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Comparative costs of cooling and storing milk in cans and bulk tanks

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Comparative Costs of Cooling and Storing Milk in Cans and Bulk Tanks

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COMPARATIVE COSTS OF STORING MILK IN CANS AND BULK TANKS

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How the cost of cooling and storing milk on the farm in bulk tanks compares to that of using can coolers is of primary concern to dairy producers in Mississippi today. Since two types of bulk tanks, direct expansion and ice bank, are being used producers who are considering a change to the bulk system may also be interested in the comparative costs of the two.

Purpose

The purpose of this study was to provide some of the basic information needed to evaluate the feasibility of changing from the can system to the bulk system. Specifically, comparisons were made of butterfat tests, bacteria counts and cost items for each system over a wide range of production levels. Cost items compared include depreciation, interest on investment, repair, electricity, cleaning materials and labor.

Source of Data

This study is based on data obtained in 1957 from 41 members of the Noxubee Milk Producers Association who had converted from the can system to bulk tank systems during the previous year. Monthly reports on volume, butterfat tests and bacteria counts of milk delivered by each of these producers were obtained from records of the association. Each producer was interviewed to obtain information on labor requirement, cleaning materials used and changes in herd composition. Records on monthly consumption of electricity on each farm were provided by the Four-County Power Association, a utility cooperative serving the area. All this information was obtained for two periods — October 1955 - July 1956, when producers used the can system, and for corresponding months one year later, when all producers were using bulk tanks. Averages of installed prices for equipment in December 1957, as given by five equipment dealers in the state, were used to estimate costs for each system.

Comparisons of Non-Cost Items

Butterfat tests: The butterfat content of milk normally varies inversely with the level of production per cow. Thus, to compare butterfat tests for two periods, they must first be adjusted to equal levels of production per cow. Thirty-five of the 41 producers in the sample reported changes in herd sizes during the period studied. Because of the difficulty involv-

Table 1. Average production per cow, average butterfat tests, and composition of herds: 6 members of the Noxubee Milk Producers Association.

Item	Unit	Can system October 1955-July 1956	Bulk system October 1956-July 1957	Net change
Production per cow	lbs.	2,726	3,245	519[3]
Butterfat tests:				
Unadjusted	percent	4.60	4.48	— .12
Adjusted[1]	percent	4.55	4.52	— .03
Composition of herds:				
Jersey	no.	255	254	—1
Holstein	no.	28	29	+1
Guernsey	no.	8	8	----
Others[2]	no.	16	16	----

[1]Adjusted to an average level of production of 2,985.8 pounds per cow.

[2]Includes mixed breeds.

[3]Difference attributed to better pastures.

Table 2. Number of bacteria counts and average bacteria count per cubic centimeter of milk 41 producers, Noxubee Milk Producers Association.

Item	Can system October 1955-July 1956	Bulk system October 1956-July 1957	Net change
Number of counts	1,228	771	— 457
Average bacteria count per cubic centimeter[1]	32,000	28,000	—4,000

[1]Eleven counts under the can system and four counts under the bulk system were too numerous to count. These were entered in the analysis at 500,000 per cubic centimeter.

Table 3. Facilities required to cool and store specified volumes of milk on the farm, can system and bulk system.

Daily production		Can system[1]		Bulk system[2]
Maximum	Average	Size of cooler	Number of cans	Size of tank
(Gallons)		(No. of cans)	(Number)	(Gallons)
20	15	4	4	100
40	30	4	8	100
60	45	6	12	150
80	60	8	16	200
100	75	10	20	250
120	90	10	24	300
140	105	12	28	350
160	120	14	32	400
180	135	8+10[3]	36	450
200	150	10+10[3]	40	500

[1]Every day pick-up with empty cans returned as milk is picked up.
[2]Every other day pick-up with reserve storage for one extra milking during flush season.
[3]Least-cost combination where capacity of one cooler is exceeded.

ed in adjusting the levels of production per cow, butterfat tests from the herds of these 35 producers were eliminated. Thus, the comparison of butterfat tests was based on only six herds in which no change in numbers occurred. This provides 60 observations for each system. (Appendix Table 1).

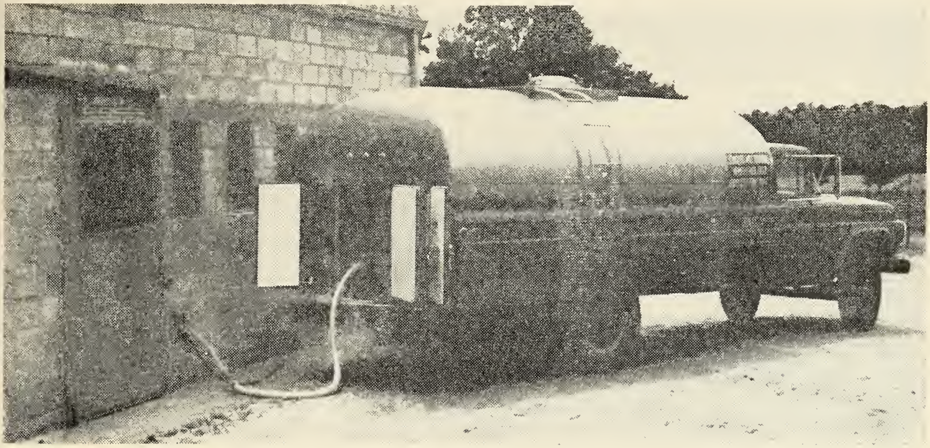
For these six, the average level of production per cow was 519 pounds higher during the time the bulk system was used than it was previously. When adjusted to an average level of production, the butterfat test under the can system was 4.55 percent, and under the bulk system, 4.52 percent (Table 1). The difference of .03 percent between the two was not statistically significant.

Bacteria counts: The bacteria counts used in this study were those made by the association for quality control purposes. The number of counts, average count per cubic centimeter, and differences in these items between can and bulk systems are shown in Table 2. A more detailed analysis is shown in Appendix Table 2.

Eleven counts under the can system and four under the bulk system were recorded as "too numerous to count"; these observations were entered in the analysis at 500,000 each. Another problem encountered was that bacteria counts for degraded milk were not recorded by the association. Because of these limitations, average bacteria counts shown for both systems are no doubt biased downward. In general, producers with high bacteria counts under the can system also had relatively high counts under the bulk system.

Facilities Required for Farm Storage and Cooling

Whether the producer uses a can cooler or a bulk tank, the size of facilities needed for farm storage and cooling of



From the bulk tank inside the barn the milk is pumped into a truck tank for delivery to the plant.

milk is determined by two factors—the maximum level of daily production and the frequency of milk pick-up. Route trucks usually pick up milk each day from farms where cans are used and return empty cans as milk is picked up. Thus, the producer with the can system must provide cooling space to hold his maximum daily volume, and cans for twice that volume. With the bulk system, routes are covered only once each two days. To allow for the possibility that the truck might not run on schedule, producers using bulk tanks must provide storage space for at least five milkings during the flush season.

Facilities required to cool and store specified maximum daily volumes of milk on the farm are summarized in Table 3.

Investment Requirements

On farms where bulk tanks can be installed without altering the milk room, the installed price of the tank will represent most, if not all, of the investment required to switch to bulk tanks. For direct-expansion tanks, these prices in 1957 ranged from about $1,500 for the 100-gallon size to about $3,500 for 500-gallon tanks. Installed prices for ice-bank tanks of corresponding sizes were from $200 to $300 less than those of direct-expansion tanks. Investment requirements for bulk tanks and can equipment, over a wide range of daily production maxima, are compared in Table 4.

As will be noted from the table, investment requirements of bulk tanks are considerably greater than for can equipment at any level of production. For the producer who converts from can to bulk system, however, a part of the investment may be recovered through the sale of his used can equipment. Average resale values of coolers and cans sold by Noxubee producers ranged from approximately $100 to $600, as shown in the latter part of the table above. Producers of manufacturing milk are the principal buyers of used can equipment. As more bulk tanks are installed, the market potential for coolers and cans will become more restricted and, as a consequence, resale values of can equipment are likely to become progressively smaller.

Cost Comparisons

To provide any producer, regardless of volume, with a basis for comparing cost expectations under the three systems, estimates of annual costs of owning and operating were made over a wide range of daily production volumes. Cost comparisons are summarized in Table 5.

Costs included in these estimates were of two types: equipment costs and operating costs. Equipment costs, i.e., depreciation, interest on investment and (in the case of bulk tanks) repairs are related to maximum daily production. Operating costs, especially those for electricity and labor are, on the other hand, more closely related to average than to maximum production. For these reasons, Appendix Tables 3-5, in which detail cost items are shown for the three systems, include both maximum daily and average annual production levels.

Equipment costs: Depreciation was calculated by the straight line method, with 10 percent of the purchase price of coolers and tanks being allowed as salvage value. For can equipment, an annual rate of 10 percent was used for coolers and 14 percent for cans. For bulk tanks, the annual rate was 6 2/3 percent. These rates were consistent with reported experiences and expectations of producers interviewed. Because of the price relationships, annual depreciation costs were least for can equipment and highest for direct-expansion tanks at all levels of production.

Interest on investment was charged at the rate of 5 percent on one-half of the purchase price of equipment.

Annual repair costs for can coolers, based on producer estimates, were not related to size of coolers. Therefore, the average of all repair estimates, $23, was applied for all coolers regardless of size. Added to this $23 was the cost of retinning 20 percent of the cans each year at $4 per can retainned. Because of their limited experiences with them, Noxubee producers had no basis for estimating annual repair costs for bulk tanks. An estimate of 1.5 percent of the purchase price of the tanks, as developed in a study in another area[1], was therefore used as a fair repair cost for bulk tanks.

The combined estimates for deprecia-

[1]Robert O. Sinclair, **Economic Effects of Bulk Handling of Milk in Vermont,** Vermont Agricultural Experiment Station Bulletin 581, Burlington, 1955, p. 19.

Table 4. Average installed prices for bulk tanks and can equipment, and resale values of used can equipment: Mississippi, 1957.

Item	Maximum daily production (gallons)[1] 20	40	60	80	100	120	140	160	180	200
Installed prices:										
Bulk tanks:										
Direct-expansion	1,543	1,543	1,784	2,108	2,300	2,625	2,850	3,099	3,300	3,485
Ice-bank	1,389	1,389	1,606	1,897	2,070	2,362	2,565	2,789	2,970	3,135
Can equipment:										
Cooler	387	387	473	559	645	645	731	817	1,204	1,290
Cans	40	80	120	160	200	240	280	320	360	400
Total	427	467	593	719	845	885	1,011	1,137	1,564	1,690
Resale value:										
Coolers	89	89	135	181	227	273	296	319	408	454
Cans	18	35	53	71	89	106	124	142	159	177
Total	107	124	188	252	316	379	420	461	567	631

Source: Table 3 and Appendix Tables 6, 7, 8, and 12.

[1]For sizes and amounts of equipment involved for each level of production see Table 3.

Table 5. Comparison of annual costs of cooling and storing milk on the farm with can coolers, direct-expansion tanks and ice-bank tanks, Mississippi.

Item	Maximum daily production (gallons)									
	20	40	60	80	100	120	140	160	180	200
	(Dollars)									
Equipment:[1]										
Can system	77	88	107	127	147	167	186	206	250	270
Direct-expansion tank	155	155	179	211	230	263	285	310	330	348
Ice-bank tank	139	139	160	189	207	236	256	279	297	313
Electricity (additional meter):[2]										
Can system	68	81	88	94	101	108	115	122	131	143
Direct-expansion tank	71	79	82	86	89	93	96	100	103	107
Ice-bank tank[3]	68	81	88	94	101	108	115	122	131	143
Cleaning materials:[4]										
Can system	73	80	86	93	100	107	114	120	127	133
Direct-expansion tank	68	75	80	[illegible]	91	98	103	109	113	120
Ice-bank tank[5]	68	75	80	86	91	98	103	109	113	120
Total excluding labor:										
Can system	218	249	281	314	348	382	415	448	508	546
Direct-expansion tank	294	309	341	383	410	454	484	519	546	575
Ice-bank tank	275	295	328	369	399	442	474	510	541	576
Labor:										
Can system	898	1,070	1,243	1,416	1,588	1,760	1,932	2,105	2,278	2,450
Direct-expansion tank	688	840	992	1,144	1,295	1,447	1,598	1,750	1,902	2,054
Ice-bank tank[5]	688	840	992	1,144	1,295	1,447	1,598	1,750	1,902	2,054
Total including labor:										
Can system	1,116	1,319	1,524	1,730	1,936	2,142	2,347	2,553	2,786	2,996
Direct-expansion tank	982	1,149	1,333	1,527	1,705	1,901	2,082	2,269	2,448	2,629
Ice-bank tank	963	1,135	1,320	1,513	1,694	1,889	2,072	2,260	2,443	2,630

Source: Appendix Tables 3 - 5.

[1]Includes depreciation, repair and interest on investment.

[2]For cost of electricity, if installed on house meter, see Appendix Tables 3 - 5.

[3]Same estimate as for can cooler.

[4]Includes cost of brushes, cleaner and sanitizer.

[5]Same estimate as for direct-expansion tank.

tion, interest and repair cost ranged from $77 to $270 for the can system. For direct expansion bulk tanks, these costs ranged from $154 to $348, and for ice-bank tanks, from $139 to $314. Estimates for the individual items at specified levels of production are shown in Appendix Tables 3-5 Estimating procedure is shown in Appendix Tables 6-8.

Electricity: When can coolers were used, electric consumption for both dwelling and barn was, on most farms, measured through the same meter. Because of the larger compressor motor on direct-expansion tanks, however, the utility company required separate meters for barns where tanks of that type were installed. Estimates of power consumption at barns where can coolers were used were obtained by comparing monthly records of kilowatt hours consumed through house meters for the two time periods studied, adjusted for changes in household electrical appliances. Utility company records of barn meter readings gave direct estimates of amounts of power used with direct-expansion tanks. The one ice-bank tank in this study was installed on the same meter as the dwelling, and was assumed to use the same amount of electricity as a can cooler of comparable size.

When can coolers were used, the average amounts of electricity used monthly at milking barns ranged from 318 to 1,593 KWH for farms with 15- and 200-gallon average daily production levels, respectively. With direct-expansion tanks and the same levels of production, the range of monthly power consumption averages was 340 to 995 KWH. Estimates of monthly power consumption at the barn, for specified levels of production, are shown in Table 6 for both types of equipment.

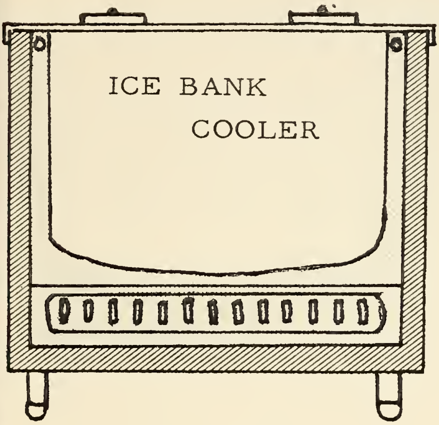
At the same rates per kilowatt hour, cost of electricity would have been considerably higher for can coolers than for direct-expansion tanks. The additional meter required for the latter, however, reversed these cost relationships. The average producer used 823 KWH of electricity a month for his dwelling alone. With a declining rate schedule, rates for additional electricity through that meter would have begun at four-tenths of one cent per KWH. On separate meters, the rate schedule begins at three cents per kilowatt.

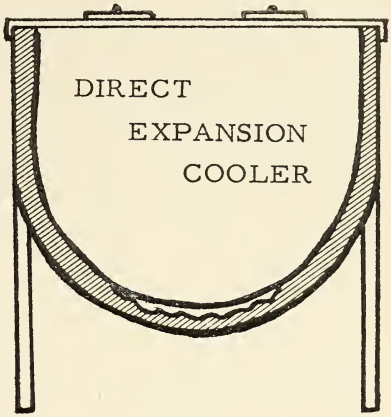
Estimates of electricity costs for each system under both meter arrangements are shown in Appendix Tables 3 - 5. The rate schedule in effect at the time the study was made is shown in Appendix Table 9.

Cleaning materials: Brushes, cleaner and sanitizer were the cleaning materials for which costs were obtained. The cost of cleaning materials for the can system was higher than for the bulk system at each level of production. Costs increased with volume under each system but were about $4 to $12 less under the bulk system. Estimates for individual items are shown in Appendix Tables 3-5, and the estimating procedure is shown in Appendix Table 10.

Labor: Greatest saving offered by bulk tanks appeared to be in labor. Since cans were cleaned and sanitized at each milking and bulk tanks only every other day, considerably less labor was required under the bulk system (Table 7). The procedure for estimating labor requirements is shown in Appendix Table 10.

Labor was charged at an hourly rate of 50 cents. Since, on some farms, labor may not be considered a cost, the cost analysis in Table 5 also shows costs when no charge is made for labor.





Two types of bulk storage tanks were being used in the area studied. As these cross-sectional drawings illustrate, one type has ice and water between the coils and the milk while the other does not.

Table 6. Estimated monthly consumption of electricity at milking barns with can coolers and direct-expansion tanks.

Daily production		Can	Bulk system
Maximum	Average	system	(direct-expansion)
(Gallons)		(Kilowatt hours)	
20	15	318	340
40	30	460	413
60	45	601	486
80	60	748	558
100	75	885	631
120	90	1,026	704
140	105	1,168	776
160	120	1,310	849
180	135	1,451	922
200	150	1,593	995

Table 7. Estimates of labor required annually to milk and clean equipment at specified levels of production, by type of cooling equipment.

Daily production		Can	Bulk system	
Maximum	Average	system	Direct-expansion	Ice-bank[1]
(Gallons)			(Hours)	
20	15	1,796	1,377	1,377
40	30	2,141	1,681	1,681
60	45	2,486	1,984	1,984
80	60	2,831	2,287	2,287
100	75	3,175	2,590	2,590
120	90	3,520	2,894	2,894
140	105	3,865	3,197	3,197
160	120	4,210	3,500	3,500
180	135	4,555	3,804	3,804
200	150	4,900	4,107	4,107

[1]Same estimate as for direct expansion tank.

SUMMARY AND CONCLUSIONS

The purpose of this study was to provide some of the basic information needed to evaluate the feasibility of changing from the can system to the bulk system of cooling and storing milk on farms. The specific data provided are comparisons of butterfat tests, bacteria counts, and cost items for each system.

The study was based on the experiences of the Noxubee Milk Producers Association and 41 of its members. This association switched from the can system to the bulk tank system during the Fall of 1956.

Butterfat tests of each producer's milk under the can system were compared to comparable tests under the bulk system. There were no diffrences in butterfat tests that could be attributed to bulk tanks.

Bacteria counts of each producer's milk under the can system were compared to counts under the bulk system. The average bacteria count per centimeter was 28,000 under the bulk system and 32,000 under the can system. Some bacteria counts above 200,000 were recorded for each system. From the comparisons made, it was apparent that bacteria counts were more closely related to producers than to the system used.

Cost of cooling and storing milk under the can system versus the bulk system was evaluated for 10 levels of maximum daily production, ranging from 20 to 200 gallons. When labor was not considered as a cost item, cost for the can system was less than for the bulk system at each level of production. When labor was included as a cost item, cost for the can system was consistently higher than for the bulk system. The difference in annual cost between direct-expansion tanks and ice-bank tanks was insignificant, provided the same meter arrangement is used for each tank. However, where it is possible to install an ice-bank tank on the same electrical meter as the dwelling, operating costs for that type of tank may be considerably reduced.

The investment required to switch to a bulk tank ranged from about $1,500 to $3,500 for a direct-expansion tank. The investment for the ice-bank tank ranged from $200 to $300 less than for the direct-expansion tank. Part of the investment may be recovered through the sale of used can equipment. Sale values realized by members of the Noxubee Milk Producers Association ranged from $100 to $600. As bulk tanks are installed on Grade A farms, resale values of can equipment will no doubt decline.

Appendix Table 1. Covariance analysis of variation in butterfat tests under can and bulk systems for six members of Noxubee Milk Producers Association, Macon, Mississippi, October 1955 - July 1956 and October 1956 - July 1957.[1]

Source of variation	d.f.	Sums of squares and cross products x^2	xy	y^2	Errors of estimate: Sums of squares	d.f.	Mean square
Total	119	1,017,553.64	—1,167.51	10.28125			
Between months	9	97,154.90	— 501.26	3.27375			
Between systems	5	80,937.06	— 194.78	.46875			
Between farms	1	558,133.72	— 149.86	3.63075			
Months x farms	45	125,686.70	— 90.41	1.33175			
Months x systems	9	31,333.78	— 10.20	.13375			
Farms x systems	5	47,247.69	— 81.13	.55475			
Months x farms x systems	45	77,059.79	— 139.87	.88775	.63569	44	.01413
Systems + error	46	157,996.85	— 334.65	1.35650	.64769	45	
Difference for testing systems					.01200	1	.01200

7 = .01200/ .01413 = .8492 (not significant) Regression coefficient = —.00181

System	Average production per cow/10 months X	Average butterfat test Y	Adjusted butterfat
	(pounds)	(percent)	(percent)
Can system	2,726.1	4.6000	4.5530
Bulk system	3,245.5	4.4750	4.5220
Difference	— 519.4	.1250	.0310

[1]Analysis was limited to six producers who reported the same number of cows in each month.

Appendix Table 2. Analysis of variation in logarithmic counts of bacteria for 41 members of the Noxubee Milk Producers Association, Macon, Mississippi, October 1955 - July 1956 and October 1956 - July 1957.

Source of variation	SS	d. f.	MS	F
Total	136.0332	759	.1792	
Between months	9.7358	9	1.0817	98.3363**
Between farms	38.2477	37	1.0337	10.0456**
Between systems	.8031	1	.8031	1.6582ns
Months x systems	3.6861	333	.0110	.1068ns
Months x farms	31.3711	9	3.4856	33.8736**
Farms x systems	17.9202	37	.4843	4.7065**
Months x farms x systems	34.2692	333	.1029	

System	Average bacteria count per c.c.	Average logarithmic count
Can	32,125	4.50685
Bulk	27,659	4.44184

** Significant beyond the .01 level. ns Not significant at the .05 level.

Appendix Table 6. Average purchase prices, estimated annual depreciation and average of annual repairs reported for can coolers, Mississippi, 1957.

Item	Size of cooler (can capacity) 4	6	8	10	12	14	16
			(Dollars)				
Purchase price	387	473	559	645	731	817	903
Annual depreciation[1]	35	43	50	58	66	74	81
Salvage value[1]	39	47	56	64	73	82	90
Annual repair	23	23	23	23	23	23	23

[1]Life of cooler estimated to be ten years with a salvage value of 10 percent of purchase price (average age of coolers at time of conversion was 5.07 years).

Appendix Table 3. Summary of estimated cost of cooling and storing milk on the farm with can coolers, Mississippi, 1957.

Cost items	Units	Maximum daily volumes (gallons)									
		20	40	60	80	100	120	140	160	180	200
Cooling & storage equip.:											
Depreciation[1]	$	40	46	59	73	86	100	113	126	159	172
Repairs[2]	$	26	30	33	36	40	43	46	49	52	56
Interest on investment	$	11	12	15	18	21	24	27	31	39	42
Electricity:											
Consumption per month	KWH	318	460	601	748	885	1,026	1,168	1,310	1,451	1,593
On house meter	$	15	22	30	43	55	68	81	94	106	119
On additional meter	$	68	81	88	94	101	108	115	122	131	143
Cleaning materials:											
Brushes	$	4	5	6	7	8	9	10	10	11	12
Cleaner	$	46	47	48	49	50	52	53	54	55	56
Sanitizer	$	23	28	32	37	42	46	51	56	61	65
Total excluding labor:											
On house meter	$	165	190	223	263	302	342	381	420	483	522
On additional meter	$	218	249	281	314	348	382	415	448	508	546
Labor, hours:	Hrs.	1,796	2,141	2,486	2,831	3,175	3,520	3,865	4,210	4,555	4,900
Cost @ 50c per hour	$	898	1,070	1,243	1,416	1,588	1,760	1,932	2,105	2,278	2,450
Total including labor:											
On house meter	$	1,063	1,260	1,466	1,679	1,890	2,102	2,313	2,525	2,761	2,972
On additional meter	$	1,116	1,319	1,524	1,730	1,936	2,142	2,347	2,553	2,786	2,996
Annual production[3]	Cwt	471	942	1,413	1,883	2,354	2,825	3,296	3,767	4,238	4,708

[1]Includes depreciation on can coolers and cost of replacing 14.11 percent of the cans each year.

[2]Includes repair on can cooler and cost of retinning 20 percent of the cans each year.

[3]Annual production is based on 75 percent of maximum daily production.

Appendix Table 4. Summary of estimated cost of cooling and storing milk on the farm with direct-expansion type bulk tanks, Mississippi, 1957.

Cost items	Units	Maximum daily volumes (gallons)									
		20	40	60	80	100	120	140	160	180	200
Cooling & Storage equip.:											
Depreciation	$	93	93	107	126	138	158	171	186	198	209
Repair	$	23	23	27	32	34	39	43	47	50	52
Interest on investment	$	39	39	45	53	58	66	71	77	82	87
Electricity:											
Consumption per month	KWH	340	413	486	558	631	704	776	849	922	995
On house meter	$	16	20	23	27	33	39	46	52	59	65
On additional meter	$	71	79	82	86	89	93	96	100	103	107
Cleaning materials:											
Brushes	$	1	2	2	2	2	3	3	3	3	4
Cleaner	$	42	45	47	50	52	55	57	60	62	65
Sanitizer	$	25	28	31	34	37	40	43	46	48	51
Total excluding labor:											
On house meter	$	239	250	282	324	354	400	434	471	502	533
On additional meter	$	294	309	341	383	410	454	484	519	546	575
Labor, hours:	Hrs.	1,377	1,681	1,984	2,287	2,590	2,894	3,197	3,500	3,804	4,107
Cost @ 50c per hour	$	688	840	992	1,144	1,295	1,447	1,598	1,750	1.902	2,054
Total including labor:											
On house meter	$	927	1,090	1,274	1,468	1,649	1,847	2,032	2,221	2,404	2,587
On additional meter	$	982	1,149	1,333	1,527	1,705	1,901	2,082	2,269	2,448	2,629
Annual production[1]	Cwt.	471	942	1,413	1,883	2,354	2,825	3,296	3,767	4,238	4,708

[1] Annual production is based on 75 percent of maximum daily production.

Appendix Table 5. Summary of estimated cost of cooling and storing milk on the farm with ice-bank type bulk tanks, Mississippi, 1957.

Cost items	Units	Maximum daily volumes (gallons)									
		20	40	60	80	100	120	140	160	180	200
Cooling & Storage equip.:											
Depreciation	$	83	83	96	114	124	142	154	167	178	188
Repair	$	21	21	24	28	31	35	38	42	45	47
Interest on investment	$	35	35	40	47	52	59	64	70	74	78
Electricity:[1]											
Consumption per month	KWH	318	460	601	743	885	1,026	1,168	1,310	1,451	1,593
On house meter	$	15	22	30	43	55	68	81	94	106	119
On additional meter	$	68	81	88	94	101	108	115	122	131	143
Cleaning materials:											
Brushes	$	1	2	2	2	2	3	3	3	3	4
Cleaner	$	42	45	47	50	52	55	57	60	62	65
Sanitizer	$	25	28	31	34	37	40	43	46	48	51
Total excluding labor:											
On house meter	$	222	236	270	318	353	402	440	482	516	552
On additional meter	$	275	295	328	369	399	442	474	510	541	576
Labor, hours:	Hrs.	1,377	1,681	1,984	2,287	2,590	2,894	3,197	3,500	3,804	4,107
Cost @ 50c per hour	$	688	840	992	1,144	1,295	1,447	1,598	1,750	1,902	2,054
Total including labor:											
On house meter	$	910	1,076	1,262	1,462	1,648	1,849	2,038	2,232	2,418	2,606
On additional meter	$	963	1,135	1,320	1,513	1,694	1,889	2,072	2,260	2,443	2,630
Annual production[2]	Cwt.	471	942	1,413	1,883	2,354	2,825	3,296	3,767	4,238	4,708

[1] Consumption of electricity to be the same as for can coolers.

[2] Annual production is based on 75 percent of maximum daily production.

Appendix Table 7. Average purchase prices, estimated annual depreciation and estimated annual repair for direct-expansion type bulk tanks, Mississippi, 1957.

Item	Size of tank (gallon capacity)										
	100	150	200	250	300	350	400	450	500	600	700
					(Dollars)						
Purchase price[1]	1,543	1,784	2,108	2,300	2,625	(2,850)	3,099	(3,300)	3,485	4,214	4,740
Depreciation[2]	93	107	126	138	158	171	186	198	209	253	284
Salvage value[2]	154	178	211	230	262	285	310	330	348	421	474
Annual repair[3]	23	27	32	34	39	43	46	50	52	63	71

[1]Installed price, 1957.
[2]Life of tanks estimated to be 15 years with a salvage value of 10 percent of purchase price.
[3]Based on 1.5 percent of purchase price.

Appendix Table 8. Average purchase price, estimated annual depreciation, and estimated annual repair for ice-bank bulk tanks, Mississippi, 1957.

Item	Size of tank (gallon capacity)										
	100	150	200	250	300	350	400	450	500	600	700
					(Dollars)						
Purchase price[1]	1,389	1,606	1,897	2,070	2,362	2,565	2,789	2,970	3,136	3,793	4,266
Depreciation[2]	83	96	114	124	142	154	167	178	188	228	256
Salvage value[2]	139	161	190	207	236	256	279	297	314	379	427
Annual repair[3]	21	24	28	31	35	38	42	45	47	57	64

[1]Installed price, 1957.
[2]Life of tanks estimated to be 15 years with a salvage value of 10 percent of purchase price.
[3]Based on 1.5 percent of purchase price.

Appendix Table 9. Electricity rates per kilowatt hour used to calculate the cost of power under the two systems of cooling milk; Noxubee Milk Producers Association, Macon, Mississippi, 1957.

Kilowatt hours consumed per month		Cost per kilowatt hour
First	50	3.00
Next	150	2.00
Next	200	1.00
Next	1,000	0.40
All over	1,400	0.75

Appendix Table 10. Relationship between specified cost items and volume of production for cans and bulk systems of cooling and storing milk, Noxubee Milk Producers Association, Macon, Mississippi, 1957.

System: Dependent variables		Constant terms		Regression coefficient	Independent variables
Can system:					
Annual cost of brushes	($) =	3.515	+	(.00185)	(Annual volume — cwt.)
Annual cost of cleaner	($) =	44.496	+	(.00252)	(Annual volume — cwt.)
Annual cost of sanitizer	($) =	18.144	+	(.01001)	(Annual volume — cwt.)
Electricity:					
Consumption per month	(KWH)=	176.45	+	(.03660)	(Monthly volume — lbs.)
Labor requirements	(Hrs.)=	1,451.08	+	(.73242)	(Annual volume — cwt.)
Bulk system:					
Annual cost of brushes	($) =	1.264	+	(.00049)	(Annual volume — cwt.)
Annual cost of cleaner	($) =	39.888	+	(.00529)	(Annual volume — cwt.)
Annual cost of sanitizer	($) =	22.255	+	(.00617)	(Annual volume — cwt.)
Electricity:					
Consumption per month	(KWH)=	267.27	+	(.01880)	(Monthly volume — lbs.)
Labor requirements	(Hrs.)=	1,073.98	+	(.64413)	(Annual volume — cwt.)

Appendix Table 11. Prices used to calculate cost of specified items for can and bulk systems, Mississippi, 1957.

Item	Unit	Price
Average price of cleaner	lb.	$ .24
Average price of liquid sanitizer	gal.	1.35
Average price of powder sanitizer	qt.	1.30
Average price of cans	ea.	10.00
Average price for retinning cans	ea.	4.00
Average price of brushes—can system	set	.80
Average price of brushes—bulk tank system	set	2.65

Appendix Table 12. Estimated sale value of coolers by size and age of can coolers, Macon, Mississippi Area, 1957.[1]

Age of cooler	Size of cooler						
	4	6	8	10	12	14	16
(Years)				(Dollars)			
		217	263	309	355		
1		201	247	293	339		
2		184	230	276	322		
3		168	214	260	306		
4		151	197	243	289		
5	89*	135	181	227	273	296*	319*
6		118	164	211	257		
7		102	148	194	240		
8		86	132	178	224		
9		69	115	161	207		
10		53	99	145	191		

[1]Estimating equation was: sale price = 79.133 + (23.013) (size) — (16.456)(age). Average of variables was: sale price, 195.69; size 8.69; age, 5.07.

*Estimates for these sizes at an average age of five years were extrapolated.