchandises the eggs, while Plant 2 has a contract with an egg packer in which it picks up the eggs twice a week off the farm and delivers the eggs to the packing plant which is located just across the street from the creamery.

Table 25 shows the procurement costs of cream per pound of butter manufactured for each plant by types of procurement.

Table 25. Procurement cost of cream per pound of butter manufactured by type of procurement.

Plant	Cents per pound					
	1940	1941	1942	1943	1944	1945
1	1.60	1.70	1.40	1.16	1.56	2.50
2	1.20	1.21	1.07	1.00	1.43	1.89
3	1.16	1.07	1.17	1.35	1.56	1.82
4	.81	.81	.88	1.11	1.45	1.35
5*	.82	1.01	.93	1.09	1.30	1.51
5a	1.20	1.20	1.20	1.20	1.60	1.60
6	1.36	1.62	1.40	1.47	1.63	1.74

*Total cost of procurement including rates paid to contract hauler which was 1.20 for years 1940-43 and 1.60 for years 1944-45.

This table shows the value of combination pick-up for Plants 1 and 2. Procurement costs tended to increase from 1940 through 1945. Plant 1 began handling eggs January 10, 1943, and the cream procurement costs for this plant dropped from 1.40 cents per pound to 1.16 per pound for that year. Plant 2 increased both egg and cream volume (Table 26 and 28) in 1942 and 1943 resulting in cream procurement costs being reduced from 1.21 cents per pound in 1941 to 1.07 cents in 1942 and 1.00 cent per pound in 1943. Tables 26, 27 and 28 show the volume of products handled in each department.

Table 26. Volume of butter manufactured by type of procurement.

Plant	1940	1941	1942	1943	1944	1945
1	1,623,954	2,000,066	1,892,227	2,248,913	2,124,927	1,898,337
2	1,343,238	1,782,120	2,113,971	2,337,574	1,963,775	1,770,970
3	646,134	1,264,232	1,305,176	1,508,305	1,343,170	1,324,360
4	1,658,657	2,039,217	2,180,034	2,014,841	1,723,485	1,777,368
*5	4,333,624	4,943,339	5,011,515	4,899,278	4,289,516	4,046,009
6	1,006,604	1,236,590	1,697,773	1,865,320	1,694,379	1,630,912

*Use both plant owned trucks and contract haulers.

Table 27. Volume of whole milk purchased in fat equivalent.

Plant	1940	1941	1942	1943	1944	1945
1			291,241	433,368	586,139	700,103
3			147,561	372,406	647,950	811,958
*5						77,581
7	439,681	660,597	635,881	487,185	651,746	773,393

*Started operations in September of 1945.

Table 28. Dozens of eggs handled.

Plant	1940	1941	1942	1943	1944	1945
1				2,047,236	2,792,349	2,387,953
2	1,076,310	1,254,210	1,644,870	2,286,851	2,111,443	1,908,056