P-377 OCTOBER 1959

Farm-to-plant Hauling and Receiving Bulk Milk

A & M COLLEGE OF TEXAS
COLLEGE STATION, TEXAS

A PART OF THE TEXAS A&M COLLEGE SYSTEM

TEXAS AGRICULTURAL EXPERIMENT STATION
R. D. LEWIS, DIRECTOR, COLLEGE STATION, TEXAS

Z30.72
T35m

Summary

The data used in this study were obtained from 27 bulk tank truck operators, six milk plant managers and the North Texas Milk Market Administrator's office.

The high cost of truck tanks is the principal cause for the larger investment in bulk trucks than can trucks. Truck tanks of 1,800-gallon capacity cost an average of $7,262 and larger tanks cost an average of $11,832 each. By comparison, the average can van bed cost $889. The average investment in a truck chasis for a 1,800-gallon tanker was $3,468 or about 10 percent more than a can truck chasis.

The 1,800-gallon tankers pick up 31 percent more milk than can trucks of comparable size. The average milk volume picked up per tank truck stop was more than three times greater than the average volume picked up per can stop. The average tank truck picked up milk from 58 percent fewer producers than can trucks did. The average milk volume hauled per truck per mile traveled was 106 pounds for 1,800-gallon tankers or 22 percent more than can trucks of comparable size. The time per hundredweight per stop averaged 2.2 minutes for bulk and 4.5 minutes for can assembly. The average distance between producers on bulk routes was 10.1 miles or almost three times the distance between producers on can routes.

Hauling rates that the producers were charged ranged from 25 to 40 cents per hundredweight for can hauling and from 20 to 60 cents for bulk hauling.

Rates to producers on the same route varied in approximately 25 percent of the cases and were determined by milk volume and distance hauled.

Drivers rejected only 23 farm tanks of milk during the 6 months prior to interview. Sixty-one percent of these were rejected because the milk was sour. Other reasons included bad odor and flavor.

Less than 50 percent of the drivers had received training in proper milk tank truck operation. Among the problems encountered in bulk hauling were (1) improper cleaning of farm tanks and milking equipment, (2) rancid milk, (3) high bacteria count, (4) overlapping routes, (5) bad local roads and bridges and (6) increased costs from shifts in delivery points.

Total investment in receiving equipment for dual operations averaged $35,460 per plant. Of this, equipment amounting to $12,681 could be eliminated by converting to all bulk receiving. Converting to all bulk receiving could result in increased volume received per man-hour by about 80 hundredweight or 140 percent.

Milk plant managers reported rejecting 20 tank loads of milk during the 6 months previous to interview. Reasons for these rejections included bad flavor, rancidity and high acidity.

Problems reported by plant managers included (1) failure of drivers to check for bad flavors and odors and to reject milk with undesirable qualities, (2) improper sanitizing of truck tanks, (3) lack of driver training on proper procedures and techniques and (4) abnormal discrepancies between farm tank and plant measurements.

Devices used by plants to check farm dipstick measurements are platform scales, liquid level gauges and flow meters. The 2,836 tank loads of milk checked had an average loss between farm and plant weight of .19 percent of the farm weights. In July the average loss per tank load of milk was .04 percent of the farm weight and .28 percent in October.

Contents

Farm-to-plant Hauling and Receiving Bulk Milk

KENNETH MCKINNEY and RANDALL STELLY*

ASSEMBLY OF MILK from the farm to plant, including cooling, collecting, hauling and receiving milk, is changed many ways when the bulk system replaces can equipment and methods.

The rapid development of the bulk system occurred because some people in the dairy industry believe that fluid milk can be handled more economically, and a higher quality milk can be produced and maintained at the same time. Texas farmers utilizing the bulk system report cost reductions in handling milk of 10 to 30 cents per hundredweight over the can system. They also report less butterfat losses, improved quality and reduced labor requirements.

In recent years Texas dairy farmers have shifted rapidly to the bulk system. There were approximately 450 bulk tanks in use on Texas dairy farms in 1956, but by January 1959 the number had increased to about 4,500.

Efficiency in marketing fluid milk will be increased if a wider segment of the dairy industry is furnished with more accurate information on the economies of bulk assembly and receiving.

Purpose of Study

The general purpose of this study is to provide information to milk haulers, plant managers, dairymen and others concerning the differences in assembly and receiving milk in bulk and cans in Texas. Specific objectives are (1) to determine differences in cost of equipment and investments in changing from cans to bulk hauling and receiving milk; (2) to determine changes in milk assembly routes with respect to reorganization of routes, route control, relative densities of routes and hauling rates; (3) to determine variations in amount between the farm and the plant and the different methods of measuring milk at receiving plants; and (4) to determine problems of converting to bulk milk assembly and receiving and present recommendations for possible solutions to those problems.

Method of Study and Data Sources

The information reported in this study was obtained through personal interviews with milk tank truck operators and milk plant managers in the North Texas milk marketing area, from records of milk plants and from the North Texas Market Administrator's Office.

All bulk tank truck operators who previously hauled producer milk in cans were interviewed to obtain information for the milk assembly phase of the study. Managers of milk plants which, at time of interview, were receiving producer milk both in cans and in bulk were interviewed to obtain information for the milk receiving phase of the study. Reliable and complete information for analysis was obtained from 27 bulk tank truck operators and six milk plant managers.

Farm dipstick readings and plant measurements were obtained for 875 tank trucks of milk in July and 1,511 tanks in October 1958. These tank trucks of milk were separated into three groups according to the method by which the milk was measured at the plant. Farm dipstick measurements were used as the basis for determining variations between farm and plant weights because plants usually pay for milk on the basis of farm dipstick readings.

The North Texas area was selected for the study because at the time of interview (summer of 1958), producers in this area had made the greatest progress in converting to bulk handling of milk. There were more bulk milk tank trucks operating in this area than in any other area in Texas. Also, more plants were receiving bulk milk in this area than in any other section of the State.

Farm-to-plant Hauling

Assembly of bulk milk from farm to plant caused a redistribution of the customary tasks of cooling, hauling, handling and receiving milk among milk handlers, haulers and farmers. Some tasks formerly performed by milk handlers now are done by haulers who have assumed greater responsibility and incurred increased investments.

CHARACTERISTICS OF BULK OPERATORS

North Texas milk haulers included in this study had been hauling producer milk an average of 14 years. These had hauled milk in cans an average of 11½ years and in bulk an average of 2½ years. Operators' experience in can hauling ranged from 6 months to 28 years and in bulk hauling from 1 year to 3½ years.

Seventy percent of the haulers owned more than one can truck. These haulers owned two to

*Respectively, marketing assistant and assistant professor, Department of Agricultural Economics and Sociology.

TABLE 1. AVERAGE INVESTMENT IN TRUCKS AND EQUIPMENT REQUIRED FOR HAULING MILK IN BULK TANKS AND IN CANS, NORTH TEXAS, SUMMER, 1958

Item	Capacity	Average Investment
Bulk Tanks		Dollars
Tank	1,800 gallons	7,262[1]
Chasis	2.0 - 2.5 tons	3,468
Total		10,730
Tank	More than 1,800 gallons	11,832[1]
Chasis	2.0 - 3.0 tons	5,080
Total		16,912
Can Trucks		
Van	120 - 200 cans	889
Chasis	1.5 - 2.5 tons	3,130
Total		4,019[2]

[1]Includes cost of pump compartment, pump and hose.
[2]Investment in cans is not included since the cans ordinarily are owned by the milk plant or the producer.

13 trucks and had an average of four trucks each. Seventy-four percent of the bulk haulers owned more than one tank truck. These haulers have two to five tank trucks each.

CHANGES IN EQUIPMENT AND INVESTMENT

The cost of milk hauling equipment is higher for bulk than for can trucks, Table 1. Larger investments for bulk hauling operations are necessary because of the higher cost of the tank and equipment compared with a van, the higher cost of the heavier truck chasis and because larger sized trucks are used.

The high cost of truck tanks accounts for 95 percent of the increase in investment. The average cost of a 1,800-gallon truck tank is $7,262 or eight times the $889 average cost of a can van bed of comparable capacity. The average cost of a truck tank with a capacity of more than 1,800 gallons is $11,832 or 12 times the average cost of a can bed. Truck tanks of 1,800-gallon capacity cost from $6,080 to $8,300 and tanks of more than 1,800-gallon capacity cost from $9,250 to $13,500, whereas, van bodies used in North Texas cost from $500 to $1,350.

TABLE 2. COMPARISON OF NUMBER OF PRODUCERS, VOLUME AND MILES TRAVELED FOR BULK AND CAN HAULING, NORTH TEXAS, SUMMER, 1958

Item	Unit	Bulk tank trucks		Can truck
		1,800 gallons	More than 1,800 gallons	
Producers per load	Number	7	8	17
Volume				
Per load	Pounds	13,679	21,050	10,406[1]
Per mile	Pounds	193	288	181
Per farm stop	Pounds	1,954	2,631	611
Miles traveled				
First to last pickup	Miles	71	73	59
Last pickup to plant	Miles	58	92	61

[1]Equals 121 10-gallon cans of milk.

The heavier chasis commonly used for a truck tank of 1,800-gallon capacity costs from $2,700 to $4,800 or about 10 percent more than the $2,400 to $4,290 for a can truck chasis.

Total investment in chasis and tank ranges from $8,780 to $13,100 for a 1,800-gallon tanker and from $12,250 to $21,300 for larger tankers, compared with $3,200 to $5,400 for a chasis and can van.

Most tank truck operators reported that truck tanks should last at least 15 years, while most tank dealers estimate that the basic tank should have a useful life of 10 to 15 years or longer. However, truck tanks have not been in use long enough to determine exactly how long they will last under operating conditions. Future changes in tank design and material may cause present tanks to become obsolete.

ORGANIZATION AND EFFICIENCY OF MILK ASSEMBLY ROUTES

Average milk volume and mileage per load, frequency of collection and densities of routes are the more important factors affecting the efficiency of milk collection routes.

Milk Volume and Mileage per Load

As a rule, the larger the milk volume per load and per mile traveled, the less the truck cost of collecting milk; and the larger the milk volume per farm, the less the labor cost of picking up the milk.

On the average, the 1,800-gallon tankers picked up 13,679 pounds of milk compared to 10,406 pounds for can trucks or 31 percent more milk per route, Table 2. However, at time of interview, there was an average of seven producers per tank route or 58 percent less than the 17 producers on the average can route. The average tank truck picked up 1,954 pounds of milk per stop or more than three times the 611 pounds picked up per stop by the average can truck.

Furthermore, tank trucks are utilized at a larger percent of capacity than can trucks are. The survey indicates that during most of the year, tank and can trucks are utilized at 88 and 75 percent of capacity, respectively. However, capacities of both truck types are utilized fully during the flush production months in the spring.

The mileage required to cover the route and deliver the milk to the plant and the time to make the route also affects the operating efficiency of milk assembly. In North Texas during the summer of 1958 the average 1,800-gallon tank truck traveled 71 miles from the first farm pick up to the last. This was 20 percent greater than the 59 miles traveled on the average can route. However, the milk volume picked up per mile on the average can route was 176 pounds or 10 percent less than the 193 pounds per mile picked up on the average tank route.

The mileage traveled from the last pick up point to the plant also must be considered. When this is added to the distance traveled in picking up the milk, the total mileage amounted to 129 and 120 for tank and can routes, respectively. Therefore, on the basis of total distance traveled from first pickup point to plant, the average milk volume hauled per mile amounts to 106 pounds for 1,800-gallon tankers or 22 percent more than the 87 pounds for can trucks. The economies in favor of bulk hauling are greater when tankers larger than 1,800 gallons are compared with can trucks of comparable capacity.

Frequency of Collection and Time Required

Collecting milk every other day has been adopted on almost every bulk route, whereas, milk is collected every day on can routes. On routes where every other day bulk milk collection replaces daily can collection, milk volume per mile of total route travel is increased substantially. Milk volume per stop doubles and time per hundredweight of milk per stop is reduced greatly. In North Texas the time per hundredweight per stop averaged 2.2 minutes under bulk hauling and 4.5 minutes under can hauling, Table 3. Total time per stop amounted to 43 minutes with bulk hauling and 28 minutes per stop with can hauling.

On bulk routes a considerable portion of the time per farm is spent checking the quality and quantity of the milk, taking a sample for butterfat content, connecting and disconnecting the milk hose and electric cord and rinsing the farm tank. The time required to perform these fixed operations is relatively constant and varies only with the ability of the driver to organize the work efficiently and do it quickly but carefully. Therefore, this constitutes a larger proportion of total farm time for small milk volumes than for large ones. The time required for pumping the milk varies with the capacity of the pump and volume of milk pickup.

Densities of Routes

Another factor affecting the efficiency of collecting milk on routes is the distance between farms, or route density. At time of interview, the average distance between producers on bulk routes was 10.1 miles. This was almost three times the average distance on can routes. This difference is due primarily to two factors: (1) Conversion to bulk operation by dairy farmers has been spotted and all producers on a can route did not convert to bulk handling at the same time, with the result that a tank trucker had to cover the two or more former can routes before filling the tank; (2) Many small producers are going out of the dairy business rather than make the high investment in bulk tanks, and since all producers on a route do not change to bulk, can truckers also must travel greater distances to fill their trucks. As more producers change from 10-gallon can to bulk, the distance between producers on tank routes should decrease, while the distance between producers on can routes should increase substantially. In some instances this has led to increase hauling rates on can routes.

CONTROL OF MILK ASSEMBLY ROUTES

Prior to the spring of 1955, all tank trucks hauling producer milk in North Texas were owned and operated by milk plants which also controlled the routes. Since that time, tankers have been purchased by independent contract haulers and by 1958 most tank trucks were owned by independent operators. These haulers formed bulk routes and hauled the producers' milk to specified milk plants. These contract haulers controlled their routes in so far as establishing the route, bargaining with producers for the hauling charges, delivering the milk regularly to the plant and being paid for the hauling by the producer.

In the past 2 years the local producers' association, to which more than 80 percent of the producers belong, leased all of the tank trucks hauling its members' milk. The association did this to facilitate movement of milk from plants with a surplus to plants with a milk shortage. By January 1959 all independently owned tank trucks were under lease to the association.

Being under lease to the association removed some of the control from the haulers. However, they still establish their own routes and retain them under the terms of the lease. The hauling charge which a hauler receives is fixed at the rate in effect at the time the lease is made. Furthermore, the plant to which the milk is to be delivered is designated by the association. Payment for hauling is made by the association direct to the hauler.

MILK HAULING RATES TO PRODUCERS

Hauling rates to producers varied 25 to 40 cents per hundredweight for can hauling and 20 to 60 cents per hundredweight for bulk hauling. Data obtained from the North Texas Milk Market Administrator's Office show that during November 1958 hauling rates for milk hauled in cans amounted to an average of 37 cents per hundredweight while rates for milk hauled in bulk tanks amounted to an average of 22 cents per

TABLE 3. TIME REQUIRED ON BULK AND CAN MILK-ASSEMBLY ROUTES, NORTH TEXAS, SUMMER, 1958

Item	Bulk routes		Can routes
	1,800 gallons	More than 1,800 gallons	
	— — — — Minutes — — — —		
Time required			
Per route[1]	300	330	480
Per farm	43	41	28
Per hundredweight	2.2	1.3	4.5

[1]Includes only the time required to collect the milk.

hundredweight or a difference of 15 cents per hundredweight.

Less than 12 percent of the tank truck haulers interviewed stated that they charged different rates to different producers on the same route. Rates to individual producers were determined by the milk volume and the distance the milk was hauled. A smaller proportion of the haulers varied charges on can routes.

However, information obtained from the Market Administrator's Office for November 1957 and 1958 indicates that on approximately 25 percent of bulk tank truck routes, rates were varied to producers on individual routes. Approximately 30 percent of the producers were located on these routes in November 1957 and 40 percent in November 1958.

Most bulk tank truck operators interviewed felt that varying the rates to producers on the same route, on the basis of volume of milk and distance the milk is hauled, is the only equitable way to charge for hauling. However, they also felt that this would be difficult to accomplish since most producers feel that their milk should be hauled for the same rate that other producers on the same route pay.

Although the producers' association makes contractual arrangements with bulk tank truck operators in leasing the trucks to have control of the movement of the milk, they do not negotiate hauling rates. Rates in the contracts result from negotiations between tank truck owners and milk producers.

MILK REJECTION

Haulers interviewed reported that during the 6 months previous to interview they rejected only 23 farm tanks of milk. Of these, 14, or 61 percent, were rejected because the milk was sour. In most cases the milk had soured because the farmer had failed to turn on the tank cooling system. Other reasons given for rejecting milk were bad odor and flavor.

The rejected sour milk was poured out. In these instances farmers lost milk from 2 days' output mostly because of carelessness. This milk amounted to 19,450 pounds. The milk rejected because of flavor and odor (26,850 pounds) was hauled to manufacturing plants for processing.

In most cases the tank truck driver takes the responsibility for rejecting the milk. In some cases the final responsibility for rejecting milk is with the plants' fieldmen.

Personnel of the Texas Agricultural Experiment Station have found that venting the bulk tank during the cooling process to allow volatile odors to escape improves milk flavor.

TRAINING OF DRIVERS

The modern method of collecting milk has made the bulk milk hauler the most important link between the producer and the milk plant. He is the "key" individual in quality control. In addition to operating a tanker, he also is a sampler, a measurer, a fieldman and a producer contact agent. By comparison, the can hauler's only task is to collect the milk in 10-gallon cans and haul it to the plant where the other tasks are performed.

In performing his specialized tasks the tank truck driver should be able to recognize desirable and undesirable milk flavors and odors and be willing to reject milk with undesirable qualities. He should be able to take properly a sample of milk for butterfat content and bacteria count, and read accurately the calibration stick in a farm tank and convert the reading to pounds or gallons of milk. He should be able to help the farmer with problems concerning milk cooling, storage and sanitation and be a public relations man to maintain good relations with the producer and the plant.

Therefore, it is important that tank truck drivers receive special training. Prior to 1959 drivers received limited training, usually provided by personnel at the plant to which they delivered milk. This training consisted mostly of on-job orientation by the plant fieldmen or what could be obtained by riding with other drivers.

Of the 27 tank truck operators interviewed, only 11, or 41 percent, had received some training. Six of these received on-job orientation from plant fieldmen, two rode with other haulers and three received training at the plants.

In the fall of 1958 the Texas State Department of Health ruled that all bulk tank truck drivers must attend a training program conducted by local health offices and pass a written, oral and practical test to qualify and be issued a milk hauler's permit.

The training program provides for at least 1 day of on-job training and 1 day of training on procedures for milk collection and sampling. The minimum training includes lectures on: (1) reasons for the Milk Sanitation Program, (2) bacteriology, (3) laws and regulations applicable to bulk milk haulers, and (4) the bulk milk hauler and his duties. The program also includes a field trip with an experienced tank operator, during which time each hauler demonstrates the proper procedures. This is followed by a written examination covering all phases of the training program.

According to public health officials, 136 persons in the North Texas area attended this training course in March 1959. Of these, 91 successfully completed the course.

PROBLEMS ENCOUNTERED BY HAULERS

Sanitation is one of the major problem areas with milk. One of the major sanitation problems encountered by haulers was improper cleaning of the farm tank and milking equipment which resulted in high bacteria count. This becomes a special problem to a hauler when the bacteria count of a producer's milk exceeds the legal maximum and the farmer is degraded until the bacteria count is lowered. In this case the milk cannot be mixed with Grade "A" milk of other producers' on the route, and as a result, the hauler obtains only a partial load of milk on that route. In some instances the hauler makes return trips to pick up this degraded milk and haul it to a manufacturing plant, resulting in additional time and mileage.

Another major problem is rancid milk, caused in most instances by incorporation of air in the milk while flowing in improperly installed pipelines. In some cases rancidity is caused by risers in the pipelines. This can be corrected by readjusting the pipeline. Other causes of rancidity include improper agitator design and speed, long storage at low temperature, individuality of cow and vacuum tanks.

When hauling milk in bulk began, the major problem bulk tank truck operators faced was the insufficient number of producers with bulk systems. The great distances between producers caused these first operators to travel long distances before picking up full tanks. Although this problem is being eliminated as more producers change from can to the bulk system, it remains a problem in areas where the change is slow.

Overlapping of bulk routes where two trucks may follow the same route is another problem. This problem is caused by competition among haulers to get enough milk to fill their tanks and lack of proper organization of routes among haulers. The resulting inefficiency would have meant higher hauling rates to producers if competition in establishing routes had not exerted a pressure for lower rates.

Bad local roads and bridges that are too weak to support a tank truck have prevented some dairymen from changing from can to bulk. Thus bulk haulers have to skip these producers, which increases the distance between farms and total route mileage and results in inefficient milk collection.

Plant Receiving

Plants included in this study had been receiving bulk milk 6 months to 4½ years previous to date of interview. Receiving bulk milk results in savings in investment and costs and increased flexibility in operating practices. Milk plants equipped to receive bulk milk may eliminate the can receiving operation. This would result in savings in investment and labor and in reducing the milk cooling and can washing operations.

EQUIPMENT AND INVESTMENT CHANGES

Total investment in receiving equipment for dual receiving operations at the plants included in this study amounted to an average of $35,460 per plant, Table 4. Of this, equipment amounting to $12,681 per plant or about one-third of the total investment in milk receiving equipment, could be eliminated by converting to bulk receiving. The equipment that could be eliminated includes can conveyors, dumping equipment, weigh can and scale, platform and reject slide and can washer. Other receiving equipment needed for either can or bulk receiving includes pump, clarifier, sampling and recording equipment, sanitary pipe and fittings, coldwall storage tank and/or plate cooler. The average investment per plant for bulk receiving equipment amounts to $22,779. This is a minimum amount and includes only one of each item of equipment. In most plants the investment in receiving equipment is higher than this because there are more than one unit of several equipment items.

Eliminating the can receiving operation often is a solution to the problem of finding more plant space without building additional space. The receiving room space occupied by conveyors, dumping equipment, weigh can and scales, platform and reject slide and can washer becomes available for expansion of the plants processing storare capacity.

VOLUME RECEIVED AND LABOR REQUIREMENTS

At the time of interview, 32 percent of all plants equipped to receive bulk milk also were receiving milk in cans. These plants were receiving approximately 60 percent of their milk supply in cans.

TABLE 4. INVESTMENT IN PLANT EQUIPMENT FOR RECEIVING AND COOLING MILK IN BULK AND CANS, NORTH TEXAS, 1958

Equipment item	Average cost per unit
	— — Dollars — —
Equipment that would be eliminated by all bulk receiving	
Conveyors	3,001
Dumping equipment	1,386
Weigh can, scale	3,000
Can washer	5,294[1]
Subtotal	12,681
Other receiving equipment	
Pump	1,270
Clarifier	6,200
Sampling, recording	673
Sanitary pipe, fittings	2,305
Coldwall storage tank	9,000[2]
Plate cooler	3,331[2]
Subtotal	22,779
Total receiving equipment	35,460

[1]A plant receiving all milk in bulk and selling some of its milk products in cans (10-gallon spigot cans) or cream in cans, needs a can washer.

[2]Usually coldwall storage tanks or plate coolers are used, seldom both.

TABLE 5. AVERAGE INTAKE CAPACITY AND VOLUME RECEIVED AT MILK PLANTS UNDER BULK AND CAN RECEIVING[1], NORTH TEXAS, SUMMER, 1958

Item	Bulk receiving	Can receiving
	— — — Hundredweight — — —	
Volume		
Capacity	3,762	2,653
Receipts	1,649	1,182
Percent of capacity	44	44

[1]Based on an 8-hour period.

These plants had a dual intake capacity of 85 percent greater than when they were receiving milk only in cans. The intake capacity for can milk was increased 10 percent and the remaining 75 percent increase was due to installation of bulk receiving equipment. However, average daily milk receipts increased by only 75 percent which included a 3-percent increase in can milk and a 72-percent increase in bulk receiving.

At the time of interview, plants were operating at an average of only 44 percent of their milk intake capacity under both can and bulk receiving operations, Table 5. This low level of utilized capacity results in inefficient use of labor and in higher labor costs than if receiving equipment were utilized more fully.

Labor requirements for receiving milk in cans are higher than for receiving bulk milk. In can receiving, usually two to four men handle, dump and wash the cans, weigh the milk and take samples, maintain records and clean the receiving room and equipment. In bulk receiving, only one man is needed to unload the tank trucks, check weights and take samples. The average milk volume received per man-hour of labor when receiving milk only in cans is 67 hundredweight, Table 6. The volume in bulk receiving is 150 hundredweight per hour of labor. Converting milk receiving operations from can to bulk results in increasing volume received per hour of labor by about 83 hundredweight.

TABLE 6. HUNDREDWEIGHT OF MILK RECEIVED AT PLANTS PER MAN-HOUR OF LABOR FOR BULK AND CAN RECEIVING, NORTH TEXAS, 1958

Receiving operation	Hundredweight of milk received per man-hour of labor[1]		
	All plants	Largest plant	Smallest plant
	— — — — —	Hundredweight	— — — — —
Can only	67	86	40
Dual operation			
Can	75	120	18[2]
Bulk	150	300	120
Average	120	150	75

[1]Based on average volume received during an 8-hour period.

[2]The large decrease in volume received per man-hour resulted because milk received in cans is only a small portion of total receipts, but the plant still must keep two men at the can-receiving equipment.

MILK REJECTION

Rejection of milk by plants affects more people than rejection by haulers. Milk rejection by a hauler affects only one producer, while rejection by a plant affects all producers whose milk is in the tank truck.

During the 6 months prior to interview, managers of milk plants reported rejection of 20 tank trucks of milk. This represented about 267,400 pounds of milk from approximately 160 producers. Twelve of these 20 tank loads were rejected because the milk had an undesirable flavor. Other reasons for rejecting milk included rancidity, 25 percent of the tanks, and high acidity, 15 percent.

PROBLEMS ENCOUNTERED IN BULK RECEIVING

The principal problem confronting milk plants is insufficient training of tank truck drivers concerning the proper procedures and techniques for milk tank truck operation. Milk plant managers reported that one of their greatest problems is having drivers examine the milk for undesirable flavors and odors and to reject milk having undesirable qualities.

Inadequate agitation of milk in the farm tank before taking a sample to determine the butterfat content also was a major problem. Other problems included improper sampling, improper gauging of milk volume and the driver picking up one farm tank of poor qaulity milk which contaminated the entire load.

Another problem area of bulk operation is sanitation. This includes improper sanitizing of the truck tank before beginning each route and collecting milk late in the afternoon and keeping it in the truck tank overnight. If the hose and pump are not cleaned before emptying the milk, bacteria develops in the milk residue left in and milk pumped through them will become contaminated. The action of local health officials in permitting milk collection only between the morning and evening milkings has eliminated this problem in some areas.

Milk Volume and Handling Losses

The change from the 10-gallon can system has aroused interest among milk plant managers in the problem of milk losses in handling. Under the can system the quantity of milk from each producer is determined at the plant and any losses in transit are assumed by the hauler or the producer. Because of the nature of the system, the quantity of milk in bulk handling must be determined when it is picked up at the farm and any milk losses occuring in transit usually are assumed by the plant.

TABLE 7. NUMBER OF TANK LOADS OF MILK REGISTERING A GAIN, LOSS AND NO CHANGE, BY MEASUREMENT METHOD, NORTH TEXAS, JULY AND OCTOBER, 1958

Measurement method	July Gain[1]	July Loss[2]	July No change	October Gain[1]	October Loss[2]	October No change
	Number					
Scale	39	62	4	210	416	10
Gauge	269	352	20	136	355	21
Flow Meter	88	32	9	195	121	47
Total	396	446	33	541	892	78

[1]Tank loads that gained weight are those which had measurements at the plant greater than at the farm.
[2]Tank loads that lost weight are those which had measurements at the plant less than at the farm.

Some milk plants receiving bulk milk have reported large paper losses of milk resulting from differences between farm dipstick measurements and the plants' method of measurement.

DETERMINING MILK VOLUME

The quantity of bulk milk received in plants is checked by measuring and weighing. The devices used are platform scales, liquid level gauges and flow meters. Approximately 50 percent of the plants checking quantity use platform scales. The liquid gauge is the next most frequently used device. Plants started using flow meters for checking farm dipstick measurements during the past 3 years. Prior to that time, a sanitary and accurate flow meter which could be readily disassembled for cleaning did not exist.

VARIATIONS BETWEEN MEASUREMENT METHODS

Of the 2,386 tank loads of milk included in the study, 875 were received at the plants in July and 1,511 in October. These tanks contained a combined farm weight of 14,131,141 pounds of milk in July and 22,451,941 pounds in October or a total of 36,583,082 pounds. The weight registered by the milk in these tanks at the plants amounted to 14,124,893 pounds in July and 22,396,428 pounds in October or a total of 36,514,321 pounds. This represents a difference between farm weights and plant weights of 68,761 pounds or a loss of .19 percent of the farm weight.

Table 7 indicates the number of tank loads of milk by each measurement method that either gained, lost or had no change in volume during July and October 1958.

TABLE 8. COMPARISON OF VARIATIONS BETWEEN FARM AND PLANT WEIGHTS, BY MEASUREMENT METHOD, FOR MILK HANDLED IN BULK, NORTH TEXAS, JULY AND OCTOBER, 1958[1]

Measurement method	Farm weights[2]	Plant weights[2]	Difference	
	Pounds		Pounds	Percent
July				
Scale	13,517	13,508	− 9	−.07
Gauge	16,214	16,196	− 18	−.11
Meter	17,975	16,143	+ 49	+.27
Average all methods	16,150	16,143	− 7	−.04
October				
Scale	14,350	14,304	− 46	−.32
Gauge	15,639	15,565	− 74	−.47
Meter	14,651	14,664	+ 13	+.09
Average all methods	14,859	14,818	− 41	−.28

[1]Includes all tank loads of milk received.
[2]Average number of pounds of milk per tank load.

TABLE 9. COMPARISON OF VARIATIONS BETWEEN FARM AND PLANT WEIGHTS, BY MEASUREMENT METHOD, FOR MILK HANDLED IN BULK, NORTH TEXAS, JULY AND OCTOBER, 1958

Measurement method	Farm weights[1]	Plant weights[1]	Difference	
	Pounds			Percent
July	Tanks with farm weights more than plant weights			
Scale	12,954	12,894	60	−.46
Gauge	16,448	16,335	113	−.69
Meter	16,284	16,242	42	−.26
Average all methods	15,950	15,850	100	−.63
October				
Scale	14,230	14,178	52	−.34
Gauge	15,797	15,644	153	−.97
Meter	16,311	16,221	90	−.55
Average all methods	15,136	15,038	98	−.65
July	Tanks with farm weights less than plant weights			
Scale	14,509	14,579	70	+.48
Gauge	16,211	16,317	106	+.65
Meter	19,042	19,129	87	+.46
Average all methods	16,672	16,771	99	+.59
October				
Scale	14,663	14,722	59	+.40
Gauge	15,496	15,616	82	+.77
Meter	13,566	13,646	80	+.57
Average all methods	14,477	14,559	82	+.57

[1]Average number of pounds of milk per truck load showing variations between farm and plant measurements.

TABLE 10. PERCENTAGE DISTRIBUTION OF TANKS WITH DIFFERENCES BETWEEN FARM AND PLANT WEIGHTS, ALL MEASUREMENT METHODS, NORTH TEXAS, JULY AND OCTOBER, 1958

Difference	Farm weights more than plant weights: July	Farm weights more than plant weights: October	Farm weights less than plant weights: July	Farm weights less than plant weights: October
	Percent			
Pounds				
1-24	23	25	19	34
25-49	30	23	23	20
50-74	15	13	14	15
75-99	9	9	10	8
100-124	6	7	9	7
125-149	3	5	5	3
150-174	2	3	5	3
175-199	2	3	2	2
200 or more	10	12	13	8
Total	100	100	100	100

TABLE 11. PERCENTAGE DISTRIBUTION OF TANKS WITH DIFFERENCES BETWEEN FARM AND PLANT SCALE WEIGHTS, NORTH TEXAS, JULY AND OCTOBER, 1958

Difference	Farm weights more than plant weights		Farm weights less than plant weights	
	July	October	July	October
	— — — — — — Percent — — — — — —			
Pounds				
1-24	29	26	15	40
25-49	32	34	36	29
50-74	10	20	20	13
75-99	15	11	8	7
100-124	6	4	8	4
125-149	3	2	5	2
150-174	2	1	3	2
175-199	0	1	0	0
200 or more	3	1	5	3
Total	100	100	100	100

In July the average loss per tank load of milk between the farm and the plant amounted to .04 percent of the farm weight, Table 8. In October the loss amounted to .28 percent.

In July 51 percent of the milk tanks registered an average loss of .63 percent of the farm weight. Forty-six percent of the tanks showed an average increase of .59 percent in weight and 3 percent had no variation, Table 9. In October 59 percent of the tank loads of milk registered an average loss of .65 percent of the farm weight. Thirty-six percent showed a gain of .57 percent on the average and 5 percent had no variation.

Twelve percent of the milk tanks were weighed on platform scales in July and 42 percent in October. The average variation of these milk tanks between farm and plant amounted to −.07 percent of the farm weight in July and −.32 percent in October.

In July the milk volume in 74 percent of the tanks was measured by liquid level gauges and in October this measurement method was used for 34 percent of the tanks. Variations between the farm and plant amounted to a net loss of .11 percent in July and .49 percent in October.

TABLE 12. PERCENTAGE DISTRIBUTION OF TANKS WITH DIFFERENCES BETWEEN FARM AND PLANT GAUGE WEIGHTS, NORTH TEXAS, JULY AND OCTOBER, 1958

Difference	Farm weights more than plant weights		Farm weights less than plant weights	
	July	October	July	October
	— — — — — — Percent — — — — — —			
Pounds				
1-24	20	21	21	33
25-49	30	11	20	15
50-74	16	7	12	13
75-99	7	8	8	6
100-124	6	9	10	6
125-149	4	7	6	4
150-174	3	4	6	4
175-199	2	6	2	3
200 or more	12	27	15	16
Total	100	100	100	100

TABLE 13. PERCENTAGE DISTRIBUTION OF TANKS WITH DIFFERENCES BETWEEN FARM AND PLANT METER WEIGHTS, NORTH TEXAS, JULY AND OCTOBER, 1958

Difference	Farm weights more than plant weights		Farm weights less than plant weights	
	July	October	July	October
	— — — — — — Percent — — — — — —			
Pounds				
1-24	38	35	12	28
25-49	28	20	24	14
50-74	9	9	18	20
75-99	16	7	15	11
100-124	9	7	8	10
125-149	0	7	5	4
150-174	0	6	6	3
175-199	0	2	3	2
200 or more	0	7	9	8
Total	100	100	100	100

The percent of tanks checked by flow meters increased from 14 percent of the total in July to 24 percent in October. These tanks registered a net gain in weight between the farm and plant amounting to .27 percent of the farm weight in July and .09 percent in October.

For all measurement methods at the plant in July, 68 percent of the tank loads of milk with farm weights more than plant weights had a difference of less than 75 pounds. Of the tanks with farm weights less than plant weights, 56 percent registered a gain of less than 75 pounds, Table 10. In October 61 percent of the tanks registering losses at the plant had a decrease of less than 75 pounds and 69 percent registering a gain had an increase of less than 75 pounds.

In July 71 percent of the tanks weighed on scales and registering a loss had a decrease of less than 75 pounds at the plant, while 71 percent of those registering a gain had an increase of less than 75 pounds, Table 11. By comparison, in October 80 percent of the tanks with decreases had a loss of less than 75 pounds while 82 percent of the tanks with increases had a gain of less than 75 pounds.

TABLE 14. PERCENTAGE DIFFERENCES BETWEEN FARM AND PLANT WEIGHTS BY PLANTS, NORTH TEXAS, JULY AND OCTOBER, 1958

Plant	Difference between farm and plant weights[1]
July	Percent
A	−.03
B	−.14
C	+.27
D	+.43
October	
V	−.95
W	+.04
X	−.22
Y	−.23
Z	−.04
All plants (both months)	−.19

[1]Some plants used more than one measurement method.

Tank loads of milk registering a weight decrease by gauge measurement at the plant of less than 75 pounds of milk represented 66 percent of all tanks with decreased weight in July and 39 percent of those with decreased weight in October, Table 12. The tanks registering a weight increase of less than 75 pounds represented 53 percent of tanks with a gain in July and 61 percent of those with a gain in October.

Of the tank loads of milk measured by flow meters which registered a decrease, 75 percent had a loss of less than 75 pounds in July and 64 percent in October, Table 13. The number of tank loads with a gain at the plant of less than 75 pounds represented 54 percent of all tanks registering an increase in July and 62 percent in October.

Among individual plants, differences in milk volume from farm to plant ranged from +.43 percent of the volume measured at the farm to −.03 percent in July and from +.04 percent to −.95 percent in October, Table 14.

North Texas plants usually pay for bulk milk on basis of volume measured at the farm and any shortages at the plant are supported by them. However, by eliminating can receiving operations, the savings in cost of receiving the milk in most plants would more than offset the .19 percent overall shortage between farm and plant weights indicated in this study.

FACTORS AFFECTING MEASUREMENT VARIATIONS

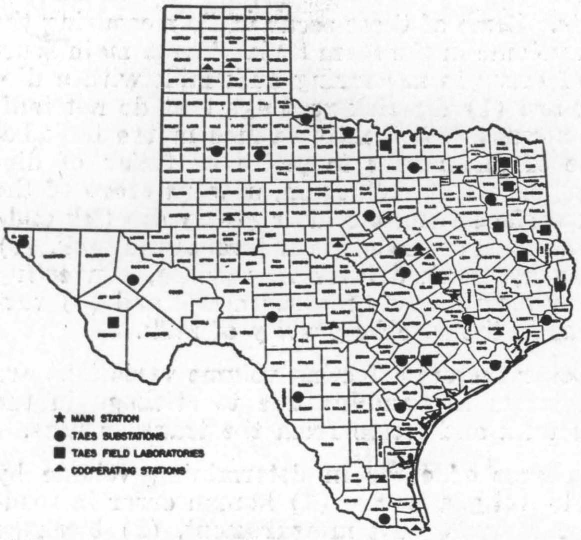
Several factors affect the variations between farm dipstick measurements and plant measurements. Some of these occur while measuring the milk volume in the farm tank. Three main sources of error in measuring bulk milk with a dipstick are (1) dipstick readings that do not indicate accurately the milk volume in the tank because of differences in polish or finish of dipsticks, excess of milk foam, upward creep of the milk surface along a cold or greasy dipstick and/or distortion of the shape or level of the tank, (2) errors by truck drivers in reading, converting and/or recording the measurements and (3) variations in the specific gravity of milk.

Other factors affecting volume variations are milk losses in handling due to stickage in the farm tank and losses from the transfer hose.

Sources of error in determining volume by liquid level gauges are (1) human error in reading or recording the measurement, (2) blockage of the air tube between the storage tank and the gauge and (3) variations in the air pressure in the tube.

Accuracy of platform scale measurements depends on the breaking point of the scales and the extent to which variations in the weight of the truck proper, before and after unloading the milk, are taken into consideration. For accurate weight determination, changes in the tank truck weight due to mud adhering or detaching from the body during rainy weather and the amount of gasoline used must be considered.

The primary sources of error in determining volume by flow meters include (1) incorporation of air in the milk and foam, (2) variation in the air pressure through the meter and (3) variation in the specific gravity of milk.



Location of field research units of the Texas Agricultural Experiment Station and cooperating agencies

State-wide Research

★

The Texas Agricultural Experiment Station is the public agricultural research agency of the State of Texas, and is one of ten parts of the Texas A&M College System

ORGANIZATION

IN THE MAIN STATION, with headquarters at College Station, are 16 subject-matter departments, 2 service departments, 3 regulatory services and the administrative staff. Located out in the major agricultural areas of Texas are 21 substations and 9 field laboratories. In addition, there are 14 cooperating stations owned by other agencies. Cooperating agencies include the Texas Forest Service, Game and Fish Commission of Texas, Texas Prison System, U. S. Department of Agriculture, University of Texas, Texas Technological College, Texas College of Arts and Industries and the King Ranch. Some experiments are conducted on farms and ranches and in rural homes.

OPERATION

THE TEXAS STATION is conducting about 400 active research projects, grouped in 25 programs, which include all phases of agriculture in Texas. Among these are:

Conservation and improvement of soil	Beef cattle
Conservation and use of water	Dairy cattle
Grasses and legumes	Sheep and goats
Grain crops	Swine
Cotton and other fiber crops	Chickens and turkeys
Vegetable crops	Animal diseases and parasites
Citrus and other subtropical fruits	Fish and game
Fruits and nuts	Farm and ranch engineering
Oil seed crops	Farm and ranch business
Ornamental plants	Marketing agricultural products
Brush and weeds	Rural home economics
Insects	Rural agricultural economics

Plant diseases

Two additional programs are maintenance and upkeep, and central services.

Research results are carried to Texas farmers, ranchmen and homemakers by county agents and specialists of the Texas Agricultural Extension Service

AGRICULTURAL RESEARCH seeks the WHATS, the WHYS, the WHENS, the WHERES and the HOWS of hundreds of problems which confront operators of farms and ranches, and the many industries depending on or serving agriculture. Workers of the Main Station and the field units of the Texas Agricultural Experiment Station seek diligently to find solutions to these problems.

Today's Research Is Tomorrow's Progress