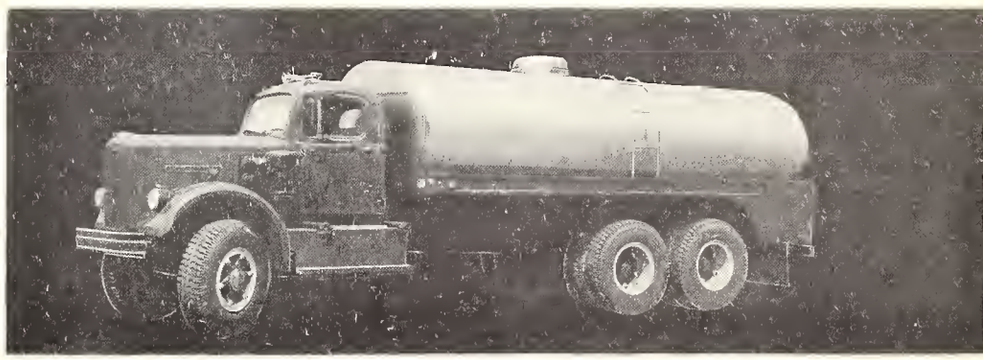
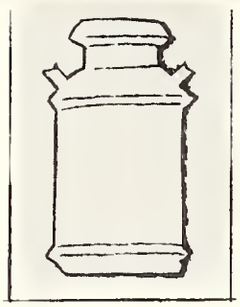
General Report 77

July 1960

Milk Receiving Costs DURING SHIFT FROM CAN TO BULK

By James B. Roof





FARMER COOPERATIVE SERVICE • U. S. DEPARTMENT OF AGRICULTURE

The Farmer Cooperative Service conducts research studies and service activities of assistance to farmers in connection with cooperatives engaged in marketing farm products, purchasing farm supplies, and supplying business services. The work of the Service relates to problems of management, organization, policies, merchandising, product quality, costs, efficiency, financing, and membership.

The Service publishes the results of such studies, confers and advises with officials of farmer cooperatives, and works with educational agencies, cooperatives, and others in the dissemination of information relating to cooperative principles and practices.

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This study was conducted under authority of the Agricultural Marketing Act of 1946 (RMA, Title II).

ACKNOWLEDGMENTS

The cooperation of the Pure Milk Association, Chicago, Ill., made this study possible.

The author acknowledges the contribution of Joseph M. Cowden, Dairy Branch, Farmer Cooperative Service, who formulated and conducted the early phases of the study.

Contents

Summary

The principal aim of this study was to analyze the receiving costs of milk receiving plants during the transition from all-can to all-bulk handling. Major attention in the study was focused on plants halfway through this transition--plants with both can and bulk lines. The use of accounting data from an operating firm made possible separate analyses of these dual receiving operations.

A cooperative operating 10 milk receiving plants in the Midwest supplied most of the data used in this study. These operating data covered the years 1953 through the first half of 1958.

Three of the plants received milk only in cans during the time of the study. Their receipts of milk decreased and consequently their total per unit receiving costs increased sharply.

Five plants added bulk facilities and continued to receive milk in cans. However, there was no decrease in unit receiving costs when the volume of the dual type plants was comparable to the volume of the can plants or to their own volume before adding bulk facilities. Thus when costs did decrease in these five plants, such decreases could be attributed only to increases in volume that occurred as can patrons shifted to bulk handling methods.

Two plants completed conversion to all bulk milk receiving. After conversion, these plants experienced lower total unit costs than either can or dual plants at comparable volumes. This decrease in costs took place even though one plant experienced only a slight increase in volume and the other plant lost volume during the time of the study. A decrease in labor requirements per unit of milk received brought about receiving-cost savings in the all-bulk plants.

The method of receiving had no significant effect upon depreciation costs. Under the bulk receiving method, additional investments in holding tanks and enclosed truck washing areas were offset by the decreased investments in can-receiving equipment.

All other costs such as taxes, insurance, supplies, utilities, and procurement also appeared to have no relationship to method of receiving.

Findings in this study indicate that dual plants are at least as expensive to operate as can plants. Therefore, in order to minimize long-run total costs, multiple-plant firms may consolidate bulk milk at one or more plants and allow others to continue with all-can operations.

Single plant firms may minimize long-run total costs by offering premiums for bulk milk. Such actions should reduce the time of dual operations and thus help the firm gain more quickly the cost advantages of the all-bulk operation.

Milk Receiving Costs During Shift from Can to Bulk

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The transition to bulk handling of milk is taking place in nearly all markets. The National Association of Dairy Equipment Manufacturers reported that the number of bulk tanks on farms in January 1959 was 117,877, an increase of 29.4 percent over January 1958.

Most bulk milk to date has been milk qualified for fluid use, but dairy concerns have begun to use bulk handling for manufacturing grade milk as well. In manufacturing-milk areas, where most milk is still received in cans, interest in bulk handling methods is high. Thus, the transition problem will continue for a long time.

Purpose and Scope of Study

Realizing the importance of the trend to bulk handling, Farmer Cooperative Service conducted a study of the cost records of 10 receiving plants operated by a cooperative in the Chicago Milkshed.[1] Most of these plants were converting to bulk handling methods. This study covered the period from 1953 through the first 6 months of 1958.

Objectives

Objectives of this study were:

1. To compare milk receiving costs before, during, and after conversion to bulk methods.

2. To determine the costs of changing from can to bulk receiving methods.

3. To isolate factors associated with changes in the relationship between can and bulk receiving costs at various levels of conversion.

Most of the earlier research studies have not analyzed separately the costs experienced in dual operations; rather, they have analyzed models of receiving operations by building cost estimates on observed data. In this study, the use of accounting data from actual operations makes analysis of dual operations possible. Receiving costs in the all-can and all-bulk operations of the 10 plants studied compared closely with the receiving costs in model and real plants analyzed in other studies (appendix figure 1).

This plant was devoted to plant operating costs during transition from can to bulk receiving of milk.

[1] These plants were operated by the Pure Milk Association, Chicago, Illinois.

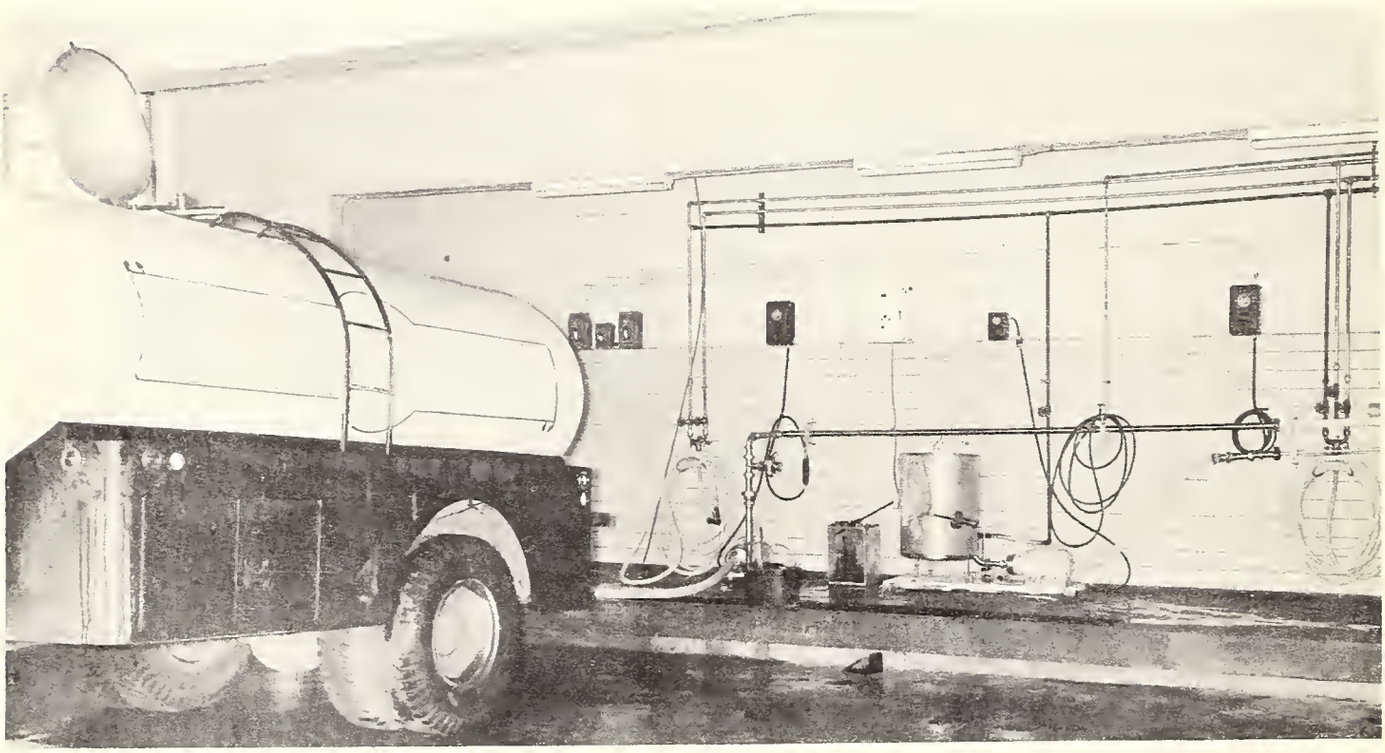
Findings not only can provide guidelines to help plant management plan a change to the bulk system, but can also show how receiving costs during the transition can affect returns to farmers.

Background

Many earlier studies have shown the effects of bulk handling on investments and operating costs on the farm itself and on farm-to-plant hauling. With the coming of the bulk milk handling system, fixed financial requirements for many dairy farmers have increased. On a farm with few cows, the fixed cost for a bulk milk tank is particularly high in relation to the small quantity of milk produced.

At the same time, milk receiving plants changing to an all-bulk operation have opportunities to reduce receiving costs significantly. If a plant saves on operating costs when it shifts to bulk receiving, ordinarily at least a part of these savings may go back to the producer who is then performing functions formerly carried out in plants that received his milk in cans. Transfer of savings from the receiving plant or hauler to the farmer could offset partially, or entirely, the additional costs incurred by many farmers. These transfers of savings could be in the form of price premiums or reduced hauling rates.

Although such savings in receiving operations generally occur in all-bulk operations, the transition phases from can to bulk receiving



Milk receiving plants changing to an all-bulk operation have opportunities to reduce receiving costs significantly. This bulk receiving room illustrates the small investment in unloading equipment necessary for the bulk operation.

methods deserve separate consideration. A receiving plant will not, in most cases, complete the transition from all-can to all-bulk receiving in a short time. It may take years for all the producer shippers of one plant to shift to bulk methods unless they are simply given a deadline to shift.

During this transitional period the receiving plant may find it necessary to maintain both can and bulk receiving facilities. Under these circumstances receiving-cost reductions may be slight or nonexistent. The additional capital expenditures necessary for sanitary pumps, pipes, and a truck washing shed may even add costs to the receiving operation while can receiving is maintained. Management may then find it difficult to pay a premium to farmers shipping bulk milk.

Dairy cooperatives have been particularly concerned with these cost problems. In order to equitably distribute income from members' marketings, to have a guide in determining conversion policy, and to have accurate information available for effective bargaining with milk dealers, cooperatives need to assess cost changes that arise from the transition to bulk handling. Both cooperative and other types of firms have been concerned with the comparative costs of operating can, dual, or bulk receiving rooms.

Method

The association supplied monthly data for each of the 10 plants. Data included a breakdown of operating costs, pounds of milk received, number of patron-shippers, number of loads of milk arriving, and a weekly sample of unloading and truck washing time. It also included the amount of labor hours and quantities of supplies used. In addition, staff members of Farmer Cooperative Service made two or three visits to each plant to collect labor-time data for receiving operations.

Monthly cost and milk volume data were summarized on a semiannual basis in order to reduce the amount of material to be analyzed. Also, semiannual time periods (January-June, July-December) coincided closely with time periods when a particular receiving method was used. Bulk facilities were added or can operations ceased usually around January or July. However, use of these time periods did reflect the unit cost fluctuations caused by seasonal variations in milk receipts.

Two adjustments on the data supplied by the association were necessary. During the period of the study, a considerable increase in wage rates and receiving equipment costs took place. In addition, the plants purchased receiving equipment over a long period of time resulting in many different rates of depreciation.

In order to evaluate costs that occurred during the change in receiving method, and to keep price changes from influencing results, wage rates and equipment depreciation rates were equalized at 1958 levels. Equipment in each plant was valued at 1958 replacement costs, and a straight line, 10-year depreciation was applied. Only equipment used each month was so adjusted. For all other costs, no adjustment was found necessary. Data actually reported and adjusted data are compared on an annual basis in appendix table 1.

Description of Plants

The 10 plants studied presented a wide diversity of operations. They were located 60 to 175 miles from Chicago, and individual plant receipts during the period studied ranged from 11.5 million to over 83 million pounds of milk a year. Three plants received milk entirely in cans during the time of the study, five shifted to dual bulk and can operations, and two plants made the transition from can through dual to a 100 percent bulk operation. A description of each plant follows:

Plant A received milk entirely in cans during the time of the study. Annual receipts decreased from 22.1 million pounds in 1954 to 12.8 million pounds in 1957. Receipts in the first 6 months of 1958 were still lower when adjusted to an annual rate.

Plant B and most of the equipment therein was leased from the former owner in November 1953, 11 months after the study began. Therefore, such fixed costs as depreciation and taxes were reflected as rent. When volume was taken into account, total fixed costs did not appear out of line with fixed costs of those plants owned by the association. This plant received milk in cans only. Its annual receipts ranged from 37.7 million pounds down to an annual rate of 22.4 million pounds in 1958.

Plant C also received milk in cans only. Milk receipts decreased from 25 to 21 million pounds a year. This plant ceased operations in August 1957, less than a year before the study terminated. The plant decided that diversion of patrons' milk to another handler was less costly than an investment in new sewage facilities. Volume had also been declining with attendant higher unit costs of operation.

Plant D initiated a bulk receiving operation in the second half of 1955, 2-1/2 years after the start of the study. For the remainder of the time, this plant was a dual bulk and can operation. In the first half of 1957, a non-grade A can receiving operation was added to accommodate patrons with ungraded milk who had lost a market. This service was necessary to fill the cooperative's obligation to provide a market for members' milk. This extra can line contributed to higher per unit receiving costs for the remaining period of the study even though total plant volume was relatively high. Volume ranged from 25 million to 46.3 million pounds a year.

Plant E was a dual can and bulk receiving facility for all except the first 6 months of the study. This plant had the highest volume of the 10 plants studied. Its volume climbed from 36 million pounds in 1953 to an annual rate of over 83 million pounds in 1958. Physical layout of this plant was relatively old and inefficient.

Plant F was purchased by the Pure Milk Association in August 1954, 1-1/2 years after the study began. Early in 1955 the plant added a bulk line. Volume climbed from 22.8 million pounds the first full year of operation by the association to an annual rate of over 62 million pounds in 1958.

Plant G started as a can operation but added a bulk facility late in the first half of 1955. Volume ranged from 21.6 million to 27.2 million pounds a year.

Plant H operated only a can line for the first 3 years of the study, but added a bulk facility early in 1956. Volume in this plant climbed from 17.9 million pounds to an annual rate of 48 million pounds a year in 1958.

Plant I also operated only a can line until early in 1956 when it added a bulk line. In the second half of 1957 it completed conversion to a 100 percent bulk operation. Volume ranged from 11.8 million to an annual rate of 26 million pounds a year in 1958.

Plant J operated only a can line until early in 1955 when it added a bulk facility. In the second half of 1956 this plant converted to an all-bulk operation. The plant closed in October 1957, but not because of high receiving costs. Association management decided that the flexibility of the bulk milk system allowed them to ship the small volume of milk in this area directly to other handlers, thereby saving the costs of a receiving plant. Volume at this plant declined from a high of 19.2 million to 11.5 million pounds in the last year of operation.

Total Receiving Costs

When plant management examines the possibility of handling bulk milk, it has a choice of three alternatives: Continue as a can operation, add a bulk receiving facility, or convert entirely to bulk receiving as rapidly as possible. In making its decision, management should keep in mind the importance of minimizing total costs in the long run.

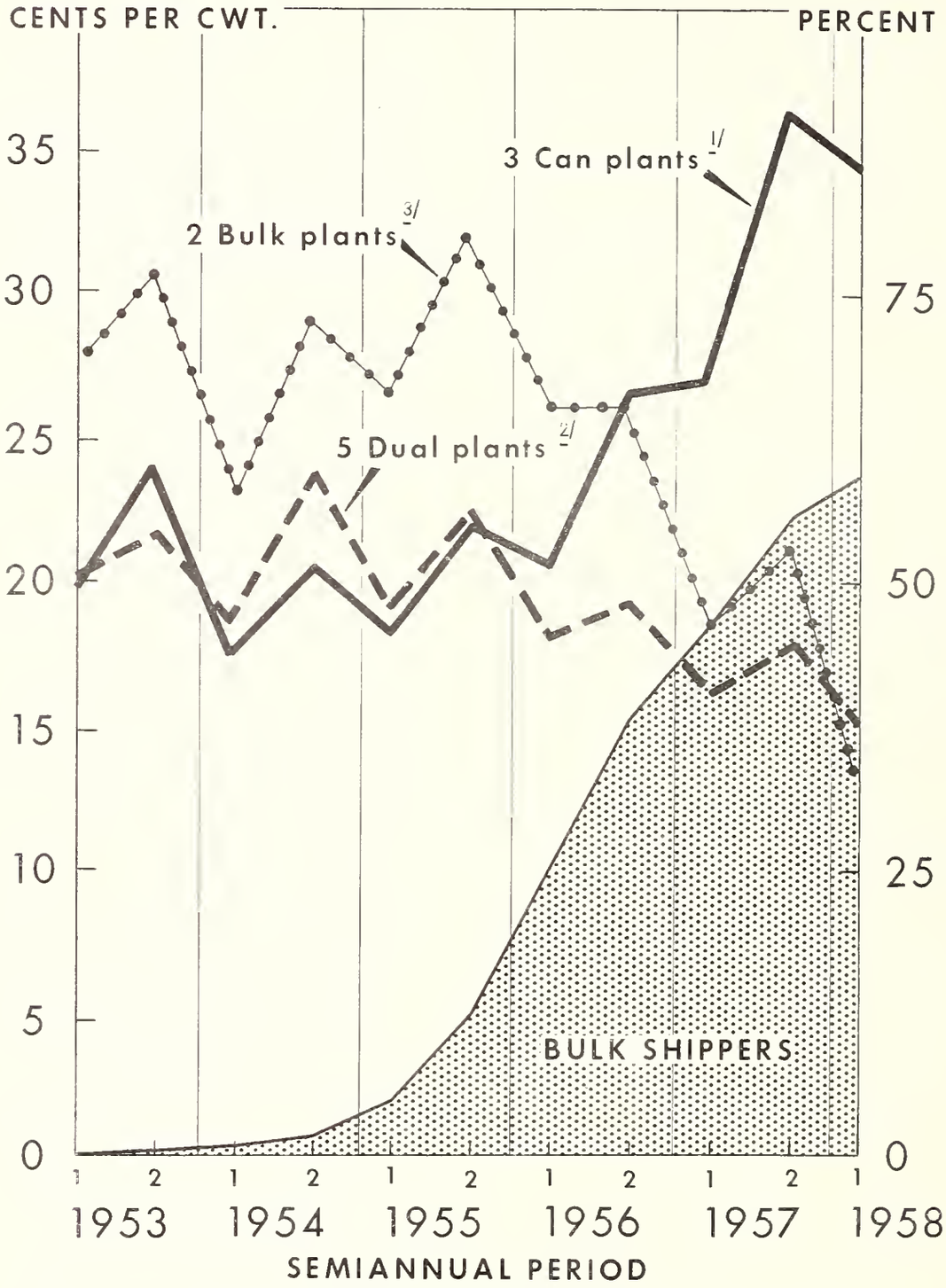
Two major conditions, however, may make it difficult to reduce costs significantly when converting from can to bulk handling: Existence of an efficient can operation, which means that savings under the bulk system would be small, and prevalence of producers with small herds who would find it difficult to pay for a bulk tank. Conversely, an outmoded can operation and prevalence of large producers would provide opportunities for maximum savings in total receiving and hauling costs.

The high proportion of fixed costs in the receiving operation causes volume to be the chief factor in determining per hundredweight costs. Thus, in order to keep costs low it is imperative that a dairy firm maintain a large volume at each receiving point during the period of conversion. But before management decides on whether or not to add a bulk operation, it should carefully assess each producer's ability to add a bulk tank. The possibility of bulk premiums and lower hauling charges should be considered as an inducement to help producers finance their tanks.

At the end of the period studied, the 10 plants examined here were experiencing wide differences in costs according to their types--can, dual, and bulk (figure 1). Beginning in 1955 a rapidly increasing proportion of the producers were shipping bulk milk. The three plants which did not add bulk receiving facilities lost volume, with a resulting increase in receiving costs per pound of milk. However, the plants that provided bulk facilities decreased their unit costs, due to higher volume, as patrons shifted to them from can plants. Bulk patrons usually

Figure 1

TOTAL COSTS OF CAN, DUAL, AND BULK RECEIVING OPERATIONS, AND PERCENT OF FARMERS SHIPPING BULK MILK, SEMIANNUAL PERIODS, 1953-58



1/ CAN PLANTS USED ONLY CAN RECEIVING METHOD THROUGHOUT PERIOD OF STUDY.

2/ DUAL PLANTS INITIALLY USED CAN RECEIVING METHOD ALONE, AND CHANGED TO DUAL BULK-CAN OPERATIONS AT VARIOUS PERIODS DURING THE STUDY.

3/ BULK PLANTS INITIALLY RECEIVED ALL MILK IN CANS, ADDED BULK OPERATIONS, AND FINALLY, BY 1957, CHANGED TO ALL-BULK OPERATIONS.

shipped more milk than the average for all patrons. Therefore, the proportionate increase in volume from the bulk patrons was even greater than the proportionate increase in number of patrons shifting to plants with bulk facilities (appendix figure 2).

At the start of the period studied, the two plants which converted to all-bulk operations had smaller than average volumes for the dual and can plants. At the end of the period, these two plants had converted to 100 percent bulk, and their costs had decreased to about the level of the plants with dual facilities which had much higher volumes (figure 1).

It might be expected that plant costs would be reduced regardless of volume as more and more producers ship bulk milk rather than can milk to a plant with both can and bulk facilities. A statistical analysis of the costs indicated that this was not true for these dual plants (figure 2). Only 1 percent of the difference in receiving costs per hundredweight could be attributed to the ratio of the plants' receipts of bulk milk to all milk receipts. About 60 percent of the differences could be attributed to plant volume. Other cost differences were due to variations between plants of labor efficiency, field costs, and, most important, the percent of capacity utilized in each plant.

Labor Costs

Labor is the most important single cost in the receiving operation. Any saving in labor can lower costs at all levels of volume. And in all but the smallest plants, an all-bulk operation offers an opportunity to decrease labor requirements from that needed in can operations. Elimination of can dumping and sampling at a small volume plant and use of simple equipment requires less labor for setup, operation, and cleanup in bulk handling. These advantages are only partially offset by the necessity for washing farm-to-plant tankers.

Continuation of can-receiving rooms when bulk receiving facilities are added means that almost all labor requirements for can receiving must be continued, and at the same time added labor is needed for the bulk operation. Few, if any, labor cost savings should then be expected as was indicated in our analysis of the 10 plants studied.

Labor costs of the 10 plants in this study are shown in figure 3. The cost per hundredweight included base wages and fringe benefits such as social security payments and union fund contributions. Wage rates were union scale and were fairly uniform among plants except for plant I, which had a slightly lower scale.

Labor cost experience at plant J requires special explanation. This plant was converted to all bulk while its volume was declining. Conversion to bulk in this plant made it possible to reduce receiving to essentially a one-man operation and thus to achieve a sharp drop in labor costs. Changes in both volume and operating cost were so large at plant J that separate lines were required in figure 3 to show experience before and after conversion.

Plants A, B, and C remained all-can operations. Where their volume of receipts were comparable to those of dual plants D, E, F, G, and H, costs were similar. Plants I and J converted to all bulk and had

Figure 2

RELATION OF TOTAL RECEIVING COSTS TO VOLUME OF MILK AMONG PLANTS WITH DUAL FACILITIES

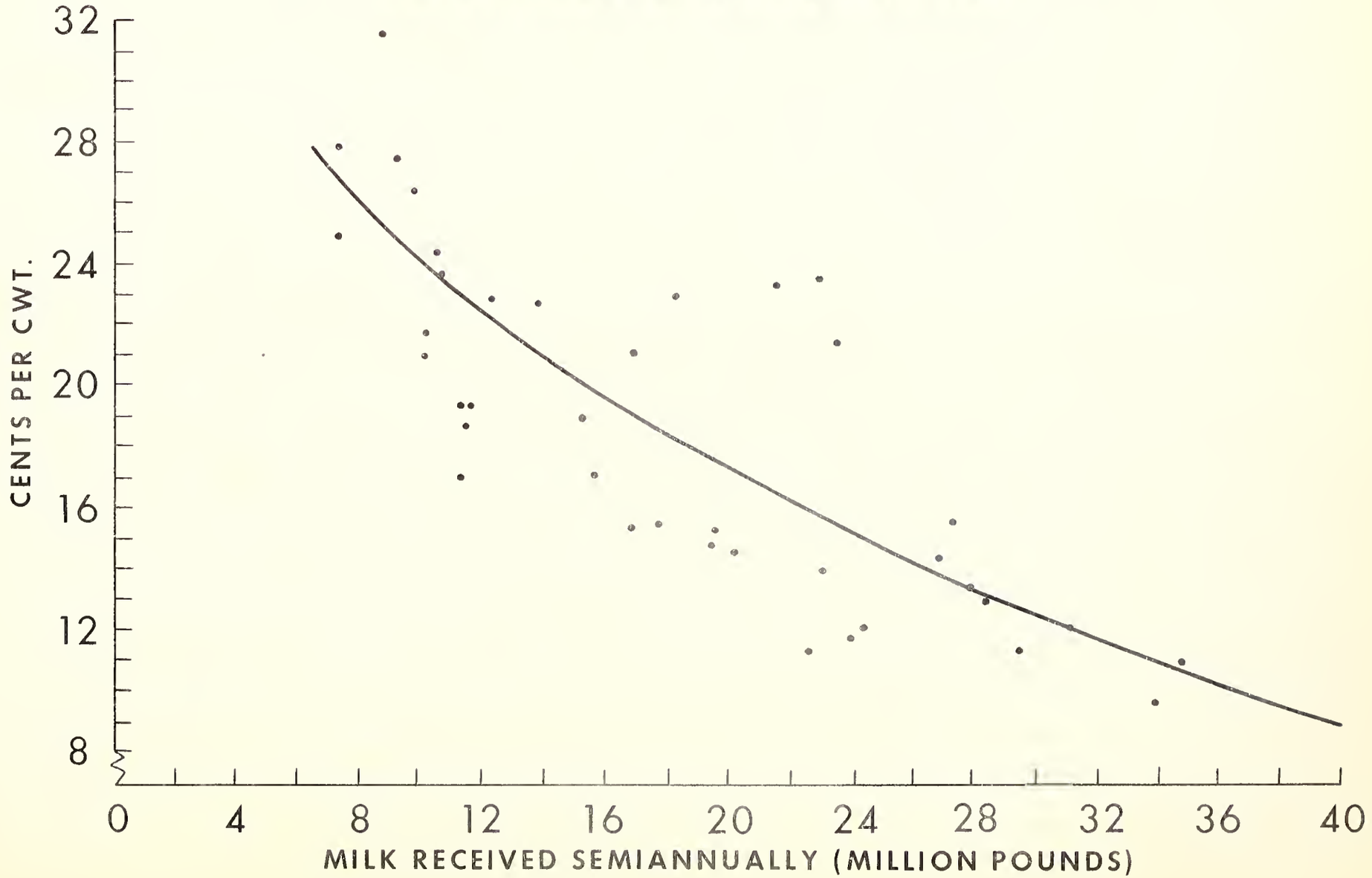
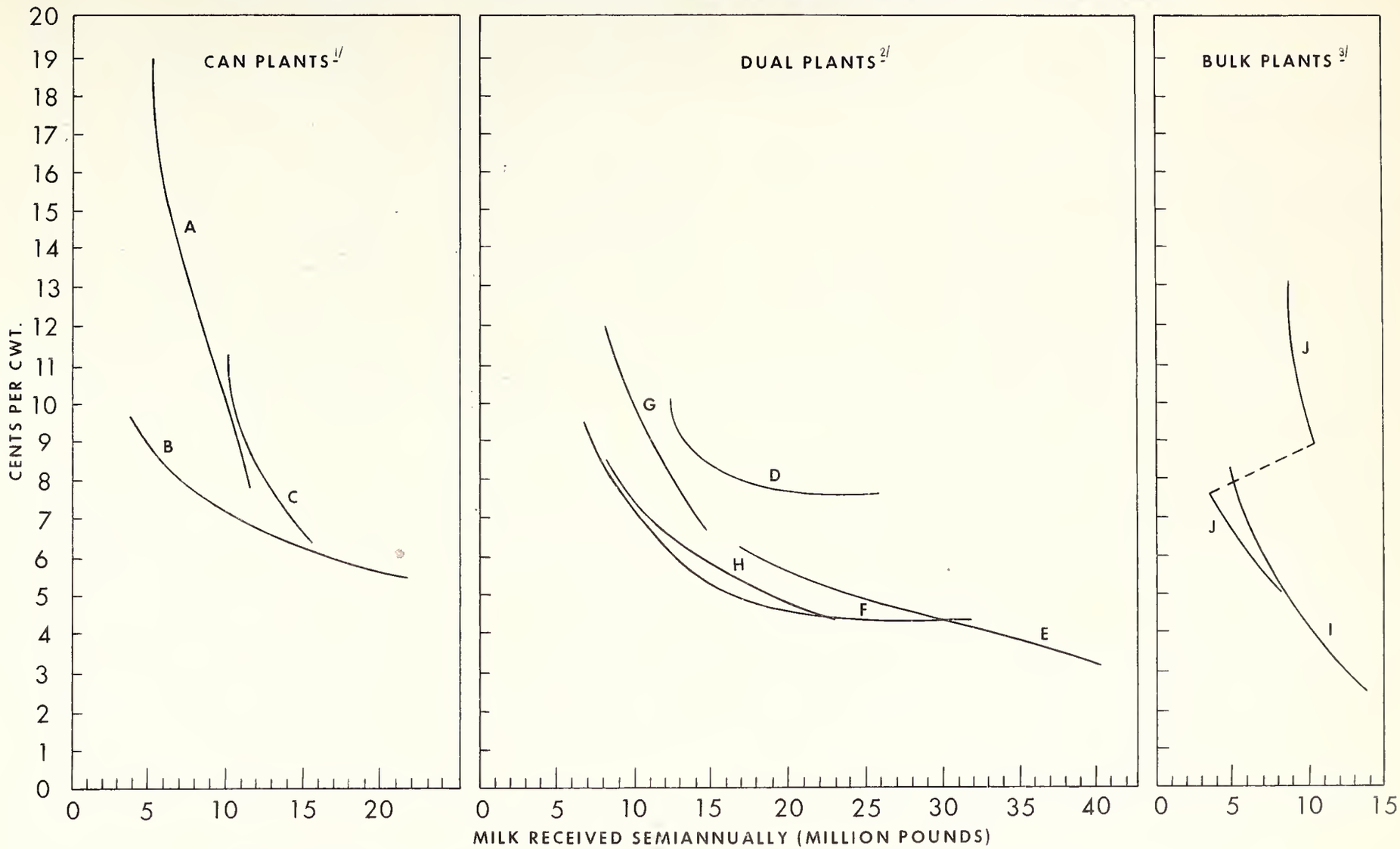


Figure 3

RELATION OF LABOR COSTS TO VOLUME OF MILK RECEIVED, 10 PMA PLANTS



1/ CAN PLANTS USED ONLY CAN RECEIVING METHOD THROUGHOUT PERIOD OF STUDY.

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significantly lower labor costs. It should be noted, however, that the amount of statistical data obtained for these two all-bulk plants was too small for a fully reliable comparison.

It was reasoned that as receipts of can milk fell off, labor efficiency during operating time would decrease for perhaps two reasons:

1. Larger farmers would go bulk first, and the average volume for the remaining can patrons would decrease. This in turn would require handling more cans for a specified volume of milk, since there would be more partially filled cans.

2. More widely spaced location of can shippers would cause erratic arrival of farm-to-plant trucks and thus increase labor waiting time.

Contrary to what was expected labor efficiency during operating time decreased very little. Average volume of shipments by can shippers increased during this period. Although the larger volume farmers usually purchased bulk tanks first, the smaller farmers increased their scale of operations rapidly enough to raise the average deliveries of the can shippers from 532 to 582 pounds shipped per day. Milk received per can and per truck also climbed. This indicated that haulers and management adjusted to changing market conditions by keeping hauling efficiency high.

Data on can intake operations were taken each summer from 1956 thru 1958 by Farmer Cooperative Service staff members (table 1). Although can volume, number of patrons, and number of route trucks decreased, operating efficiency showed no significant decrease. Total receiving labor per hundredweight barely increased from 1956 to 1958--0.57 to 0.59 minutes of labor per hundredweight. Operating time increased from 46.6 to 47.6 percent of total receiving time.

Total labor time for the entire 10 plants dropped from 2,786 minutes per day in 1956 to 2,157 minutes in 1958, or 22 percent. Total volume of can milk received dropped from 485,568 to 366,463 pounds, or about 24 percent. However, an average of 1.2 men were on duty in the receiving rooms in both 1956 and 1958. After receiving can milk, these men were engaged in other duties such as maintenance and cleanup. Labor cost outlays were the same in both years but unit labor costs necessarily rose because of the drop in volume.

Although it generally is possible to reduce labor costs under bulk receiving, labor remains a large item. A certain amount of fixed time is involved in pumping out and cleaning bulk tankers. Hoses must be connected and disconnected, while about the same amount of time is consumed in the cleaning operation regardless of size of load.

This study showed that as more farmers added bulk tanks, haulers carried loads nearer capacity and purchased larger trucks. Pumpout and cleaning-time efficiency increased correspondingly (figure 4).

Comparison of labor requirements under all-can, dual, and all-bulk receiving operations brings out several significant points. Some of these points, however, are necessarily based on observations independent of the present study, since sufficient

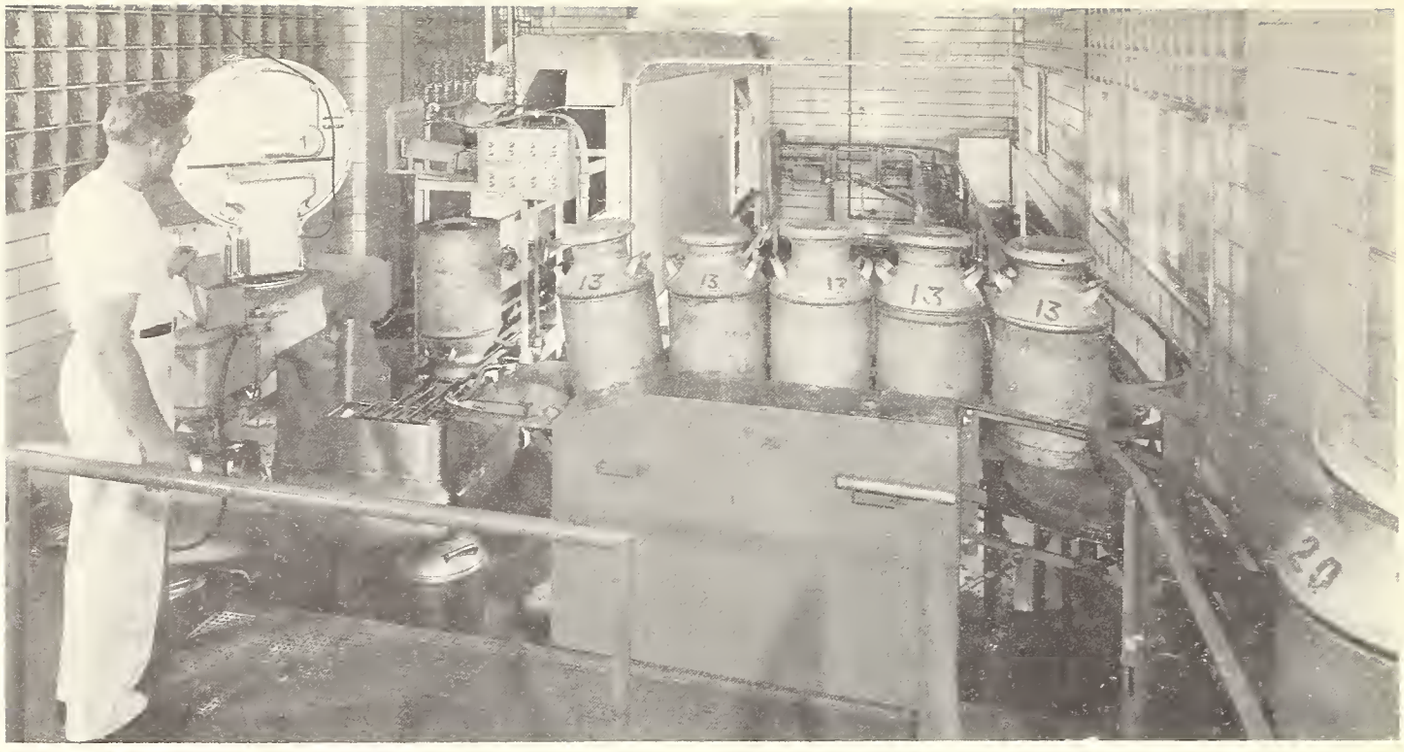
Table 1.--Time requirements and volume data for can intake operations in PMA plants

Item	Data for one day between May and July in:		
	1956	1957	1958
Number of men on duty	11.2	10.2	11
Average men per plant	1.2	1.1	1.2
Time			
Operating time (minutes)	1,300.0	1,152.5	1,027.5
Operating delays (minutes)	70.0	109.5	77.0
Waiting time (minutes)	1,416.0	1,457.0	1,052.5
Total time	2,786.0	2,719.0	2,157.0
Operating time as a percent of total	46.6	42.3	47.6
Receiving labor per cwt. milk (minutes)	0.57	0.63	0.59
Operating time per cwt. milk (minutes)	0.27	0.27	0.28
Cans handled per minute of operation	5.8	5.6	5.2
Cans handled per man per minute of operation	4.8	5.1	4.4
Vehicles unloaded			
Patrons trucks	29	24	20
Route trucks	101	87	69
Total vehicles unloaded	130	111	89
Volume of milk received (lbs.)	485,568	426,343	366,463
Number of patrons	913	755	622
Number of cans	7,602	6,415	5,388
Milk received per vehicle (lbs.)	3,735	3,841	4,117
Milk received per patron (lbs.)	532	565	589
Milk received per can (lbs.)	63.9	66.5	68.0
Cans per vehicle	58	58	60
Cans per patron	8.3	8.5	8.7

data were not obtained in this study to cover all the points.

The first point, based on observations made in this study, is that by adding bulk receiving to a can operation, labor requirements and costs are likely to increase rather than decrease.

Second, a very large amount of milk can be received per man in a bulk operation. Total receiving capacity per man is limited only by time required for connecting and disconnecting hoses, for washing tankers and pumps, and for minor duties. If there is only one pumpout station at a plant, however, this will place an additional limit on capacity per man. Many men overcome this restriction by washing the pump on the bulk truck while it is being emptied by the plant pump.



Decreasing receipts in can receiving rooms will cause unit labor costs to rise.

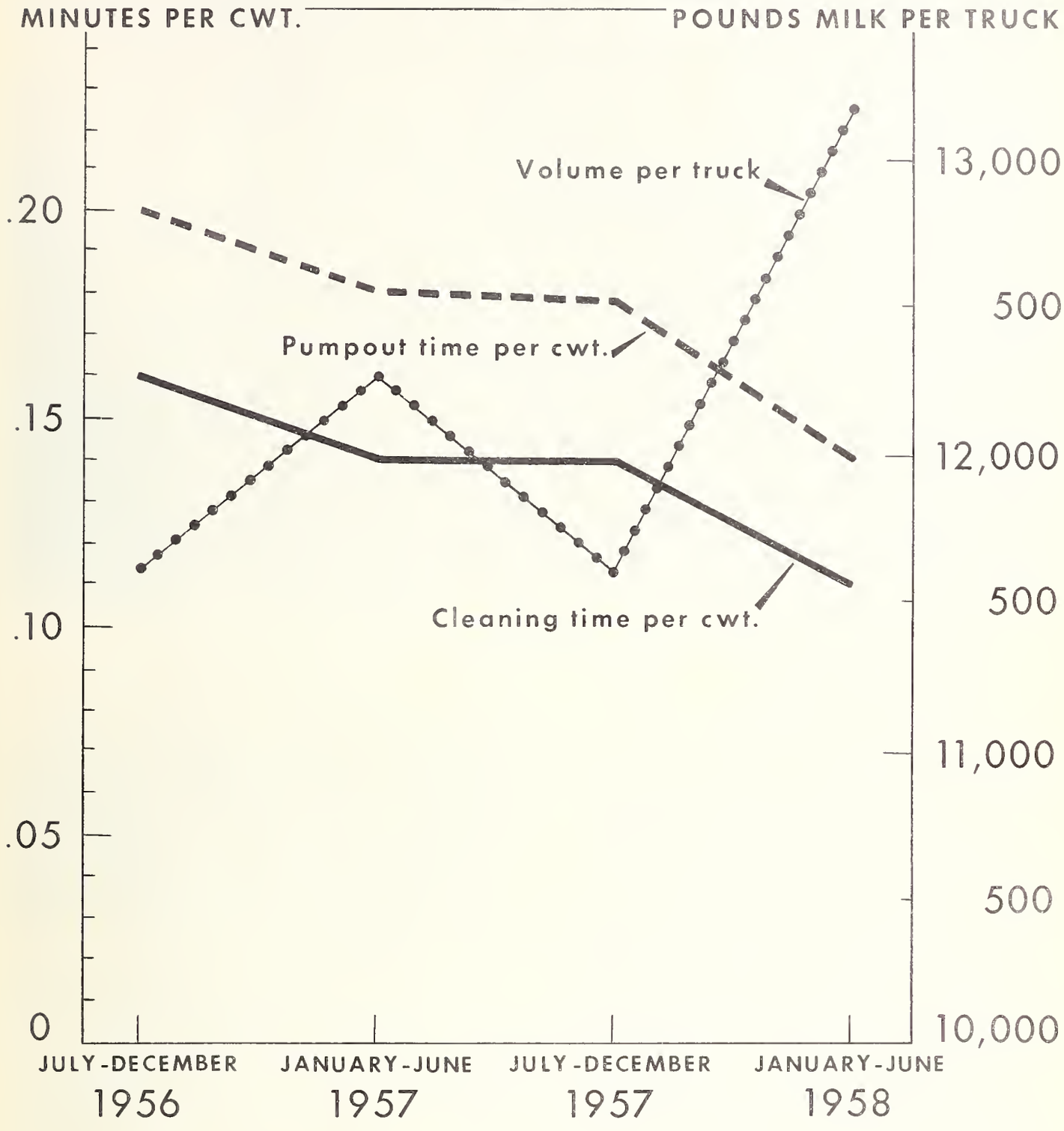
Setting up and cleaning bulk-receiving equipment requires much less time than similar operations in can receiving, since bulk equipment is greatly simplified. If volume is sufficient to justify investments in mechanized cleaning techniques, it is possible to further increase receiving capacity per man, and thus reduce costs. Cleaning bulk equipment, however, was not mechanized at plants in this study.

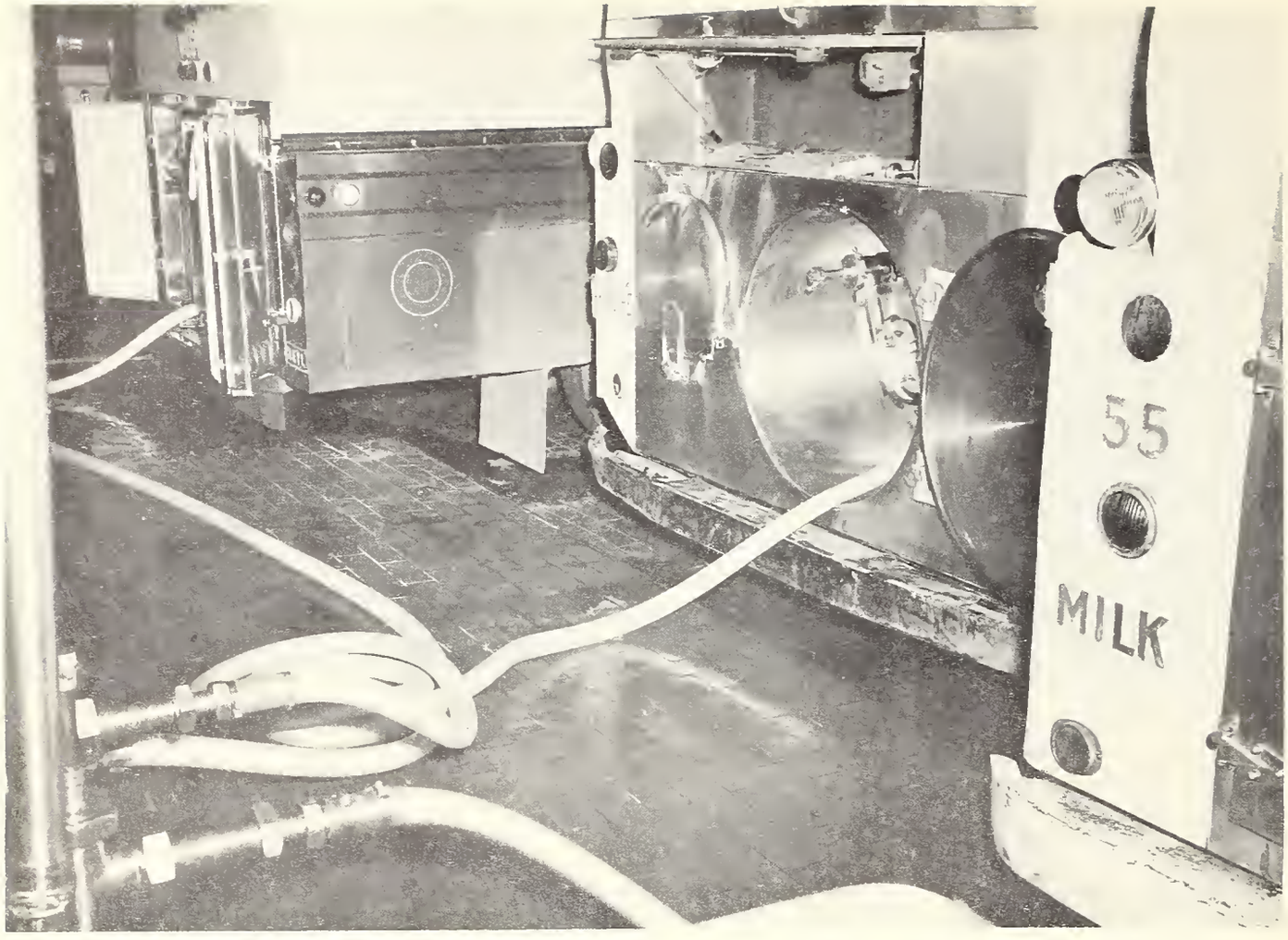
The labor saving of the bulk receiving method results from the fact that one man in a bulk receiving operation can handle a much greater volume than even a 2- or 3-man crew normally can in a can-receiving room. This is shown in terms of dollar savings in plants I and J in figure 3. Labor costs were fairly low in these plants even though volume handled was very small. The savings resulted from a decrease in the number of men assigned to milk receiving.

The third point grows out of the second. While labor costs may generally be lower in bulk than in can receiving, the extent of the savings depends greatly on three conditions: volume of milk received, spacing of truck arrivals during the day, and opportunities to use the same men in receiving and processing, clean-up, or maintenance jobs. During the transition from all-can to all-bulk handling, delays and idle time may be especially great. Such delays and idle time may be reduced, and thus greater efficiency obtained, if it is possible to increase volume and to space arrival of loads to keep receiving labor busy.

Figure 4

BULK PUMPOUT AND CLEANING TIME PER HUNDREDWEIGHT IN RELATION TO AVERAGE TRUCK VOLUME AMONG PLANTS WITH BULK FACILITIES





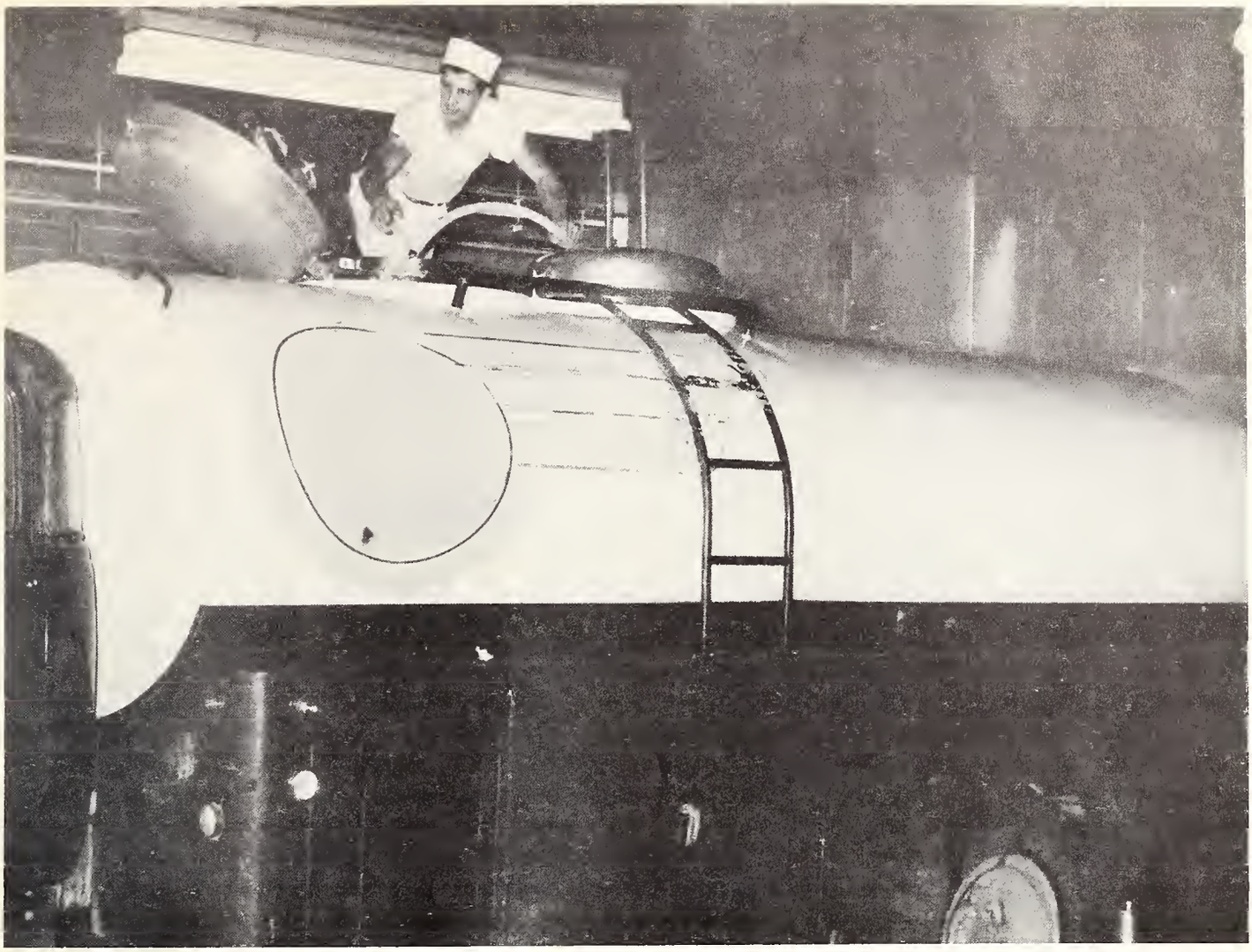
Double discharge outlets in a bulk receiving room can greatly increase receiving capacity per man.

Depreciation

This study, supported by numerous other studies, showed that depreciation cost of buildings and equipment is the second largest cost item in the receiving operation. As milk receiving changes from can to bulk handling methods, operators and analysts have believed that most firms would find depreciation costs lower for bulk handling than for the can handling methods being replaced.

This would be true if the cooperative or other firm did not have to make any additions in the form of building construction and new equipment, and could recover the undepreciated costs still in the can operations by selling unneeded equipment. The plants included in this study had some experience, however, that showed how savings in one type of investment may be offset elsewhere.

In Chicago and some other milk sheds, health regulations require washing tank trucks in heated, enclosed places. In addition, the large amount of milk that can be unloaded in a short time under the bulk system may necessitate adding extra



Labor time involved in cleaning bulk tankers remains a large cost item in bulk operations.

storage tanks. Thus, while the amount of machinery, pipes, and motors required for bulk handling generally will be much less than for the conventional can handling methods, the reduced depreciation cost of this type of equipment may be offset by having to depreciate the increased investment in washing sheds and holding tanks.

In this study, the association owning the 10 plants recovered undepreciated costs from the sale of can facilities. In those plants which began to handle bulk milk, however, it was necessary for the association to add storage tanks and facilities for washing tankers. Thus, when the depreciation costs were adjusted, as described on page 3, they remained as high during the transition phase, and even after complete conversion to bulk handling, as during operation of the can system.

None of the 10 plants actually showed a substantial drop in depreciation costs per hundredweight when the plant changed from one

system of handling to another (figure 5). Furthermore, the depreciation costs did not differ by more than 2 cents per hundredweight between plants at any specific volume of receipts. Only plant D, with three separate intakes for milk, had depreciation costs substantially higher than the others at comparable volumes.

Ordinarily, total depreciation costs during the operation of dual facilities will be higher than during the operation of all-can or all-bulk facilities. Cost increases could vary from an insignificant to a considerable sum, depending on need for additional storage or a washing shed.

For example, a 5,000-gallon insulated holding tank cost about $8,000 in the Midwest at the time of this study. The association in this study invested from $2,000 to $25,000 per plant for washing sheds when bulk facilities were added. Washing shed facilities added at various plants ranged from cutting a hole in a wall and putting in a door to constructing a drive-through room with elaborate tiled walls, truck scales, and motorized doors.

Field Service and Procurement

The association allocated field service and procurement costs to each plant. This made it possible to compare procurement costs for plants before, during, and after the transition to bulk handling.

Procurement costs studied included fieldmen's salary plus benefits, auto expense, and personal travel expenses. Salaries were equalized to 1958 hourly levels to make comparisons possible. Semi-annual average procurement costs per hundredweight were summarized for the 10 plants in three phases of the transition as follows:[1]

Item	Can	Dual	Bulk
Cents per hundredweight	1.72	1.90	1.80
Number of semi-annual observations	60	40	5

An increase in procurement costs was only 18/100 cents per hundredweight when bulk facilities were added. This could have been caused by increases of automobile expenses and personal travel expenses. It is reasonable to assume that the bulk system did not give rise to higher procurement costs for this group of plants.

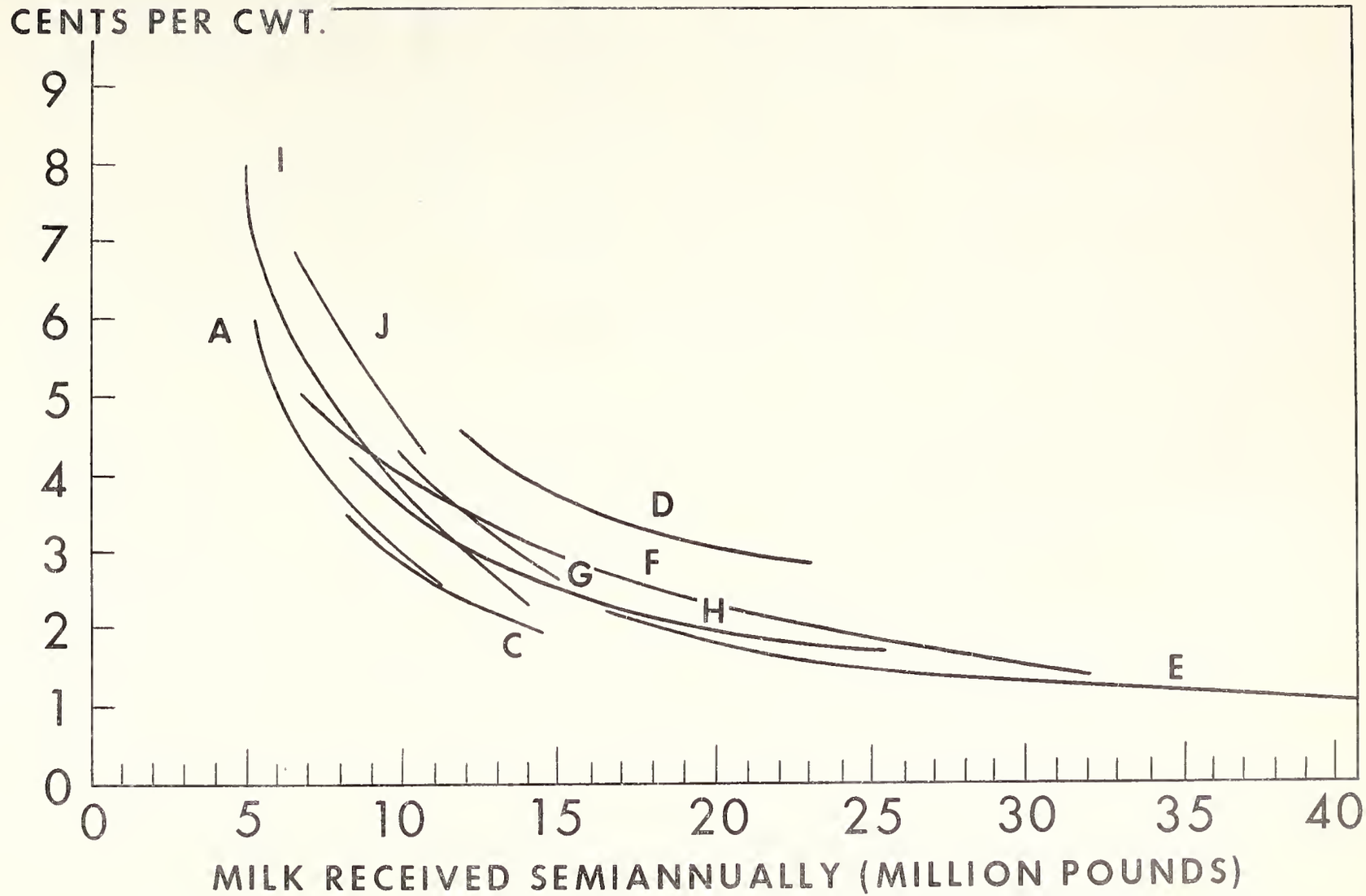
Supplies and Utilities

The costs of supplies and utilities in plants before, during, and after conversion to bulk were difficult to compare. Since individual items of equipment were not metered to determine consumption of steam or power, only total monthly supplies and utilities bills could be compared. Some variations that make comparisons difficult resulted from the following conditions: Heating seasons varied in severity from year to year, varying the amount of power consumed; power cost rates varied according to on- and off-peak loads; and quantity purchases for supplies varied and thus influenced discount rates.

[1] Based on regular reports to the association by receiving plant managers.

Figure 5

RELATION OF DEPRECIATION COSTS TO VOLUME OF MILK RECEIVED, 10 PMA PLANTS [1/]



[1/] EACH PLANT, A TO J, IS DESCRIBED IN THE TEXT. PLANT B DOES NOT APPEAR IN THIS FIGURE BECAUSE ALL BUILDING AND EQUIPMENT WAS LEASED RATHER THAN DEPRECIATED ON ASSOCIATION BOOKS.

Analysis of the cost data revealed that the unit costs of supplies and utilities at several of the plants did not decline as intake volume increased. Since such costs ordinarily decline as intake volume increases, the analysis of supplies and utilities costs of the 10 plants in this study may not be applicable for other situations.

More revealing was a letter from a major manufacturer of cleaning materials pertaining to their research on bulk and can receiving of milk. He estimated that costs of cleaning materials to wash a 400-can milk tank truck with automatic equipment would be 12 to 27 cents more than to wash 400 milk cans. When converted to a hundredweight basis, this additional cost would be relatively unimportant.

The U.S. Department of Agriculture has compiled costs of supplies and utilities used in can and bulk receiving as experienced by several firms.[2] Between plants with similar daily milk capacity, unit costs incurred in bulk operations were always lower by over 1 cent a hundredweight. This saving occurred chiefly because bulk milk usually was cooled sufficiently for storage and transhipment on arrival at the plant, whereas can milk needed further cooling.

Cost data obtained from the 10 plants in this study were inconclusive with respect to supplies and utility costs. However, results from the studies described above illustrate this point: Costs of cleaning supplies and power for can receiving rooms are relatively fixed and do not vary greatly with volume. Therefore, if a bulk receiving operation is added to an existing can operation, volume in can receiving will fall and unit costs in the can "room" will increase. This will ordinarily occur unless the total volume of milk received increases at the same time.

Thus, dual operations may offer no savings in supplies and utilities costs unless total plant volume increases. There will in fact be an added cost of cleaning both can and bulk receiving equipment, since the same equipment is not used for both methods. This disadvantage of dual operations may make it difficult, indeed, to avoid higher unit costs of supplies and utilities in dual than can operations at comparable total plant volumes.

Savings on supplies and utilities costs may be expected only when conversion to bulk is complete, chiefly from lower utility costs.

Other Costs

Each plant in this study had a plant manager, with the field man sometimes acting as assistant manager. Salaries were based on length of service and other factors rather than on type of receiving plant. Property taxes did not have a measurable relationship to type of plant. When taxes increased, they usually resulted from a reassessment of all property in the local community. Reassessment of a plant as a result of a change in receiving method usually occurred long after the change.

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[2] Agnew, Donald B. How Bulk Assembly Changes Milk Marketing Costs. Marketing Research Report No. 190. Agricultural Marketing Service, U.S. Dept. Agr., July, 1957, pp. 60-61.

The receiving plants analyzed in this study required the use of telephones, laboratory services, and automobiles in quantities not related to the method of operation. Costs of these items appeared fixed in total amount and were not related to volume or other factors.

Conclusions

Three groups of plants were analyzed in this study: (1) Three plants that did not add bulk receiving facilities, (2) five that added bulk facilities but did not completely convert, and (3) two that added bulk facilities and finally converted completely to bulk.

The function of these plants was limited to assembling and shipping raw whole milk. The greater flexibility of the labor force and other cost factors present in manufacturing and fluid bottling plants probably would result in a different cost structure than occurs in the single function plants studied here. For this reason these conclusions are limited to single function receiving plants.

The three plants that continued as can-receiving stations lost volume because surrounding producers were shifting away from can deliveries. Had these plants not been operated as parts of a multiple-plant firm, the sharp increase in unit receiving costs they experienced could, under normal competitive operating conditions, have caused a serious drain on operating capital. The experience of these plants illustrates the cost problems of plants that do not add bulk receiving operations in a milkshed where other plants are making this change.

The five plants which added bulk facilities but did not complete conversion to all bulk during the period of the study experienced a decrease in unit receiving costs. However, statistical analysis showed that these costs did not drop merely by adding bulk facilities. Actually, about 60 percent of the decrease in costs resulted from increase of volume received. The analysis covered the various stages of dual operations from a small percentage of bulk handling to a large percentage.

Turning from dual to all-bulk operations, this study showed the potentially lower cost of all-bulk receiving operations. The two plants which converted entirely to bulk handling had smaller volumes of receipts than the average of the plants which did not complete conversion to bulk. Costs at these two plants, for the period of all-bulk operations, were significantly lower than the dual and can plants experienced at comparable volumes. These findings, based on only two plants, are consistent with findings from other research.

Labor costs were studied separately and showed that the saving in total labor costs in the two all-bulk plants resulted directly from their bulk operations. The dual plants, by contrast, did not find it possible to reduce total labor costs and could not reduce total unit receiving costs until milk volume was increased.

For the entire 10 plants in this study, receiving costs other than

labor did not decrease when the method of receiving was changed.

In a shift from can to bulk operations, a firm should maintain dual operations for as short a time as possible. Multiple plant firms could accomplish this by converting one or more plants to an all-bulk operation and allowing other plants to continue as all-can plants.

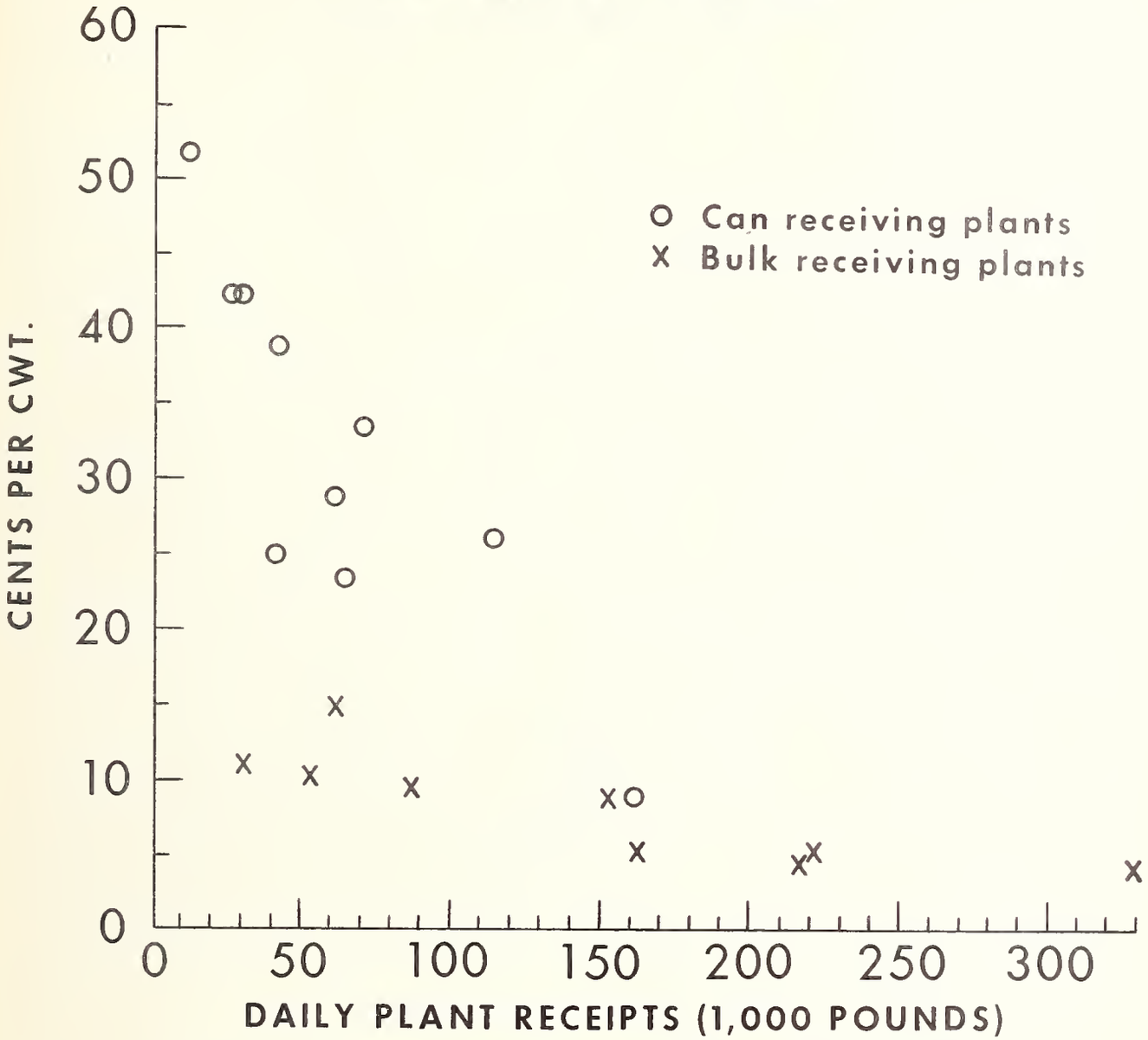
Data from this study suggest that can plants are about as economical as dual receiving plants at comparable volumes of receipts. It is, however, imperative to keep volume high in can plants in order to keep costs down. Therefore, savings from the all-bulk plants could be used to subsidize the added transportation cost of shipping milk to consolidated, but necessarily more widely dispersed, can receiving plants.

During the transition period, single plant firms may want to encourage patrons to shift more quickly from cans by offering them premiums for bulk milk. In the long run, then, cost of premiums may be more than offset by savings in an all-bulk receiving operation.

Appendix

Appendix Figure 1

COMPARISON OF RECEIVING COSTS IN THIS AND OTHER RESEARCH STUDIES [1/]



[1/] *HAND, PAUL E., AND PIERCE, C. W. COST STUDIES OF RECEIVING AND TRANSPORTING MARKET MILK IN THE PHILADELPHIA AREA, A. E. AND R. S. NUMBER 6. THE PENNSYLVANIA STATE UNIVERSITY, UNIVERSITY PARK, AUGUST 1956.*

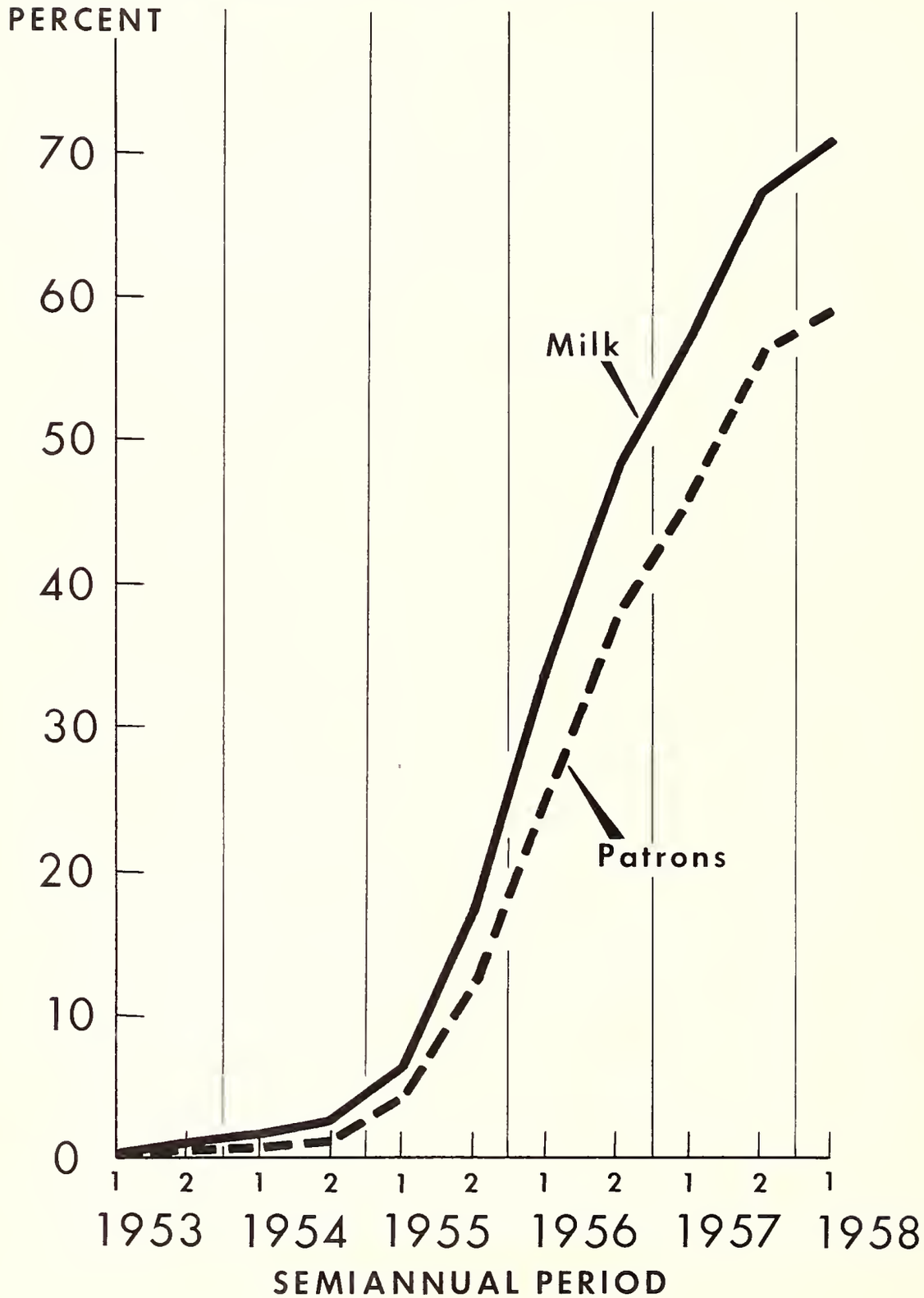
MILLER, ARTHUR H. BULK HANDLING OF WISCONSIN MILK; FARM TO PLANT. RESEARCH BULLETIN 192. UNIVERSITY OF WISCONSIN, MADISON, FEBRUARY 1956.

APLIN, R. D. COUNTRY RELOAD PLANTS FOR BULK MILK; SPECIFICATIONS AND COSTS, A. E. - RES. - 1. NEW YORK STATE COLLEGE OF AGRICULTURE, ITHACA, JULY 1958.

BAUM, E. L., RILEY, R. D., AND WEEKS, E. E. ECONOMIES OF SCALE IN THE OPERATION OF CAN AND TANK MILK RECEIVING ROOMS, WITH SPECIAL REFERENCE TO WESTERN WASHINGTON. TECHNICAL BULLETIN 12. WASHINGTON AGRICULTURAL EXPERIMENT STATIONS, STATE COLLEGE OF WASHINGTON, PULLMAN, MAY 1954.

Appendix Figure 2

PERCENT OF MILK RECEIVED IN BULK AND PERCENT OF PATRONS SHIPPING BULK MILK, 10 PMA PLANTS, 1953-1958



Appendix table 1.--Reported and adjusted annual receiving costs for 10 PMA plants

Plant	A						B					
Year	1953	1954	1955	1956	1957	1958[1]	1953	1954	1955	1956	1957	1958[1]
Milk received (1,000 pounds)	18,226	22,111	20,586	19,558	12,833	5,623	4,255	37,742	32,578	24,542	23,659	11,235
						Cents per hundredweight[2]						
Fixed plant costs	4.96	5.45	6.47	6.17	8.36	9.65	9.51	8.71	9.05	12.74	13.36	14.12
	7.31	7.22	8.24	7.36	11.40	13.00	9.76	8.72	9.06	12.87	13.44	14.17
Variable plant costs												
Labor	8.66	7.56	8.49	9.67	14.86	16.51	7.54	5.12	5.04	6.61	5.68	5.73
	10.75	8.97	11.29	10.69	15.23	16.52	9.48	6.52	6.02	7.36	5.96	5.73
Other	3.48	3.09	3.30	3.84	5.26	5.95	8.10	2.95	2.54	3.29	3.77	3.60
	3.48	3.09	3.30	3.84	5.26	5.95	8.10	2.95	2.54	3.29	3.77	3.60
Total variable costs	12.14	10.65	11.79	13.51	20.12	22.46	15.64	8.07	7.58	9.90	9.45	9.33
	14.23	12.06	14.59	14.53	20.49	22.47	17.58	9.47	8.56	10.65	9.73	9.33
Procurement costs	.44	.71	.98	1.70	4.67	5.32	2.59	1.43	2.16	2.66	3.25	3.88
	.44	.71	.65	1.81	4.93	5.32	3.05	1.58	2.05	2.69	3.37	3.88
Other charges	.19	.24	.12	.20	.31	.34	.31	.08	.26	.29	.36	.26
	.19	.24	.12	.20	.31	.34	.31	.08	.26	.29	.36	.26
Grand total	17.73	17.05	19.36	21.58	33.46	37.77	28.05	18.29	19.05	25.59	26.42	27.59
	22.17	20.23	23.60	23.90	37.13	41.13	30.70	19.85	19.93	26.50	26.90	27.64
Receiving phase (B = bulk, C = can, BC = bulk and can)	C	C	C	C	C	C	C	C	C	C	C	C

[1] 6 months.

[2] Upper figure represents reported annual receiving costs. Lower figure represents adjusted annual receiving costs.

Appendix table 1.--Reported and adjusted annual receiving costs for 10 PMA plants (continued)

Plant	C						D					
Year	1953	1954	1955	1956	1957[1]	1958	1953	1954	1955	1956	1957	1958[2]
Milk received (1,000 pounds)	21,732	24,532	25,197	21,169	10,567		27,030	25,019	25,651	32,082	46,382	21,545
					Cents per hundredweight[3]							
Fixed plant costs	4.89	4.17	4.49	4.73	7.12		10.44	9.55	9.25	7.97	7.54	7.48
	6.75	5.85	6.08	6.58	9.09		9.60	8.86	10.09	7.91	7.30	7.78
Variable plant costs:												
Labor	7.14	6.87	7.03	8.98	12.32		6.71	6.56	6.36	6.20	6.89	7.95
	9.20	8.35	8.37	9.71	12.39		10.31	9.46	9.36	7.80	7.57	7.98
Other	1.80	1.85	1.59	1.94	2.92		5.59	4.58	4.46	3.96	3.98	4.10
	1.80	1.85	1.59	1.94	2.92		5.59	4.58	4.46	3.96	3.98	4.10
Total variable costs	8.94	8.72	8.62	10.92	15.24		12.31	11.14	10.82	10.16	10.87	12.05
	11.00	10.20	9.96	11.65	15.31		15.90	14.04	13.82	11.76	11.55	12.08
Procurement costs	.27	.28	.25	.38	.83		2.44	2.51	2.09	2.77	3.03	3.36
	.27	.28	.25	.38	.84		2.79	3.08	2.26	3.03	3.13	3.36
Other charges	.17	.12	.11	.17	.26		.33	.23	.29	.28	.16	.18
	.17	.12	.11	.17	.26		.33	.23	.29	.29	.56	.18
Grand total	14.27	13.29	13.47	16.20	23.45		25.51	23.43	22.45	21.18	21.60	23.07
	18.19	16.45	16.40	18.78	25.50		28.62	26.21	26.46	22.99	22.54	23.40
Receiving phase (B = bulk, C = can, BC = bulk and can)	C	C	C	C	C		C	C	C	BC	BC	BC

[1] 8 months.
[2] 6 months.
[3] Upper figure represents reported annual receiving costs. Lower figure represents adjusted annual receiving costs.

Appendix table 1.--Reported and adjusted annual receiving costs for 10 PMA plants (continued)

Plant	E						F					
Year	1953	1954	1955	1956	1957	1958[1]	1953	1954[2]	1955	1956	1957	1958[1]
Milk received (1,000 pounds)	36,860	41,986	47,478	57,367	68,843	41,730		7,299	22,858	32,223	54,240	31,291
	Cents per hundredweight[3]											
Fixed plant costs	3.77	3.31	3.46	4.48	3.08	2.46		14.19	9.79	7.88	5.60	3.48
	4.79	4.11	4.37	4.76	3.22	2.74		13.06	8.76	7.64	5.32	3.30
Variable plant costs												
Labor	4.38	3.98	4.43	4.13	3.61	3.22		9.54	7.45	5.82	4.98	4.34
	5.58	4.82	5.01	4.51	3.88	3.22		9.13	6.63	5.01	4.22	4.34
Other	2.44	2.29	2.13	1.71	1.49	1.18		7.11	4.86	3.85	2.71	2.11
	2.44	2.29	2.13	1.71	1.49	1.18		7.11	4.86	3.85	2.71	2.11
Total variable costs	6.82	6.27	6.56	5.84	5.10	4.40		16.65	12.31	9.67	7.69	6.45
	8.02	7.11	7.14	6.22	5.37	4.40		16.24	11.49	8.86	6.93	6.45
Procurement costs	1.80	1.25	1.33	1.17	1.57	1.62		3.30	3.01	3.55	2.87	2.37
	2.00	1.74	1.51	1.27	1.69	1.62		3.15	3.19	3.62	2.74	2.30
Other charges	.17	.08	.15	.18	.17	.08		.68	.29	.17	.16	.19
	.17	.10	.15	.18	.17	.08		.68	.29	.17	.16	.19
Grand total	12.56	10.91	11.50	11.67	9.92	8.56		34.82	25.40	21.27	16.32	12.49
	14.98	13.06	13.17	12.43	10.45	8.84		33.13	23.73	20.29	15.15	12.24
Receiving phase (B = bulk, C = can, BC = bulk and can)	BC	BC	BC	BC	BC	BC		C	BC	BC	BC	BC

[1] 6 months.
[2] 5 months.
[3] Upper figure represents reported annual receiving costs. Lower figure represents adjusted annual receiving costs.

Appendix table 1.--Reported and adjusted annual receiving costs for 10 PMA plants (continued)

Plant	G						H					
Year	1953	1954	1955	1956	1957	1958[1]	1953	1954	1955	1956	1957	1958[1]
Milk received (1,000 pounds)	27,205	24,975	22,020	21,914	21,692	11,377	17,941	20,208	26,762	32,593	38,819	24,041
	Cents per hundredweight[2]											
Fixed plant costs	5.53	5.47	7.17	6.57	6.32	5.64	6.53	6.06	4.88	3.64	4.15	2.88
	6.91	6.99	8.71	8.18	7.98	7.36	9.38	8.76	6.82	5.26	5.12	3.91
Variable plant costs												
Labor	6.25	6.86	8.05	8.20	8.32	8.52	6.23	6.07	4.89	4.98	5.00	4.15
	7.88	8.66	9.79	9.01	8.60	8.51	7.87	6.92	6.31	5.68	5.28	4.15
Other	2.96	2.95	3.22	2.87	2.67	2.44	3.49	3.53	3.44	3.09	2.56	2.24
	2.96	2.95	3.22	2.87	2.67	2.44	3.49	3.53	3.44	3.09	2.56	2.24
Total variable costs	9.21	9.81	11.27	11.07	10.99	10.96	9.72	9.60	8.33	8.07	7.56	6.39
	10.84	11.61	13.01	11.88	11.27	10.95	11.36	10.45	9.75	8.77	7.84	6.39
Procurement costs	.50	.50	.35	.35	.35	.78	.44	1.61	2.16	2.07	1.69	1.43
	.49	.50	.35	.36	.35	.78	.44	1.69	2.48	2.15	1.76	1.43
Other charges	.20	.13	.13	.22	.33	.29	.22	.16	.19	.22	.28	.25
	.20	.13	.13	.22	.33	.31	.23	.16	.19	.22	.28	.25
Grand total	15.44	15.91	18.92	18.21	17.99	17.67	16.91	17.43	15.56	14.00	13.68	10.95
	18.44	19.23	22.20	20.64	19.93	19.40	21.41	21.06	19.24	16.40	15.00	11.98
Receiving phase (B = bulk, C = can, BC = bulk and can)	C	C	BC	BC	BC	BC	C	C	C	BC	BC	BC

[1] 6 months.
[2] Upper figure represents reported annual receiving costs. Lower figure represents adjusted annual receiving costs.

Appendix table 1.--Reported and adjusted annual receiving costs for 10 PMA plants (continued)

Plant	I						J					
Year	1953	1954	1955	1956	1957	1958[1]	1953	1954	1955	1956	1957[2]	1958
Milk received (1,000 pounds)	12,302	12,197	11,841	14,478	20,829	13,121	18,579	19,202	17,895	17,338	11,530	
					Cents per hundredweight[3]							
Fixed plant costs	11.47	12.64	14.13	11.41	7.28	5.27	8.97	8.79	10.43	9.27	10.61	
	13.48	13.73	15.23	12.49	7.63	5.42	10.83	10.58	12.20	11.12	12.82	
Variable plant costs.												
Labor	5.39	5.16	5.63	4.75	3.77	2.75	8.22	8.35	9.41	8.29	5.90	
	7.01	6.15	7.24	6.00	3.80	2.75	10.38	10.15	12.12	9.60	6.07	
Other	3.26	3.55	4.12	3.63	1.81	1.28	4.34	4.60	4.66	3.65	1.70	
	3.26	3.55	4.12	3.63	1.81	1.28	4.34	4.60	4.66	3.65	1.70	
Total variable costs	8.65	8.71	9.75	8.38	5.58	4.03	12.56	12.95	14.07	11.94	7.60	
	10.27	9.70	11.36	9.63	5.61	4.03	14.72	14.75	16.78	13.25	7.77	
Procurement costs	5.08	1.51	1.26	3.47	3.51	2.73	.46	.47	.49	.59	.74	
	5.58	1.55	1.26	3.89	3.70	2.73	.46	.47	.49	.59	.74	
Other charges	2.49	.54	.18	.47	.55	.33	.16	.14	.19	.24	.34	
	2.49	.54	.18	.47	.55	.33	.16	.14	.19	.24	.34	
Grand total	27.69	23.40	25.32	23.73	16.92	12.36	22.15	22.35	25.18	22.04	19.29	
	31.82	25.52	28.03	26.48	17.49	12.51	26.17	25.94	29.66	25.20	21.67	
Receiving phase (B = bulk, C = can, BC = bulk and can)	C	C	C	BC	BC	B	C	C	BC	BC	B	

[1] 6 months.
[2] 10 months.
[3] Upper figure represents reported annual receiving costs. Lower figure represents adjusted annual receiving costs.

Other Publications Available

Multiquart Containers--Their Significance in Dairy Cooperatives, General Report 54. William J. Monroe.

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