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Tank-Truck Assembly of Milk for New Hampshire

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Increased use of tank trucks and farm tanks in the assembly of milk is affording economies and conveniences to producers and dealers in several of the United States milksheds. This cannot be accepted as a blanket approval. however. An appraisal of the conditions specific to each market or milkshed is an essential procedure before investment in or change to tank assembly can be advocated as universally beneficial. Moreover, the conditions under which this system is beneficial should be determined.

Any techniques which reduce costs or increase efficiency in the production and processing of milk are welcome to an industry which is facing growing competition for its products. Tank-truck assembly can therefore best be evaluated where it permits cost reductions to the industry as a whole and where it improves the competitive position of this industry in a particular area.

There are four distinct functional operations in the sale of milk. They are: production, assembly, processing, and distribution. As so defined, production is limited to the farm operations of milking and animal husbandry. Assembly is the collection from farms and delivery to the processor or dealer. Processing refers to those plant operations necessary for the bottling of whole milk and the preparation of milk products. Distribution is the final step of getting milk and milk products into the hands of the consumers.

A reduction in costs in any one of these operations may be retained by that sector to improve its cost position, or it may be passed forward to consumers either as lower prices or as improved quality, or passed backward to producers as higher prices. It is necessary therefore to decide what economies, if any, are possible from the adoption of tank handling, and to estimate how the distribution of benefits and costs between producers and dealers would influence the dairy industry in New Hampshire.

Review of Literature

Studies by Clarke** and by Baum and Pauls† claim cost savings from tank trucks in assembly as volume increases under the conditions peculiar to California and Western Washington.

Twining‡ describes the bulk handling of milk in the Washington, D. C., milkshed. This provides information on a current operation where the majority of herds are 75 cows and over, and describes the generally favorable impressions of 57 producers cooperating in the study.

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**Clarke, D. A., Jr. *A Comparative Analysis of the Costs of Operating Milk Collection Routes by Can and Tank in California*, Giannini Foundation of Agricultural Economics, Berkeley, Calif., Mimeo. Report 91, October, 1947.

†Baum, E. L., and Pauls, D. F. *A Comparative Analysis of Costs of Farm Collection of Milk by Can and Tank in Western Washington.* Washington Agr. Exp. Station, Pullman Tech. Bull. No. 10, 1953.

‡Twining, C. R. *Bulk Handling of Milk in the Washington, D. C., Milkshed.* M. S. Thesis, University of Maryland, 1953.

Many statements and claims are made by manufacturers and industry leaders which can be better evaluated as more detailed information on individual operations becomes available and as studies are made of the separate markets.

Conditions for Investment

Increased use of tanks in the assembly of milk has industry-wide effects. The decision to invest in and proceed with the change-over from cans to tanks rests jointly with producers and dealers. Bulk assembly with tank trucks is not generally possible until farm tank coolers are installed in fairly large numbers in any area. On the other hand, disinvestment in the old van-type truck places similar emphasis on the decisions of dealers or private truckers.

No rational investment will be made until future savings or returns on the investment are apparent. Milk dealers will encourage the change to bulk handling if there are advantages and potentially lower costs in the assembly or processing of milk. Farmers favor a change if they expect the costs of handling milk on their farms will be reduced or the price received for milk sufficiently increased. The conveniences may be valued higher by some producers than others in relation to dollar costs. Producers pay for the transportation of milk to the plant, therefore the trucking costs must either be reduced or increased less than the savings from the farm tank. Cost reduction in the creamery or dealers plant operation will enable dealers to increase their profit margin, maintain or reduce prices to consumers, or raise payments to producers. The incentives will vary for each investor in proportion to expected savings or benefits.

The ownership of capital is divided between producers, dealers, and/or truckers so that decisions will be made separately by each individual except in the case of producer-owned cooperatives when a joint decision is made.

It is the purpose of this bulletin, therefore, to outline the problems of tank assembly and to assist in future investment-decisions of farmers, truckers, and dealers. It is oriented to New Hampshire conditions, but the techniques and the findings will be of value in milksheds of similar or dissimilar structures.

At the Farm

Producers

There were 7,603 producers of milk in New Hampshire during 1950. About 30 percent of these producers owned over 75 percent of the cows milked, while 44 percent percent milked only 8 percent of the cows. It would be safe to estimate therefore that in 1950 about 3,500 farms were producing most of the market milk in the State. Fifty percent of the cows being milked were in herds of from 10 to 29 cows. There are, however, numerous owners of 1- to 4-cow herds shipping milk to dealers. Table 1 approximates the distribution of cows milked by size of herd.

The major part of the approximately 300 million pounds of milk sold each year by New Hampshire producers is processed and distributed by dealers. There are still some producer-distributors of raw milk, but their number is declining.* About 60 percent of the milk sold is consumed in the State while most of the remainder is delivered to Massachusetts milk dealers.

*Bowring, J. R., and Holmes, J. C. *Milk Marketing in Small Towns*, Agricultural Economics Research Mimeograph No. 6. New Hamphire Experiment Station.

Table 1. Number of Cows Milked by Size of Herd in New Hampshire, 1950*

Cows Milked per Herd	No. of Farms	Percent Distribution of Farms	No. of Cows	Percent Distribution of Cows
1– 2	3,337	43.8	4,904	8.2
3– 4	742	9.8	2,251	3.7
1– 4	4,079	53.6	7,155	11.9
5– 9	1,151	15.1	7,344	12.2
1– 9	5,230	68.7	14,499	24.1
10 19	1,526	20.1	20,100	33.4
20–29	469	6.2	10,329	17.1
30 49	310	4.1	10,991	18.3
50	68	0.9	4,222	7.1
Total	7,603	100.0	60,141	100.0

*1950 Census of Agriculture, U. S. Dept. of Commerce.

The minimum prices payable to producers is announced by the New Hampshire Milk Control Board. These prices bear a direct relation to the Boston price and are uniform to all producers within two price zones. Transportation and handling charges prior to receipt at the dealers plant are paid by producers.

Current Methods of Holding Milk

The majority of producers hold their milk from night and morning milkings in 40-quart cans which are immersed in water tanks cooled by electric refrigeration or in some cases by spring water. The cooler is in a milk house which is located at varying distances from the barn. The milk is hauled from the barn to the milkhouse in pails, strained, and dumped into the larger containers. The degree of handling before and after dumping in the containers varies between farms and farm layouts.

The majority of dealers take responsibility for milk collection and the truck driver loads the cans from the cooler to his van-type truck at regular times daily or in a few cases every other day. Cans are washed and sterilized by the dealer.

Farm Tank

The proposed farm tank would be located in the milk room and the milk would be strained from the pails into the tank, or piped directly from the barn. A refrigerator unit lowers the temperature to that which is required by sanitation laws and regulations and holds it at that temperature until picked up by the trucker. The milk is then pumped from the farm tank into a tank on the truck and hauled to the dealer for processing.

The farm tank is hosed out by the trucker but the final cleaning is the responsibility of the producer.

Such a tank allows more rapid cooling and better temperature control than the can-type cooler under ordinary methods. This will tend to reduce the bacteria count and it will improve the flavor. The weight is calculated at the farm and in this way may be checked by the producer. Milk samples for butterfat testing are extracted at the farm and duplicate samples may be left with the producer as a check if he so desires.

Any loss of weight after the milk leaves the farm is a cost to the dealer. Under the present system, the loss from handling and spillage is borne by the producer who must accept the weight as taken at the processing plant. Lifting of cans is eliminated, which will reduce labor requirements. There is a high rate of back injury among truckers. The tank method will reduce risk of injury and physical exertion requirements. In time this might enable insurance rates to be reduced and also make working conditions more pleasant.

No effort will be made to evaluate many of these advantages in terms of dollars. Some of them are subjective costs which can best be measured by each individual. For example, greater accuracy in the butter-fat test may or may not be possible and a change in the bacteria count may make little difference in the price dealers will pay. Loss of weight from spillage, however, is more obvious and some evaluation is possible.

Producer Loss From Spillage

The first stage in the handling of milk in cans when spillage may occur is at the farm when milk is poured from the pail to the can or from can to can. The second stage is in trucking cans from the farm to the plant. If cans are too full or if the road is particularly rough, some spillage is expected. The loss will very likely be in cream unless the milk has been agitated.

The third stage is in the dumping of milk from cans to be weighed. This loss may occur in dumping from can to weigh tank or from overloading of the weigh tank, but the most important loss is from milk residue left in the can later to be washed out. This residue may also include cream frozen to can covers. After the milk is weighed further spillage is a loss to the dealer.

In an experiment in Vermont, cans were drained for 60 seconds on a rack after the milk had been poured into a weigh tank. There were four ounces of residue in each can. This is .29 percent of a 40-quart can or about 2 cents per hundredweight at $6.00 milk which could be saved.*

Higher Price of Farm Tank†

The initial price of the farm tank is higher than the initial price of a can-type cooler. If the time has arrived when investment in some type of cooler has to be made, the difference in the price of each must be evaluated in terms of the convenience and probable savings of one type over the other. A comparison of the older type can cooler with the farm tank indicates the higher initial price of the farm tank as installed.

Table 2. Approximate Prices of Farm Tanks and Can Coolers of Various Sizes‡

Farm Tank Installed			Can Cooler Installed	
Size of Can	Equivalent No. of 40-qt. Can	Price	Size of Can	Price
Gallons				
60	6	$1200.	6 - 40's	$520.
100	10	1600.	8 - 40's	600.
150	15	1875.	12 - 40's	875.

‡Appendix 1.

*Statement by Alec Bradfield, Associate Professor, University of Vermont, at a meeting in Durham, N. H., August 11, 1953.

†The prices of tanks used in this bulletin are average price and some variation can be expected between manufacturers.

There is not sufficient evidence available to generalize on the relative costs of operation in terms of electricity and repairs. Each case will require individual evaluation depending on prevailing power costs in that area and the extent of adoption by other farmers. The major costs which can be compared however are for capital and financing. Expressed in terms of cost per hundredweight of milk per day, the farm tank is considerably higher than the can cooler.

Table 3. Comparison Between Prices of Tank and Can Cooler per Hundredweight of Milk per Day Based on Two-year Financing*

Hundredweight Per Day	Cost Per Hundredweight	
	Tank	Can Cooler
5.16	$ .23	$ .12
6.88	.20	.10
10.32	.19	.10

What Tank Size?

The price of a tank used for cooling milk becomes measurable and more appreciated when allocated to the quantity of milk sold. The more complete the utilization, the lower the unit cost per hundredweight of milk. One of the most important decisions when making the initial investment, therefore, is on the size and the extent of the use of the tank.

There are at least two important questions to be answered when deciding which size of tank is most economic.

1. What is the maximum daily requirement based on current and prospective milk production during the next 10 years?

2. What allowance over and above the daily requirement should be made for emergencies, and every-other-day or three-times-a-week pickup if this system becomes common?

The extent to which a tank is utilized will govern the unit cost of operation and depreciation. The less a tank is used, the higher will be the cost per hundredweight because the fixed or overhead costs are spread over fewer units. On the other hand, under-estimation of requirements would create waste and inconvenience or unexpected future investment. To facilitate decisions as to size and to estimate the probable cost in terms of milk produced, the following charts have been developed.

Chart 1 relates the size of the pickup in cans or pounds to the size of tank necessary for that amount of milk. For example, reading on the vertical axis, a pickup of 3 cans or 258 pounds of milk would utilize 50 percent of a 60-gallon tank or 30 percent of a 100-gallon tank as indicated on the horizontal axis. If 10 cans or 860 pounds of milk is the estimated pickup, then this would use a 100-gallon tank at 100 percent of capacity.

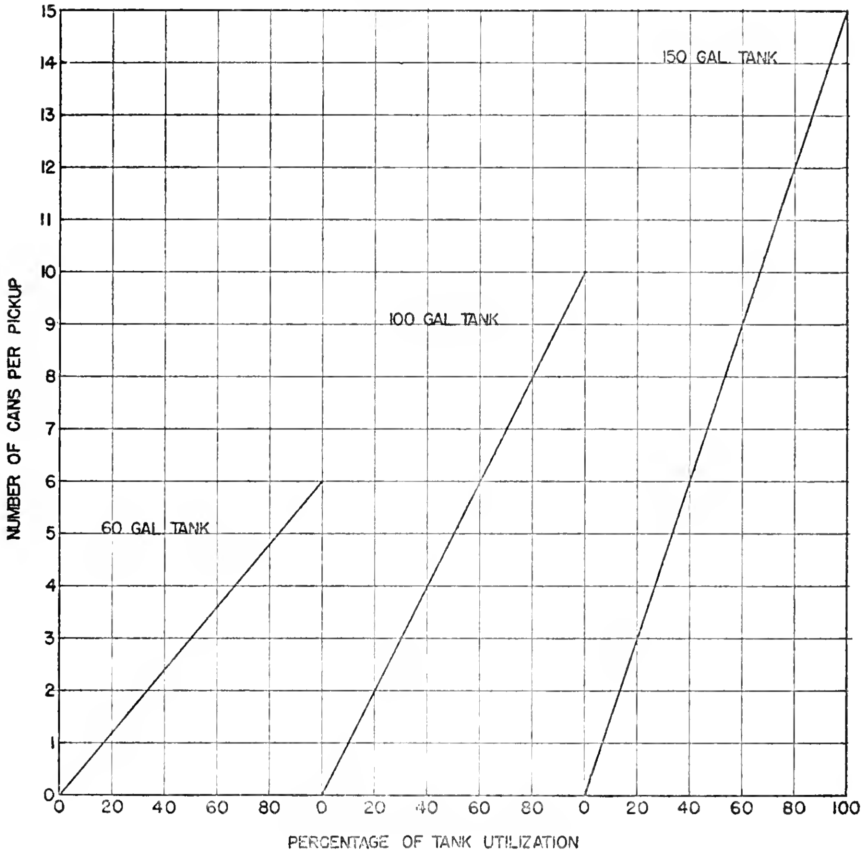
Having decided on the size of tank necessary for a particular farm from Chart 1, it is now possible to estimate the cost per hundredweight of milk of this particular tank.

Three tanks, of 60 gallons, 100 gallons, and 150 gallons, and the percent usage as derived from Chart 1 are given on the horizontal axis of Chart

*Two-year financing refers to 25% down payment with remainder costing 11% interest paid in equal monthly installments.

CHART NO. 1

RELATIONSHIP OF NUMBER OF CANS PER PICKUP TO SIZE AND PERCENTAGE OF TANK UTILIZATION



2. Reading up to a time curve and then across at the point of intersection will approximate the financing cost per hundredweight of this tank at the particular percent of usage.

For example, 7 cans or 602 pounds of milk will utilize 70 percent of the capacity of a 100-gallon tank as given in Chart 1. Read on the horizontal axis of Chart 2 at 70 percent of use for a 100-gallon tank up to the plotted curves of 2 years' credit. At this point reading across to the vertical axis will show a cost of 23 cents per 100 pounds of milk sold for 2 years.

It will be noted that the larger the tank and the greater the percent of usage of the tank, the lower will be the investment cost per hundredweight of milk. The prices are calculated as time payment costs over one- to four-year periods after down payments.

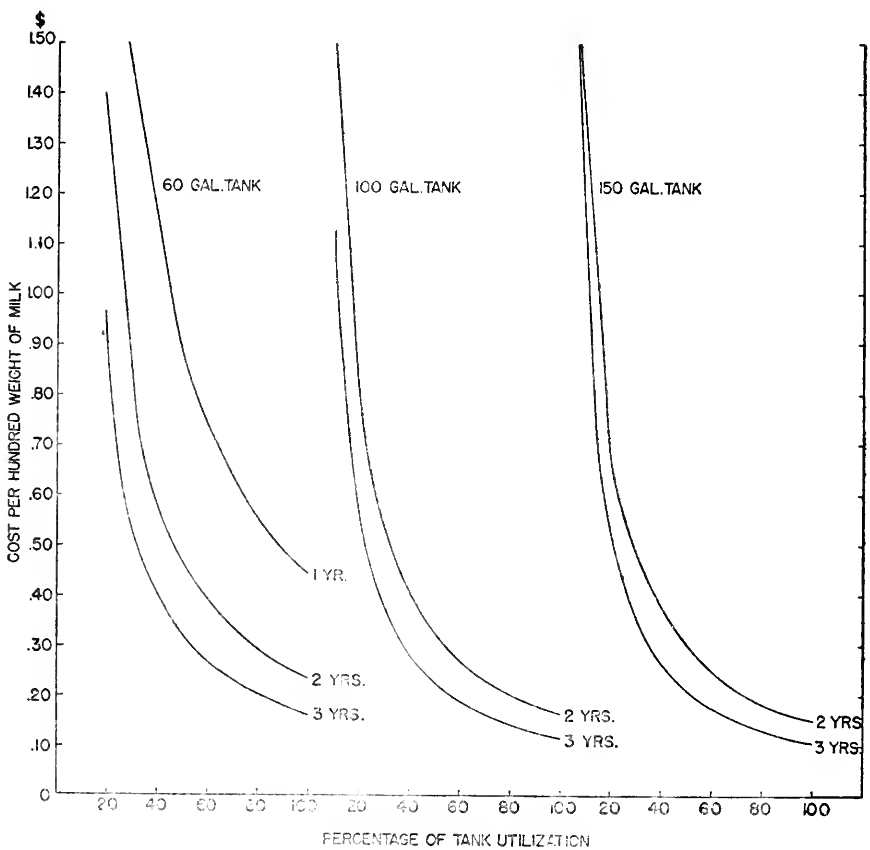
If payment is made in cash by the producer, the estimated cost over 5- and 10-year periods is shown in Chart 3. This is interpreted similarly to Chart 2.*

Calculating Expected Use

The importance of selecting the most economical size of tank has been illustrated in terms of cost per hundredweight of milk sold. How to arrive at the best estimate of tank size will of course depend on the accuracy of the calculation of the expected production and usage during the lifetime of the tank. This estimate may be based on present or past milk production,

CHART NO. 2

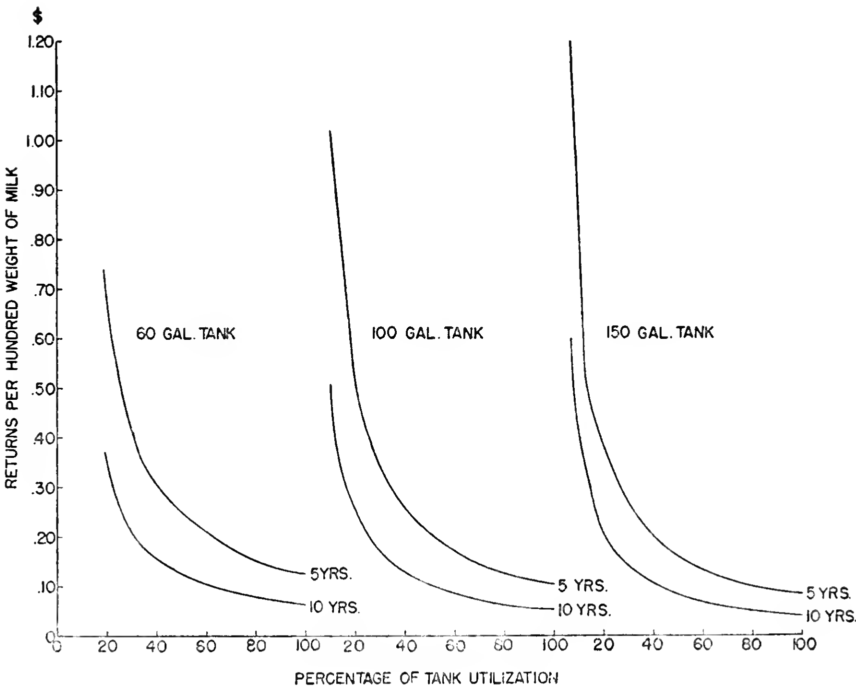
FINANCE COST PER HUNDRED WEIGHT OF MILK SOLD
RELATED TO PERCENTAGE OF TANK UTILIZATION



*Details are given in Appendix 2.

CHART NO. 3

RETURNS PER HUNDRED WEIGHT OF MILK NECESSARY TO REPAY CASH INVESTMENT–IN 5 AND 10 YEAR PERIODS



on current production plus an emergency allowance, or on estimated herd expansion in the forseeable future.

The difficulties implied by these estimates are illustrated in Twining's study† which tabulated the reasons given by producers for choosing a particular tank size. The majority based their choice on present or past production followed by a large number who attempted to estimate emergency requirements as well as every-other-day pickup. Of those in the first group, 19 out of 26 producers could handle two milkings only at peak production which allows them little adjustment in size of assembly operations without additional investment.

Examples of current operations recently started in Massachusetts show the varying degrees to which farm tank capacity is utilized. Some producers investing in a 150-gallon tank use only 43 percent of capacity at peak production periods, while another example indicated only 32 percent of utilization.

Larger producers seemed to make better estimates of their tank-size requirements because the percent of capacity used is greater for the tanks

†Opus cit.

of 400-gallon capacity and over. But even here the use is still considerably below capacity.

The following table estimates the percent of farm tank capacity used by some of the producers supplying Massachusetts dealers who have invested in farm tanks.

Table 4. Farm Tank Utilization for Operations by Two Dealers in Massachusetts — June, 1953*

Size of Tank	No. of Producers	Percentage Use June 1953
DEALER A		
150 gal.	5	43.1
200 gal.	9	50.1
300 gal.	6	56.8
400 gal.	1	64.0
500 gal.	2	65.1
Total	23	54.9 % average use
DEALER B		
100 gal.	2	31.6
150 gal.	4	34.2
200 gal.	7	42.3
300 gal.	5	51.3
400 gal.	2	50.7
Total	20	45.2 % average use

*Information for this table was obtained by personal interview with the dealers concerned.

Seasonal variation in production will accentuate the problem of acquiring the most economical size of tank. If June is the month of peak production, then the above producers will own and pay for considerable unused capacity during the rest of the year.

Assembly

THE FARM ASSEMBLY of milk in New Hampshire is predominantly practiced by independent truckers. Some little selfhauling is done by producers and by producer-dealer cooperative trucks.

The cost of haulage is paid by the producer. Following daily truck routes, the trucker calls at the farm, loads the cans of milk onto his truck, and returns empty cans washed and sterilized by the dealer. Sometimes the producer owns the cans but more often they are owned by the dealer and rented to the producers. The milk is then hauled to the processing plant, weighed, sampled, tested, and the payments to producers calculated.

The distance milk is hauled in relation to the size of load governs the rates of haul. Assembly from larger producers and those densely settled will increase the milk picked up per mile of travel. Therefore to evaluate the assembly problem it is necessary to examine the distribution of dairy farms in relation to size.

The Problem of Farm Size

Table 1, showing the number of cows and farms in the State, implies that the majority of the cows are in herds of more than 10 cows while there is a larger number of producers with smaller herds. If, then, producers can be classified as potential users of farm tanks at present production levels or herd size, this will throw some light on the assembly problem.

Assume that the minimum advisable utilization is 60 percent capacity of a 60-gallon tank or 310 pounds of milk *daily*, as advocated by manufacturers of tanks. At 20 pounds production per day per cow, this would limit tanks to herds of 15 or more milking cows which would include only 20 to 25 percent of the dairy herds in the State.

Further evidence of the size limits in New Hampshire herds is provided by the average daily production of producers delivering to four representative dealers. Two of the dealers had producers with average daily deliveries below the assumed minimum for a farm tank and two only just above, during the peak production month of June. Production in November reduced the average of all producers below the minimum.

Table 5. Average Size and Range of Daily Production of Producers' Delivery to Four Dealers in New Hampshire in June and November 1952

Dealer	Average Daily Deliveries by Producers June	November	Percent November/June
1	323 lbs.	214 lbs.	66.2
2	304 lbs.	230 lbs.	72.4
3	226 lbs.	167 lbs.	73.9
4	321 lbs.	222 lbs.	69.2

In addition each of the dealers studied had a small proportion of his producers whose daily deliveries exceeded 310 lbs., although it is true that these producers delivered the major supply of milk as shown in Table 6.

Table 6. Proportion of Total Milk Supplied by Producers Whose Average Daily Deliveries Exceeded 310 lbs. in 1952

Dealer	Percent of Producers	Percent of Supply
1	32.5	60.2
2	41.7	72.5
3	35.3	70.8

Where 32 percent of the producers provide 60 percent of the milk, this also means that 68 percent of the producers deliver only 40 percent of the milk. Each dealer buys milk from a large number of such small producers, and each of the small producers relies on the dealer for his market. This is further accentuated in the case of producer-owned cooperative plants.

Milk Per Mile of Assembly

Evidence of the general nature of the size problem in relation to assembly by tank is provided by estimates of the amount of milk picked up by trucks per mile of travel in the State. A sample of assembly routes showed an average pickup of .78 per hundredweight or about .9 of a 40-quart can per mile.* When this is compared with the three and four cans per mile of

*In 1942 the per hundredweight of milk assembled per mile of travel was .51 on routes and .31 for self-haulers.

areas in Massachusetts currently adopting tank assembly, some appreciation of the additional assembly costs for New Hampshire is apparent.

Tank Assembly for Large Producers

By a process of selection a dealer could develop a tank-truck route for the larger producers. This would isolate the lower cost segment of the assembly job and leave a higher cost for assembly of milk from producers too small to justify a farm tank.

Any reduced costs of assembly by tank made possible by a route composed of large-size producers could be passed on to those producers, or it could be used to subsidize the assembly of smaller producers. The policy followed would depend on the ownership of the assembly facilities. If assembly were hired, then the smaller producers would probably have relatively higher hauling charges for their milk. This would either provide incentives for increase in size of herd and the purchase of a farm tank or would further encourage small producers to go out of business. There would be short-term problems of haulers' rates and producers' returns which would have to be resolved if tank assembly were offered by a dealer.

What Size of Tank Truck?

The minimum size farm tank of 60 gallons as currently available from manufacturers places certain price limits to its use at less than capacity as shown in Charts 1 and 2. For example, a 2-can producer would use only a third of the tank capacity which would cost as much as 70 cents per hundredweight payable over a 2-year period, or nearly twice that much if payable over a 1-year period.

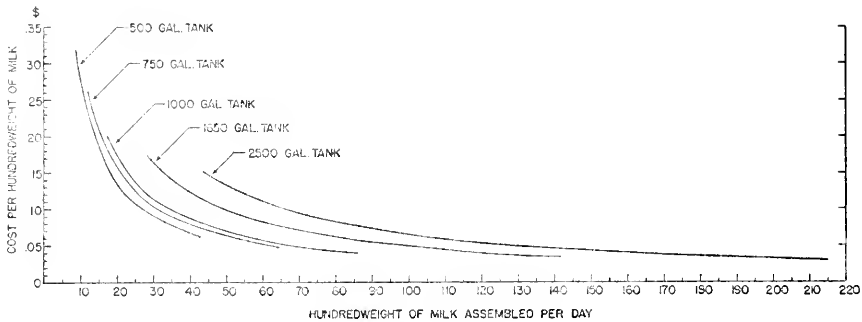
Similarly, the assembly of milk by tank truck is justifiable only if savings over the present method are apparent. Such a route is limited to those producers operating farm tanks, and the cost of assembly will vary with the distance travelled and the proportion of capacity in use.

The variable costs of gasoline, tires, and repairs will not likely differ greatly from the van-type truck of comparable size now in use. The major difference will be in the capital cost and depreciation charges and probably labor. The tank and the chassis will be depreciated over different lengths of time and the costs can again be expressed per hundredweight of milk. The larger the tank truck or the more the capacity of a tank is utilized, the lower the unit cost of operation per hundredweight of milk hauled. This reemphasizes the importance of acquiring a tank truck which will provide no more nor less than the necessary capacity.

To facilitate this decision Chart 4 relates the pounds of milk picked up to the price of truck tanks and the estimated cost per hundredweight per day. An assembly load of 43 hundredweight, using a 500-gallon tank to capacity, would cost about 6 cents per hundredweight of milk per day. The cost of hauling the *same* volume of milk would increase as the tank size increased—for example, 7.5 cents per hundredweight per day for a 750-gallon tank, 11 cents for a 1,650-gallon tank, and 15 cents for a 2,500-gallon tank. An increase in the size of tank will lower unit costs, however, when used to capacity. As the size of tank increases a larger truck chassis is required. Therefore unit capital cost may not decrease evenly as the size of the tank increases to the same extent that it would if the tank were the only item of expense.

CHART NO. 4

TANK TRUCK DEPRECIATION COST PER HUNDREDWEIGHT OF MILK ASSEMBLED PER DAY BY TANK SIZE



Investment in a tank truck too large or too small for requirements is a costly mistake which can be avoided or reduced by calculations such as those afforded in Chart 4.*

Higher Costs of Tank Truck

Investment in a tank truck necessitates both additional capital and running costs. The following table estimates the cost per mile and per hund-

Table 7. Comparison of Assembly Costs per Mile by Van and Tank Trucks on a 100-mile Trip

	Van Type**	Tank Truck
	Dollars	Dollars
Labor	8.75	10.50
Depreciation	2.51†	4.96‡
Insurance: Cargo, Liability, Collision, Fire and Theft	1.00	2.00
Tires	2.30§	2.76‖
Gas and oil¶	5.00	5.00
Garage	.50	.50
Administration	.25	.25
Repairs and maintenance	3.56	3.56
Cost per 100 miles	23.87	29.53
Cost per mile	.2387	.2953
Cost per hundredweight at 8,600 lbs.	.277	.343

**Based on data from firm operating 20 trucks in New Hampshire and Vermont.
†Chassis $4.000 for 4 years, less trade-in $1,000. Body $1,000 for 6 years.
‡1,650-gallon tank at $5.825 for 10 years; pump compressor $400 for 10 years; 2½-ton chassis $5,000 less trade in $1.000; pump equipment $750 over 4 years.
§Ten tires at $80.00, 6 tubes at $7.00 per year.
‖Twenty percent increase for larger tires and increased wear.
¶Six miles per gallon at 25 cents per gallon, 3 quarts oil at 28 cents per quart.

*For details see Appendix 3.

redweight for a van-type truck and a tank truck. The comparison is made on the assumption of equal density of producers and size of pickup for both trucks over a 100-mile trip for 100 gallons of milk. This shows an additional 5 to 6 cents per mile for the tank truck. Higher labor costs for the driver presupposes that the additional responsibilities will require higher remuneration if the preferred type of man is to be hired.

Other Uses for Tank Truck

Uses for the tank truck supplementary to the assembly of milk may lower the unit cost of operation. The tank may be used as a holding tank by the dealer in connection with the processing of milk. Particularly would this be true if the plant operated on a six-day week. The tank may also be used in cases of emergency to haul additional supplies during periods when local production is inadequate to meet seasonal increases in demand or in periods of flush production, and to haul excess supplies to manufacturing plants. The full utilization of the driver's time at prevailing wage contracts, however, presupposes that the assembly operation will make full use of the tank truck in assembly.

Dealers

THERE WERE 753 retail milk dealers in New Hampshire in 1952.* The majority were producer-distributors selling amounts less than 300 quarts a day. In contrast there were only 175 pasteurizing plants in operation, of which 131 sold less than an average of 1,000 quarts a day for the year.

The remaining 44 pasteurizing plants handled increasingly larger quantities of milk in their plants. Their proportion of the total milk processed is considerably higher than their number is of all dealers, as shown in Table 8.

Table 8. Relationship of Number of Dealers to Quantity of Total Milk Sold in New Hampshire

Size of Dealer	No.	Percent of All Dealers	Percent of All Milk Sold
400 qts. per day and less	636	84.5	28.6
400 to 600 qts. per day	46	6.1	10.6
Over 600 qts. per day	71	9.4	60.8

From this table it is apparent that a large number of the dealers handle a small proportion of the total milk sales. This is important for any consideration of tank-truck assembly.

If we assume a minimum size tank of 500 gallons, then a dealer using this form of assembly must process at least 4,300 pounds a day. This would eliminate all but about 23 dealers under present average daily output, who in turn handle at the most 30 percent of the total milk sold.

What a Change-over Would Mean

A change-over to bulk assembly of milk would enable a dealer to eliminate the steam and labor costs of washing and sterilizing cans, and the retinning and other costs of can purchase and maintenance.

*Based on licenses issued by the New Hampshire Milk Control Board.

It is probable that some can sterilizing would continue because of commercial deliveries. Consideration of utilizing a smaller unit in place of the usual can sterilizer would hinge on whether the savings in space, depreciation, and operating costs would exceed the loss on the sale of the old equipment.

Space savings because of the elimination of the scales might, or might not, be tangible. Utilization of such space and the sale of the used equipment become an individual problem. Loss from sale rests on two factors: (1) age and condition of the equipment, and (2) the extent to which change-over affects the used-equipment market. The released space must be included in the revised operational setup or it becomes waste space. Also, the need for additional holding tanks under bulk haul may further complicate the problem of efficient space utilization.

Greater flexibility in plant operation is provided by the ownership or availability of a tank truck which can be used for milk storage to eliminate processing on Sundays, holidays, or in an emergency.

By weighing and buying the milk at the farm, the labor for receiving and weighing at the plant can be reduced to a minimum, if not eliminated. With 100 percent or with anything less than 100 percent change-over, the labor and machine time in handling cans is reduced. There may be alternative uses for this labor in the plant which will not necessitate lay offs. On the other hand, if part-time labor is available, or the reduced weighing and receiving job can be allocated to other plant employees, through overtime or recombination of duties, one man less is needed in the plant operation.

If the plant only partially changes to bulk assembly, which is the more probable immediate situation for New Hampshire production conditions, the savings will be reduced accordingly. In fact the economical use of labor becomes a more difficult problem. Labor may be wasted because of the uncertain arrival of cans which would not be true of a 100 percent conversion.

Estimated Cost Savings to the Dealer

The probable savings to a plant processing six to seven thousand pounds of milk per day, if all milk is delivered by bulk, are estimated in Table 9.

Table 9. Probable Savings per Hundredweight from Bulk Handling for a Dealer Processing 6,000 Pounds of Milk Daily

Electricity, Fuel, Refrigeration	$ .03*
Labor	.065†
Can replacement and retinning	.015‡
Total	.110

*Based on 1 hour per day savings for light, fuel, water, and washing fluid at 67.51 hundredweight per day.

†Based on 3½ hours labor saving at $1.25 per hour.

‡Based on replacement of 10 40-quart cans and 25 20-quart cans per year plus retinning of 7 40-quart cans, 12 20-quart cans, and 10 covers. Total cost $373.50.

As an example of the probable savings from using the tank for holding milk over on Sundays, the estimates in Table 10 refer to plant costs. Additional savings may be possible if labor costs are also eliminated.

Table 10. Possible Savings from 6-day Operation of Plant by Using Truck Tank as a Holding Tank

	Expenses Annually	Probable Savings
	Dollars	Dollars
Electricity	2,055.	293. (1/7)
Fuel	2,970.	424. (1/7)
Water	916.	62. (1/14)
Washing fluid	400.	57. (1/7)
Total Savings		836.
Savings per hundredweight $.034		

Conclusions

Increased Farm Costs

The adoption of tank assembly in New Hampshire poses certain problems. A 100 percent conversion to tank assembly will provide the greatest economies to dealers. The conversion is dependent on the willingness of producers to buy farm tanks. This can only be expected if capital is available and if the quantity of milk sold justifies the investment. The cost to producers and truckers will be increased from investment and operating charges, so that some additional payments for milk and handling appear a necessary incentive to adoption.

Problem of Selecting Producers

By a process of selection, some dealers may buy milk only from producers large enough to utilize the farm tank unit. This can be done gradually but will drive small producers to other dealers willing to pick up their milk in cans, force them to invest in a tank, or drive them out of business. Other dealers deriving a larger proportion of their milk from small producers cannot expect 100 percent conversion without some drastic changes in the farming practices of their producers. Such dealers will be delayed in receiving benefits from any economies of assembly provided by the tank method unless they are prepared to operate at less than 100 percent conversion. This decision will affect their long-run competitive position with respect to other dealers and their producers.

Increased Competition

Larger producers may demand tank-truck service by their present dealer or from a dealer with tank-assembly facilities. Competition between dealers for milk from larger producers will thus increase and competition for milk from smaller producers will decrease. The effect will be shown in the premiums paid to larger producers and the lower payments to smaller producers. Such competition will result eventually in lower assembly costs, but only after many serious adjustments have been made in the size and type of producers supplying market milk.

Problem of Small Producers

New Hampshire has a large number of small producers who are distributed fairly evenly between dealers. This even distribution is also true of the larger producers. Similarly there are a large number of small dealers who handle a small proportion of the milk. The volume of milk assembled per mile of travel is, in consequence, quite low. Therefore any adoption of truck tanks with lower assembly costs will discriminate against small producers and dealers.

As such competition appears inevitable it would be wise for dealers and producers who are able to utilize tank capacity to examine the potential costs and economies of such a change-over. No increase in herd size should be planned until markets for the milk are found. Necessary adjustments of size and capital investments expressed in dollars per pound of milk produced, as shown in this bulletin, offer some measure of the investment cost which must be carried by producers and dealers alike.

A large number of small producers in New Hampshire will delay the introduction of farm-tank assembly so that a 100 percent conversion cannot be expected in the near future. Its adoption is symptomatic of the economies of scale, however, and strengthens the pressure for more efficient milk production and marketing from larger operating units at lower costs.

Appendix 1

Size of Tank

	60 gal.	100 gal.	150 gal.	200 gal.	300 gal.	400 gal.	500 gal.	600 gal.
Measurement								
Outside width	27″	35″	35″	43″	47″	47″	47″/65″	47″/65″
Outside length (not including compressor)	30″	38″	55″	65″	87″	100″	100″	100″
Shipping weight	400 lbs.	600 lbs.	700 lbs.	800 lbs.	1,000 lbs.	1.300 lbs.	1,400 lbs.	1,800 lbs.
Size of Compressor								
Every day pickup	½ H.P.	1 H.P.	1½ H.P.	2 H.P.	3 H.P.	3 H.P.	5 H.P.	5 H.P.
½ H.P. to 3 H.P. are 220 V single phase								
5 H.P. are 220 V-3 phase								
Air and water cooled through 3 H.P.								
Water cooled on the 5 H.P.								
Every-other-day pickup	⅓ H P.	½ H.P.	¾ H.P.	1 H.P.	1½ H.P.	1½ H.P.	2 H.P.	2 or 3 H.P.

Appendix 2

Financing of Farm Tanks Related to Capacity Use

(Tentative Finance Schedule)

Size	Estimated Price	25% Down		Credit Amount	Terms	Per Month	(30 Days) Per Day
60 gal.	$1,033.	$258.		$ 775.00	6% 12 mos.		
Instal.		131.	Int.	46.50			
		389.		821.50		$68.45	$2.28
				775.00	11% 24 mos.		
			Int.	85.25			
				860.25		35.84	1.20
				775.00	16% 36 mos.		
			Int.	124.00			
				899.00		24.97	.83
100 gal.	1,471.	368.		903.00	11% 24 mos.		
Instal.		142.	Int.	99.33			
		510.		1,002.33		41.76	1.39
				903.00	16% 36 mos.		
			Int.	144.48			
				1,047.48		29.09	.97
150 gal.	1,675.	419.		1,256.00	11% 24 mos.		
Instal.		200.	Int.	138.16			
		619.		1,394.16		58.09	1.93
				1,256.00	16% 36 mos.		
			Int.	200.96			
				1,456.96		40.47	1.35
				1,256.00	21% 48 mos.		
			Int.	263.76			
				1,519.76		31.66	1.06

Financing of Can Cooler Related to Capacity Use

Size	Estimated Price	25% Down	Credit Amount	Terms	Per Month	(30 Days) Per Day
60 gal.	$520.	$130.	$390.00	6% 12 mos.		
			Int. 23.40			
			$ 413.40		$34.45	$1.15
			390.00	11% 24 mos.		
			Int. 42.90			
			432.90		18.04	.60
80 gal.	600.	150.	450.00	11% 24 mos.		
			Int. 49.50			
			499.50		20.81	.694
150 gal.	875.	219.	656.00	11% 24 mos.		
			Int. 72.16			
			728.16		30.34	1.011

Appendix 3

Approximate Price by Sizes of Tank Trucks

500 gal. Tank	
14 gauge stainless steel with 2" insulated body	$3,350 00
Rear pumping compartment	400.00
$1\frac{1}{2}$-ton chassis	2,250.00
Pumping equipment	750.00
Total	6,750.00
750 gal. Tank	
14 gauge stainless steel — insulated	3,750.00
Rear pumping compartment	400.00
2-ton chassis	2,700.00
Pumping equipment	750.00
Total	7,600.00
1,000 gal. Tank	
12 gauge stainless steel — insulated	4,875.00
Rear pumping compartment	400.00
2-ton chassis	2,700.00
Pumping equipment	750.00
Total	8,725.00
1,650 gal. Tank	
12 gauge stainless steel — insulated	5,825.00
Rear pumping compartment	400.00
$2\frac{1}{2}$-ton chassis	5,000.00
Pumping equipment	750.00
Total	11,975.00
2,500 gal. Tank	
Stainless steel — insulated	7,000 00
Rear pumping compartment	400 00
3-ton chassis	8,000.00
Pumping equipment	750.00
Total	16,150.00

Yearly and Daily Depreciation Costs for Various Sizes of Tank Trucks

1. Depreciation on 500-gallon Tank Truck

Tank	$3,350	10 year depreciation	$ 335.00 yearly depreciation
Pumping compartment	400	10 year depreciation	40.00 yearly depreciation
1½ ton chassis	2,250		
Less trade in	500		
	1,750		
Pumping equipment	750		
	2,500	4 year depreciation	625.00 yearly depreciation
		Total	1,000.00 yearly depreciation or $2.73 a day

2. Depreciation on 750-gallon Tank Truck

Tank	3,750	10 year depreciation	375.00 yearly depreciation
Pumping compartment	400	10 year depreciation	40.00 yearly depreciation
2 ton chassis	2,700		
Less trade in	500		
	2,200		
Pumping equipment	750		
	2,950	4 year depreciation	737.50 yearly depreciation
		Total	1,152.50 yearly depreciation or $3.16 a day

3. Depreciation on 1,000-gallon Tank Truck

Tank	4,875	10 year depreciation	487.50 yearly depreciation
Pumping compartment	400	10 year depreciation	40.00 yearly depreciation
2 ton chassis	2,700		
Less trade in	500		
	2,200		
Pumping equipment	750		
	2,950	4 year depreciation	737.50 yearly depreciation
		Total	1,265.00 yearly depreciation or $3.46 a day

4. Depreciation on 1,650-gallon Tank Truck

Tank	5,825	10 year depreciation	582.50 yearly depreciation
Pumping compartment	400	10 year depreciation	40.00 yearly depreciation
2½ ton chassis	5,000		
Less trade in	1,000		
	4,000		
Pumping equipment	750		
	4,750	4 year depreciation	1,187.50 yearly depreciation
		Total	1,810.00 yearly depreciation or $4.96 a day

5. Depreciation on 2,500-gallon Tank Truck

Tank	7,000	10 year depreciation	700.00 yearly depreciation
Pumping compartment	400	10 year depreciation	40.00 yearly depreciation
3-ton chassis	8,000		
Less trade in	2,000		
	6,000		
Pumping equipment	750		
	6,750	4 year depreciation	1,687.50 yearly depreciation
		Total	2,427.50 yearly depreciation or $6.65 a day