THE ROUTE SYSTEM OF CREAM GATHERING IN KANSAS

by

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TABLE OF CONTENTS

INTRODUCTION

One of the chief sources of the regular cash income for many farmers in the state of Kansas is their cream check.

Most of the butter manufactured in Kansas is made from sour cream. This cream is marketed principally through the cream stations of large centralizers or by shipping it direct to the central plant. As a consequence, the cream is held on the farms until it is possible for the farmers to break away from their regular farm work to take the cream to the station in town or the shipping point. Too, the majority of the farmers milk cows as a side line and either through lack of knowledge or carelessness do not particularly emphasize the proper methods and care for the production of first grade cream. Because dairying is a side line with a majority of the farmers, the milch cows do not receive the proper care and management for a large volume of production. These facts are indicative to the production of a large amount of high acid cream.

Although the greater majority of the cream is marketed through stations or by the direct shipper method, in a few localities of the state, the cream is marketed by the use of the route system. This latter method brings the market direct to the door of the farmers and allows the cream to

be collected at regular intervals and often enough to indicate great possibilities for reducing the amount of high acid cream.

Many of the farmers cooperative creameries in Kansas use the system of cream gathering, which enables the creamery to keep in direct contact with the patrons through the drivers, cuts down the shortage loss and allows the cream to be graded and tested under regular and favorable conditions. With the creameries in direct contact with the patrons, it is possible for them to stress the importance of producing first grade cream by the use of proper methods and practices

The expense curtailed for procuring cream by any of the methods in use has a direct influence on the cost of cream production. Naturally the least expensive method of gathering cream has the added advantage of lower costs.

A study was made of two of the farmers cooperative creameries in Kansas to obtain knowledge concerning the general dairy farm conditions existing in the localities with respect to the care and management of the herds and to what extent the proper methods and practices for the production of first grade cream are in use. A survey was also made of the route systems of the creameries to determine the effect, if any, the use of this system had upon the quality of the cream, and to obtain the data necessary to compute the cost figures of the operation of the trucks for com-

parison with other methods used in Kansas for the marketing of cream.

REVIEW OF LITERATURE

A review of the literature pertaining to cream procurement costs shows that very little work has been published on this subject. There are, however, numerous publications relating to the production and care of cream on the farm.

Many investigators, Gregory (2), Talstrup and Cushman (18), Manhart (11), McKellip (14), Hutton (6) and Lamaster and Cushman (8) have reported and advised practices to be used in the production of quality cream. Since these reports are essentially the same, only one general list of advised practices will be discussed in this study. Some of the essentials given by Martin and Caulfield (12) are: clean barns, clean cows and attendants, a milk house, clean and sterile utensils, a good separator, and a cooling tank. A list of the practices to be followed on dairy farms include:-

1. Have a clean, properly drained barnyard and barn.
2. Remove manure daily.
3. Clip cows flanks and udders and keep them clean.
4. Remove milk from barn immediately after milking each cow, or if allowed to stand until the milking is completed, keep can covered tightly.

5. Use a small top or covered milk pail.
6. Keep dirt out of milk or use a wire strainer.
7. Have a separate, clean, well ventilated room for skimming and handling milk.
8. Milk with clean dry hands.
9. Feed hay and dusty feeds after milking.
10. Feed silage after milking.
11. Take cows off of pastures which contain onions, garlic, or ragweed, four to six hours before milking.
12. Cool the warm cream before adding to cold cream already in the can.
13. Keep cans covered to eliminate flies and dust.
14. Protect cream from the sun, keep it in a cool place.
15. In summer separate cream containing 35 to 45 per cent butter fat.
16. In winter separate cream containing 30 to 40 per cent butter fat.
17. Keep gas fumes away from cream.
18. Sell cream often.
19. Use cream cans for cream only.
20. Use a stiff brush for washing utensils.
21. Sterilize all utensils with steam, boiling water or chemical disinfectants.

Another report by Hopper (3) states that the utensils

should be sound, free from rust and uneven surfaces which invite contamination, that the seams must be flushed or smoothed with solder, and that the doors and windows of the milk house must be screened. He also states that while the cream is in transit care should be exercised to have the cans covered to keep the contents cool, make rapid deliveries and keep all sources of contamination, either bacterial or dirt from gaining entrance into the cream.

Potts (16) says that proper care and handling of the cream, with sanitary methods of production, and the cream screw of the separator set to skim a rich cream, will make it possible to produce first grade cream.

Manhart (10) reports that clean, sanitary methods of production, proper cooling and frequent deliveries are three important factors in producing cream that will make good butter. His investigation deals principally with the effects of cooling and number of deliveries of the cream upon the score of the resulting butter. The results of his work show that butter made from clean cream, not cooled, and delivered at intervals of seven days will score about 86 points. A four day interval of delivery of the same cream will produce an 87 score butter. Clean cream which was cooled and delivered at intervals of seven days made it possible to make an 88 score butter, while a shortening of the delivery period to four days improved the score an ad-

ditional two points.

Hunziker, Mills and Switzer (4) state that proper cooling of the cream is essential if it is to arrive at the plant in good condition. In the absence of natural running springs and cold water wells, it is desirable to construct a cooling tank. They claim that the proper use of the cream cooling tank retards the souring, checks undesirable fermentations, eliminates the animal heat and protects it from contamination with dust, foul odors, flies and other impurities. The results of their investigation showed conclusively the advantages to be derived from a cooling tank in improving the quality of the resulting butter. By using a cooling tank there was a reduction of 35 per cent of all the bacteria, 35.8 per cent of all the acidifiers, 72 per cent of the liquefiers and 75 per cent of all the yeasts and molds present in the cream. Other tests carried on by three investigators, indicated that uncooled cream will contain in eleven and one-half hours 293 times as many bacteria as that cooled to 60° Fahrenheit. They also found that sediment tests of cooled cream showed a clean, nearly perfectly white disk and a relatively much darker one for the uncooled cream.

The effect of cooling the cream on the bacterial content of the resulting butter was also studied by these investigators. They found a decrease in the total bacterial count of 58.6 per cent, in the acidifiers 60.2 per cent, in

the liquefiers 81.9 per cent and in the yeasts and molds 87.4 per cent. They state that the effect of low bacterial count means higher scoring butter on the New York market: that the butter made from properly cooled cream had an average increase in score of two points and an average increase in price of one cent per pound.

Potts (16) carried on a similar investigation. His results are based on the acid content of the cream, which is in direct ratio to the number of bacteria present. He found that cream kept at 80°F. developed about .7 per cent lactic acid in the first 24 hours, while cream that was kept at 50°F. at the end of six months contained less than .6 per cent. He also found that if the fresh cream is not cooled immediately and kept separate from the already cooled cream, it will raise the temperature of all the cream with a resulting rapid increase in the acid content. Cream kept at 60°F. will contain .4 per cent lactic acid in 40 hours, while the same cream held at 50°F. would require 96 hours to develop nearly the same amount of acid. From the results of his work he has made a guide for the delivery of cream according to the temperature at which it has been held. For cream held at 80°F., deliveries should be made every day, cream held at 70°F., every other day, at 60°F. every third day, while cream held at 50°F. should be sweet if delivered twice a week.

The steaming of utensils used in milk production was found by Prucha, Weeter and Chambers (17) to influence the germ content of the milk. They found that through washing and steaming of the utensils, the milk was produced with 4,566 bacteria per cubic centimeter, where as by omitting the steaming the count was increased to 257,240 bacteria per cubic centimeter.

Jones (7) has found that where the quality of the cream has improved, the farmers have received from 2.5 cents to 5 cents more for their product. It has also been found by Manhart (10) that the average price of butter made from 4 day cooled cream was 2.99 cents higher than that made from 7 day cooled cream, 3.90 cents higher than that of 4 day cream not cooled, and 4.64 cents higher than that of 7 day cream not cooled.

The various methods of cream procurement as described by Hunziker (5) are: the direct delivery of cream to the creamery by the patrons, cream routes, cream stations and direct shippers.

The direct delivery method of buying butter fat is best adopted to a section where dairying is intensified, the cow population high, and where dairying is the principle farm business. This system keeps the creamery in constant contact with its individual patrons and makes possible a

better quality of cream through frequent deliveries. The greatest drawback to this system is its limited area, only those farmers close by bringing their cream to the plant.

The cream route system is adopted to nearly all localities where the density of the cow population warrants its use. Poor roads are also a limiting factor in the use of this system. The farmers may combine their interests to transport their cream to the processing plant by owning and operating a truck or by taking turns in hauling the cream themselves. In the case of creamery owned trucks, drivers may be hired on the commission basis, flat salary or on a combination of the two. The salary and commission basis offers the drivers some incentative to get new customers and to take better care of their trucks.

The route system extends the producing area of the local creamery. The trucks bring the market to the door of the patron so that even a small producer can patronize the creamery. It saves the farmer time and equipment necessary to haul his own cream and if efficiently operated reduces the cost of delivery. The chief disadvantage in this system lies in the fact that the creamery is no longer in direct contact with the patrons. However, competent drivers and careful work in sampling and grading done at the plant lessens the possibility of disagreements.

The cream station method of cream procurement is widely used by centralizers. The chief advantages of this system are the development of dairy sections as it is a market for the cream of the small producer and the direct contact existing between the patrons and the grader and tester. This system has several important disadvantages, however. It is universely used by large concerns attempting to obtain cream in outlying districts where the production is small and dairying is a side issue. Much of the cream is not graded. Competition arises between various companies which in some instances reaches cut-throat measures.

The direct shipper method greatly extends the producing area of the creamery to those communities where dairying may not be the chief agricultural occupation, or, where the condition of the roads do not warrant a creamery. By shipping direct to the creamery the cost of operating a station, is eliminated. The cream is weighed and tested under more favorable conditions for accurate work and it is possible for the creamery to send back clean sterile cans to its patrons. The elimination of the small producer, large turnover of patrons and absence of daily contact with patrons are the chief disadvantages of this system.

Potts (15) in a paper reviewing the various methods of cream procurement, reports that the patrons of many local

creameries in Minnesota have formed groups in which each patron takes turns in hauling his own and his neighbor's cream. Local cooperative creameries expect the farmers to deliver the cream to the creamery or to pay for the hauling cost.

Potts (15) also reports the cost of collecting butter fat under Wisconsin conditions as ranging from .5 cents to 4.6 cents per pound, with an average cost of 1.7 cents per pound. He found that a survey of the Wisconsin creameries showed that 20 per cent of them collected their cream by the cream route system. The average length of the route was 25 miles. It cost eight creameries, which gathered their cream by this method, 2.7 cents per pound to collect 952,449 pounds of butter fat.

Macklin and Schaars (9) working on the cream procurement cost of Wisconsin creameries, found that the hauling costs are not proportionately greater for large than for small creameries. For small volumes handled the cost of hauling was 1.46 cents and for the greater volumes the cost was 1.12 cents per pound of butter fat with an average cost of 1.31 cents per pound.

Thomsen and Reid (19) found that there was no relation between the volume of business and cost of procurement of butter fat in Missouri. They found that the average cost of procurement for 233 Missouri cream stations operated by

three centralizers ranged from 5. 7 to 6.4 cents per pound. The average cost was 6.2 cents per pound. These investigators also found that the difference in procurement costs between stations and direct shippers was 4.4 cents more than the usual premium paid to the direct shippers: and that the range of costs, both between creameries and the individual stations of each creamery was small.

PLAN OF STUDY

Location of Study

A study of the factors involved in collecting cream by the route system was made of the routes of two cooperative creameries, The Washington Cooperative Creamery Company at Linn, Kansas, and the Nemaha Cooperative Creamery Company at Sabetha, Kansas. At the same time data relative to the general dairy farm conditions were obtained from the patrons of the two creameries. Throughout this report these creameries will be listed as Creamery No. 1 and Creamery No. 2 respectively.

These creameries are located in Northeastern Kansas, where there has been considerable dairy development in the past few years. Creamery No. 1 has been in existance for over 10 years. In the past few years it has maintained an extensive development program. This organization is a strong sponsor for dairy herd improvement work and for cor-

rect cream handling practices. It has fostered the importation of dairy cattle from Wisconsin and the development of a Dairy Herd Improvement Association. To create interest for the production of quality cream, the association has issued phamphlets containing helpful suggestions for the proper care of the cream on the farm. There has also been a dairy specialist in the county for three years.

Creamery No. 2, however, has existed for only one and one-half years, but since its origin it has been a strong force behind any movement to increase interest in the betterment of the dairy farm conditions and proper care and handling of cream.

Time of Study

This survey was conducted during the summer of 1930, when the temperature ranged around 100°F. daily. This intense heat caused the volume of the cream secured to fall somewhat below normal and it materially increased the amount of second grade, high acid cream.

The Cream Route System

To obtain the information relative to the procurement costs, each cream route was traveled and the following information was secured: the time of starting in the mornings,

the time spent at a stop and between stops, the time of return to the plant, the mean, maximum and minimum temperatures and other information relative to the problem. Notes were also made on the general dairy farm conditions, where the cream was stored, the condition of the storage place and the care which the cream received.

The time spent at all stops throughout the route was checked with a watch and the milage was obtained from the speedometer on the trucks. The temperature readings were obtained with an ordinary thermometer.

The cream was graded and the temperatures taken, both on the farm and at the plant. This was to determine if the heat and time spent enroute to the plant had any effect, as noted by a change in grade, upon the quality of the cream. The pounds of cream and of butter fat collected on each route was obtained from the plant records, as was the information relative to the expenses alloted to the trucking department. A blank form was used to facilitate keeping the records of each trip, a copy of which is included in this report.

The General Farm Practices

In addition to securing data relative to the procurement costs, a questionnaire was sent out to each patron of the two creameries for the purpose of obtaining information

pertaining to dairy farm practices. The size of the farm, the amount of land owned and rented, the size, breed and number of dairy cows and heifers two years or older, whether a grade or purebred bull was owned, the amount of pasture and hay land, and information relative to the care and handling of the separators and cream was obtained. A copy of the questionnaire used is included in this report.

Of the 974 questionnaires sent out to patrons of Creamery No. 1, 508 or 62.42 per cent were returned. At Creamery No. 2, 299 were distributed and 180 or 60.2 per cent were returned.

Information Blank

1. Name _____ Date_____

   Township_____ 2. Address_____

3. How many acres do you own ____ or rent_____ acres in alfalfa_____ in sweet clover ____ in native grass ____

4. Number of milk cows on farm _____ Number of heifers 2 year or under_____

5. Breed of cows_____

6. Number of Grade cows and heifers _____

7. Number of Purebred cows and heifers _____ Do you own a bull _____?

8. What breed of bull do you use _____ Grade or purebred___

9. Do you wish to change breeds ___ if so which one do you prefer_____

10. Have you a silo ____ Kind _____ Capacity_____

11. Do you own a milking machine _____

12. Do you feed cows grain in summer_____

13. Do you feed the standard ration of 400 pounds ground corn, 200 pounds of ground oats or bran, and 100 pounds of cottonseed or linseed meal in winter at the rate of one pound of grain to 3 or 4 pounds of milk _____

14. Are you interested in having your herd tested for milk production _____

15. Kind of separator _____ Location _____ yrs in use

16. Times washed daily _____ Do you adjust to separate 40 per cent fat in summer and 35 per cent fat in winter____

17. Do you cool cream immediately after separation _____

18. Do you cool fresh cream before adding to previous skimmings _____

19. Do you have a cooling tank _____

20. If not, how do you care for the cream until called for

21. Would like to get forms from the creamery for constructing a cooling tank _____

22. Put a check mark after each of the following dairy practises which you follow: (a) Do you flush separator with cold water after separation__ (b) Do you wash with hot water and washing powder___ (c) Do you disinfect utensils

with steam, boiling water or chemicals___

Cream Route Information Blank

Route No._____Date_____Driver_____

Wt. of truck_____ H.P._____Capacity_____Make_____

Outside Temp. Max.____Min.____Mean_____ Lbs. Butter sold___

Time to get truck ready, Hrs.____Min.___Time of starting___

Speedometer at start_____ at finish_____Kind of road____

Condition_____

Gas Used_____Oil Used_____Time of arrival_____

Time to unload_____Time working in plant, Hrs.____Min._____

Patron No.	Speedometer Read.	Time of Arrival	Time of Departure	Lbs. Cream	Lbs. Fat	Doz. Eggs

Temperature of Cream		Grade of Cream		
On the Farm	At the Plant	On Farm	At the Plant	Where Stored

Results of Investigation

Limitation of Investigation. In discussing the results of this survey, it should be borne in mind that the figures are only representative of the patrons of the respective creameries and do not apply to the community as a whole. Since a dairy program has been carried on in these communities for a number of years, the data while representative of these districts may not apply to other communities where dairying is not so highly developed. Many of the practices, particularly those pertaining to dairy farm operation are very representative of farms in other localities.

Distribution and Size of Farms. In Kansas the dairy farms are much larger than they are in some of the highly intensified dairy districts. The cow population is also less dense in Kansas than in states like Minnesota and Wisconsin. This survey brings to light some interesting facts concerning the ownership of farms, the acreage of alfalfa, sweet clover and pasture, and the distribution of dairy cattle on these farms.

TABLE I

Distribution of Land Owned and Rented and Average Size of Dairy Farms

	Creamery No. 1	No. 2
Acres owned and rented	107,487	33,413

TABLE I - Continued

	Creamery No. 1	No. 2
Acres Owned	61,399	15,858
Acres Rented	46,088	17,555
Per cent of Land Owned	57.12	47.46
Per cent of Land rented	42.87	52.53
Average Acres per farm	211.5	185.6

The figures in Table I indicate that 57 per cent of the land farmed by patrons of creamery No. 1 is owned, while at creamery No. 2 the land owned amounts to 47 per cent. With such a big percentage of dairy farms rented it is only natural to find many of the farms poorly equipped for the production of high quality cream. This fact is emphasized further along in this report where figures are given relative to the number and per cent of cooling tanks, milking machines and other equipment used in the production and care of cream.

The success of dairying in any given community is dependent, somewhat, upon the type of farming practices. It is particularly important that a sufficient quantity of hay and forage crops are grown to have enough fresh roughage to feed the cows throughout the entire year. Figures showing the number of acres of the three chief hay and pasture crops alfalfa, sweet clover and native grass, grown on the farms studied were obtained and are given in Table II.

TABLE II

Per cent of Land in Alfalfa, Sweet Clover and Native Grass in two Kansas communities

	Creamery	
	No. 1	No. 2
Acres in Alfalfa	7,744	1,811
Acres in Sweet Clover	12,183	1,107
Acres in Native Grass	18,655	5,092
Per cent of total land in alfalfa	7.20	5.42
" " of " " in Sweet Clover	11.33	3.31
Per cent of total land in Native Grass	17.35	15.23

The percentage as given in Table II represents the percentage of all the land owned and rented that is used for these hay and pasture crops. They were obtained by dividing the acres of land used for each of the crops by the total acres of land owned and rented in the particular locality.

The order of importance of these crops from the standpoint of acres was found to be native grass, sweet clover and alfalfa. However, when these crops are compared for hay and pasture purposes it is evident that alfalfa is the chief hay crop, followed by sweet clover and the native grass. The last two crops mentioned are chiefly used for pasture purposes. This general order of importance is the same in both localities. But, when comparison is made of

the average in the two localities, there is a noticeably larger percentage existing for each crop in the vicinity of creamery No. 1, than for the same crops in the vicinity of creamery No. 2. This is due, no doubt, to the extensive better dairying campaign this creamery has put on in the last few years.

Distribution of Dairy and Non-Dairy Animals. Each dairy locality is characterized by one or more particular practises. In the localities studied a number of the patrons have herds made up of non-dairy breeds. These herds are composed largely of red cows, beef type animals or of a mixture of both dairy and beef type. Many of these patrons keep these non-dairy type cows for the purpose of raising calves for beef. The cows are kept on pasture and fed very little grain, milked during the spring and summer, producing according to their owners. butter fat at a low cost. From the standpoint of efficient production it is a well known fact that profitable production of butter fat is dependent upon the efficiency of the cows. A few high producers of the strictly dairy breeds are as a rule more profitable than a larger number of representatives of the non-dairy kind. The distribution of cows kept for milking purposes was obtained to determine the percentage of various breeds in the localities studied. Representative figures

of this distribution is found in Table III. This table also shows the per cent of the total of the cows and heifers of each breed and the per cent of all the purebred cows and heifers found as representative of each breed.

TABLE III

The Number and Per Cent of Cows and Heifers two Years old or Younger Present on the Farms in Two Kansas Communities

Breed	Number of			Total Number Cows and Heifer		Purebred Cows and Heifers	
	Herds	Cows	Heifers	Number	Per Cent	Number	Per Cent
Creamery No. 1							
Holstein	90	787	577	1364	22.4	300	44.77
Jersey	42	283	151	434	7.1	120	17.91
Guernsey	3	35	20	55	.9	4	.59
Br.Swiss	0	0	0	0		0	
Ayrshire	3	22	15	37	.6	19	2.84
Shorthorn	138	1015	632	1647	27.1	109	16.26
Hereford	14	90	49	139	2.2	20	2.98
Mixed	201	1393	855	2248	36.9	88	13.13
not Stated	17	100	57	157	2.5	10	1.49
Total	508	3725	2356	6081	99.7	670	99.90
Creamery No. 2							
Holstein	46	386	265	651	26.7	223	59.10
Jersey	19	151	88	239	9.8	90	23.80
Guernsey	2	10	8	18	.7	7	1.80
Br.Swiss	2	21	12	33	1.4	2	.50
Ayrshire	0	0	0	0		0	
Shorthorn	45	356	167	523	21.4	31	8.20
Hereford	0	0	0	0		0	
Mixed	60	605	312	917	37.7	0	0
Not Stated	6	43	11	54	2.2	24	6.30
Total	180	1572	863	2435	99.9	377	99.7

Some very interesting facts are illustrated by these figures. An examination of Table III shows that of the dairy herds represented, the Holstein breed with 90 and 46 herds in the locality of creameries No. 1 and 2, respectively,

is far in the majority. The Jersey breed is second with 42 and 19 herds in the respected communities. Of the remaining prominent dairy breeds, the Guernseys lead the Brown Swiss and the Ayrshire. This ranking holds true for all the cattle representing the dairy breeds and for the cattle representing only purebred stock.

A comparison of all the breeds of cattle found in these localities shows a vast majority of the non-dairy type. In the locality of creamery No. 1, 67.06 per cent of all the cows used for milking purposes are non-dairy animals and 63.83 per cent are used for this purpose in the vicinity of creamery No. 2. This vast majority of these non-dairy type animals shows that there is considerable room for a selective dairy breeding and improvement plan. However, when the figures relative to the purebred animals representing the various breeds are studied, a predominance of the purebred dairy cattle over the purebred beef breeds is found. In the area of creamery No. 1, 63.39 per cent, while at creamery No. 2, 85.41 per cent are purebred dairy cows and heifers.

Aside from the information relative to the distribution of the dairy and non-dairy breeds present in the two localities, the average herd was found to consist of 11.97 cows and heifers at creamery No. 1 and 13.52 at creamery No. 2. The average number of cows milked on each farm was found to be 7.31 at creamery No.1 and 8.73 at creamery No. 2. These

figures were obtained by dividing the total number of cows and calves present in the locality by the number of the patrons reporting. The ratio of calves to cows was found to be exceedingly high in both creamery localities. These figures though not included in this report were computed on the basis of each breed represented in the locality. They were obtained by dividing the number representing the cows of a particular breed by the number representing the calves of the same breed. The ratio in nearly every instance was approximately 1:2 or nearly twice as high as usually advised for being sufficient for herd replacement. These figures conclusively show that there is need for a culling program to weed out the undesirable calves which, no doubt, are consuming feed that could be more profitably fed to a fewer animals. It is an interesting figure as it shows the extent to which these farmers are raising calves and selling milk; a beef and dairy combination well known not to bring as great returns as a purely dairy production program.

One of the best and most economical means of insuring production is by the use of the purebred sires on grade cattle. Through this practise it is possible for a dairyman with a low average production in his herd to materially raise the average. Data relative to this may be cited from the work completed by McCandlish, Gillette and Kildee (13)

at Iowa State College, by which these investigators show from the results of a 10 year experiment that the first generation from the use of purebred sires on scrub cows means a percentage increase of 39 per cent in milk and 35 per cent in fat production. For the second generation there was an icrease in percentage of 130 per cent for milk and 109 per cent in fat.

Throughout the areas studied a relatively high percentage of purebred dairy sires were found to be in use, showing that the people have an interest towards efficient milk production. The statistical measure of the distribution of the dominating breeds as represented by their respective sires, both grade and purebred, in these localities, is given in Table IV, which also shows the per cent of the distribution of the purebred and grade animals.

TABLE IV

Distribution in Number and Per Cent of the Purebred and Grade Bulls in Two Kansas Communities

Creamery No. 1

Breed	Purebred & Grade Bulls		Purebred Bulls		Grade Bulls	
	No.	%	No.	%	No.	%
Holstein	105	20.6	66	36.6	39	11.89
Jersey	33	6.4	17	9.4	16	4.87
Guernsey	11	2.1	6	3.3	5	1.52
Brown Swiss	-	-	-	-	-	-
Ayrshire	4	.7	2	1.1	2	.60
Shorthorn	193	37.9	61	33.8	132	40.24
Hereford	67	12.9	26	14.4	41	12.50
Aberdeen Angus	3	.5	2	1.1	1	.30

TABLE IV - Continued

Breed	Purebred & Grade Bulls		Purebred Bulls		Grade Bulls	
	No.	%	No.	%	No.	%
Milking Shorthorn	1	.2	-	-	1	.30
Mixed Breeds	1	.2	-	-	1	.30
Not Stated	90	17.7	-	-	90	27.45
Total	508	99.2	180	99.7	328	99.95
Creamery No. 2						
Holstein	55	30.5	17	29.3	38	31.10
Jersey	17	9.4	9	15.5	8	6.50
Guernsey	2	1.1	2	3.4	-	-
Brown Swiss	2	1.1	2	3.4	-	-
Ayrshire	-	-	-	-	-	-
Shorthorn	77	42.7	24	41.3	53	43.40
Hereford	9	5.0	3	5.1	6	4.90
Aberdeen Angus	1	.5	1	1.7	-	-
Milk.Shorthorn	-	-	-	-	-	-
Mixed Breeds	-	-	-	-	-	-
Not Stated	17	9.4	-	-	17	13.90
Total	180	99.7	58	99.7	122	99.80

The figures presented in Table IV show an astounding high percentage of non-dairy breed bulls in the two localities. Leaving out the figures representing the Milking Shorthorn breed and the "not stated" group, the percentage of non-dairy animals in the locality of creamery No. 1 amounts to 51.96 per cent and at creamery No. 2, 48.33 per cent. The percentage of the dairy animals in these two areas are 30.11 per cent and 42.22 per cent. However, when only the figures representative of the purebred animals are studied, the percentage of dominance swings in favor of the

dairy breeds. At creamery No. 1, the percentage of the purebred dairy bulls is 50.54 as compared to a percentage of 49.44 representing the non-dairy type. At creamery No. 2, the percentages are 51.72 and 48.27 respectively. The total percentage of all purebred sires of all the sires in these two localities are 35.45 and 32.22 per cent. However, this percentage includes both the beef and dairy bulls and when computed for the dairy animals alone it was found to be 17.91 and 16.66 per cent for creamery No. 1 and creamery No. 2, respectively, or approximately only one half of all the purebred animals present in both localities. The majority of the purebred percentage is upheld by the dairy sires and shows that the people in these localities are interested in dairy herd improvement, yet the majority is quite small and is indicative of much room for greater expansion along this line.

Care and Management of the Herds. High producing cows cannot maintain their production level for any considerable length of time without proper feeding methods and handling practises. It is common knowledge among dairymen that the cow must have a definite amount of feed for maintenance and growth of the body, and in addition enough feed for milk production. A ration, therefore must insure the cow of obtaining both maintenance and milk production requirements.

An ideal ration is one that does afford a cow enough nutrients for these purposes and yet is financially low enough so all farmers are able to put it in use. These rations need not necessarily be the same as each locality throughout the entire country has only certain feeds available. The ration must be devised according to these conditions. A ration suited for the greatest number of the Kansas sections consists of feeding 4 parts corn, 2 parts ground oats or bran and one part cottonseed or linseed oil meal at the rate of one pound of the mixture to every 3 or 4 pounds of milk.

Not only is it necessary to insure the cow a proper feeding ration for efficiency in production, but it is also necessary that efficient methods of feeding, of care of the cows and time and labor saving devises are to be had as they allow the farmer to spend less and yet enough time with the herd and still give him more time for other farm work. It means a step towards efficiency of production for all farm work. Silos are important from the standpoint of insuring the cow succulant roughage throughout the year. Milking machines are one form of time and labor saving devises which though they require a large original investment are a great aid toward the efficient production of butter fat.

During the survey of these two Kansas communities, information relative to the number of farmers feeding the

standard ration, whether they fed grain to cows in the summer, if they owned a silo or milking machine, and if they were interested in having their herd tested, was obtained. The information is found in Table V, which shows the distribution of the number and per cent of the people reporting in answer to the questions. The information concerning the question of herd testing, was included in this table and not placed directly after the table relative to the herds in the locality as it follows the same form as the points just discussed. The figures themselves are self explanatory.

TABLE V

Some General Dairy Farm Practises in Use
in Two Kansas Communities

	Creamery No. 1					
	Number of Replies			Per cent of Replies		
	Yes	No	Not Stated	Yes	No	Not Stated
Feed grain in summer	117	348	43	23.0	68.5	8.5
Feed Std. Ration	64	352	92	12.5	69.3	18.2
Have a silo	141	336	31	27.7	66.1	6.2
Interested in Herd Testing	95	309	102	18.7	60.8	20.0
Own milking machine	16	455	37	3.14	89.56	7.28
	Creamery No. 2					
Feed grain in summer	65	100	15	36.2	55.5	8.3
Feed Std. Ration	26	121	33	14.9	67.2	18.3
Have a silo	30	135	15	16.6	75.0	8.3
Interested in Herd Testing	32	92	45	17.7	51.1	25.0
Own milking machine	5	166	8	2.77	92.22	4.44

An examination of Table No. 5 shows that tho 23 per cent of the patrons of creamery No 1 feed grain in the summer and 36.1 per cent at creamery No. 2, only 12.5 per cent and 14.4 per cent feed the standard advised ration. 27.7 per cent of the patrons at creamery No. 1 have a silo and 3.14 per cent own a milking machine as compared to only 16.6 per cent and 2.77 per cent for the patrons of creamery No. 2, showing that the older section where dairying has been strongly advocated for a number of years is in the lead with respect to the facilities used for efficiency of production, but slightly behind the younger community with respect to the feeding program.

Distribution and Cost of the Farm Separator. The manufacture of butter entails many various steps before the final product is ready for the market. One of the first processes that the raw product, milk, has to go through is the separating the butter fat from the bulk of the milk. This process may take place at one of two places, on the farm or at the creamery. When the milk is separated at the creamery, it means the hauling of a large bulk to the plant with a resultant high cartage expense. Whereas, when the milk is separated on the farm, the expense of delivery is less, due to the lesser volume handled and the skim milk remains on the farm where it can be used for feeding purposes. In Kansas the long distances from the creamery has

compelled the farmers to separate the cream at home.

To obtain proper separation of the butter fat from the skim milk, a highly efficient machine must be used. It must be set level upon a firm foundation and all parts in good working order. If the machine is an inferior make or if it is not set properly on a firm foundation, the bowl will vibrate, parts of the mechanism will cramp, freeze or become cracked, broken or bent with a resulting loss in the skimming efficiency of the machine. There are various types and makes of separators on the market. Some of them have proved to be more efficient than others. Many different makes are in use in Kansas. The various makes in use and the distribution of these makes, in the two localities studied, was determined and these figures recorded in Table VI. This table gives the distribution both in numbers and per cent, and also shows the average years and the longest and shortest years in use.

In this study there was no attempt made to determine how firm a foundation the machine had or if it was properly balanced. Observation was made of the various places in which the separator was placed. As is well known from the quality standpoint of the cream, it is best to have the machine placed in a cool place away from any source of contamination, either bacterial, dirt or undesirable odors or flavors. Numerous places were found in which the separators

were placed, some in shed, garages, cellars, caves, in the house, in the barn and various other places. The extent to which the various places were used for the location of the separator is fully shown in Table VII, which gives the location of the machines and the dominance of some places over others.

TABLE VI

The Types of Separators and Age of the Machines Found in Two Kansas Dairy Communities

Creamery No. 1

Make of Machine	Number in Use	Per Cent of Total	Years in Use		
			1-5	6-10	over 10
De Laval	174	34.44	105	47	22
McCormick-Deering	128	25.19	96	24	8
Anker Holt	46	9.05	32	9	5
Great Western	27	5.31	4	9	14
Economy	20	3.34	10	6	4
Melotte	19	3.74	15	3	1
Beatrice	13	2.55	4	5	4
Galloway	13	2.55	6	4	3
Sharpless	12	2.36	4	1	7
Sattley	5	.98	2	3	-
Water	5	.98	4	1	-
Royal Blue	4	.78	4	-	-
Iowa	2	.39	1	1	-
Renfrew	2	.39	-	1	1
Lilly	1	.19	-	-	1
Golden Harvest	1	.19	1	-	-
John Deere	1	.19	1	-	-
Jentenowine	1	.19	-	1	-
Empire	1	.19	-	1	-
Not Stated	32	6.29	10	7	15
Total	508	99.48			

Creamery No. 2

De Laval	64	35.55	27	21	16
McCormick-Deering	60	33.33	49	9	2
Melotte	18	10.00	13	2	3
Economy	9	5.00	9	-	-
Beatrice	8	4.44	5	2	1

TABLE VI - Continued

Creamery No. 2

Make of Machine	Number in Use	Per Cent of Total	Years in Use 1-5	6-10	over 10
Sharpless	4	2.22	2	1	1
Sattley	3	1.66	1	2	-
Galloway	3	1.66	2	1	-
Royal Blue	3	1.66	3	-	-
Iowa	3	1.66	3	-	-
Great Western	1	.55	1	-	-
Not Stated	4	2.22	1	2	1
Total	180	99.94			

TABLE VII

Various Locations used for Cream Separators in Two Kansas Dairy Communities

Location of Separator	Frequency of Occurrence: Creamery #1	Creamery #2	Per Cent of Occurrence: Creamery 1	Creamery 2
House	103	29	20.27	16.11
Milk House	93	42	18.30	23.33
Kitchen	58	13	11.41	7.22
Porch	54	15	10.63	8.33
Cellar	42	28	8.26	15.55
Wash House	25	22	4.92	12.22
Pantry	19	4	3.74	2.22
Shed	7		1.37	
Cow Barn	5		.98	
Milk Barn	3		.59	
Pump House	2	5	.39	2.77
Out House	1	13	.19	7.22
Yard	1		.19	
Not Stated	95	9	18.70	5.00
Total	508	180	99.97	99.97

A glance at Table VI shows a large number of various types and makes of separators in the two localities and of all the kinds present, the De Laval with 34.44 per cent in locality of creamery No. 1 and with 35.55 per cent in the

locality of creamery No. 2, is evidently the most popular make. The McCormick-Deering with 25.19 per cent at creamery No. 1 and 33.33 per cent at creamery No. 2 ranks second. Third place at creamery No. 1 is held by the Anker Holt make with 9.05 per cent, while the Mellote with 10.00 per cent holds this position at creamery No. 2. By popular choice, the De Laval and the McCormick-Deering makes of separators are the most widely used machine on the market.

The dominance of these makes in both localities proves beyond a doubt that the greater majority of the farmers in these localities are using the makes of machines that insure efficient separation of the fat from the remainder of the milk. It is of interest to note the many other makes of machines present in the localities and the types they represented. The usual disk-bowl type as represented by the De Laval, the spindle type bowl, the hanging disk-bowl and the split disk-bowl type of machine were found to be present as well as a few of the old time water dilution separators.

A very striking fact brought out by these figures is the age of many of the machines in the localities. The ages of all the machines vary from one to twenty-five years. Many of the machines in the localities are more than 10, 15 or even 20 years old.

The grouping of the separators into three groups according to the number of years in use (Table VI) shows a large

number of machines in the communities over the ten year mark. The question arose at once relative to the skimming efficiency of these older machines, as to what effect the age had upon the ability of the machine to separate the fat from the skim milk.

An attempt was made to determine the efficiency of the older machines and to compare them with the newer ones in the same locality by the use of the Babcock and Mojonnier tests for the determination of the per cent fat remaining in the skim milk. For various reasons, this phase of the work could not be completed, but future work is planned along this line. After the accumulation of the data and the knowledge that there existed a large number of old machines in the communities, the creameries took steps to have such plant facilities that is required for the testing of skim milk samples and will test the efficiency of any patron's separator if he so desires.

Although it was impossible at the time to make the tests relative to the efficiency of these machines it is possible to show a correlation between the ages of the machines in these localities to the ages and tests of machines of similar ages in another area. Skim milk tests of 1027 separators in an Iowa cow testing association as reported by Arnold (1) show that 12 per cent of all machines one year

old have a fat loss of .06 per cent, that 35 per cent of the five year old machines have a loss of .08 per cent and that 50 per cent of all the machines 15 years old have a loss of .11 per cent. It is evident from these figures that it is possible to expect a loss of fat in the skim milk when the older machines are used for this purpose.

Table No. VII indicates the great number of places in which the separators in these two localities may be located. No further attempt of condensing these locations to a few numbers was made so this table would emphasis the large number of places used for this purpose. It would be extremely difficult to determine an exact classification of these places as definitions to designate the places would vary considerably. If a classification of the most desirable places in which the separators were located, is attempted, the question arises as to just what to include. If the most desirable places were selected as the milk house, the cellar, the porch, the house, the pantry and the kitchen, the percentage of separators located in these places would amount to 72.63 per cent at creamery No. 1 and 72.77 per cent at creamery No. 2. Though this classification is an arbitrary one it does show that these farmers do have their machines located in fairly ideal places.

Care of the Separators on the Farm. The proper care of the separator is an important factor in the production of quality cream and consists of a proper adjustment of the cream screw for the correct percentage of fat and proper cleansing methods from the standpoint of sanitation. It is important that the cream screw be set to deliver cream which contains 35 to 40 per cent fat. A definite amount of water or skim milk should be used for flushing the separator bowl if a uniform per cent of fat is maintained in the cream.

As first grade cream is highly desirable for the production of butter, those factors directly related to the prevention of any contamination which in any way may impair the quality of the cream must be controlled at all times. Cleanliness of the parts of the separator is important for the control of bacteria, dirt and undesirable flavor contamination.

Various methods may be used for the cleaning of the parts of the machine. One method which is advised is to flush the separator with a definite amount of either water or skim milk directly after the last of the milk has been run through the machine, then take it apart and wash, first giving all the parts a rinse in cold water to release adhering milk from sticking, in boiling hot water containing some strong soap or preferably a disinfectant of some kind. A complete rinsing with clean scalding hot water is advised.

Steaming, whenever it is possible will dislodge and kill the majority of the bacteria and remove dirt present in the machine. If steaming is not to be had, setting the parts out in the sun away from dust as much as possible will aid in the destruction of bacteria. The presence of a chlorine disinfectant of the proper strength in the rinse water will take the place of steam to kill organisms. The use of chlorine must be followed with plain boiling water to remove all traces of the chlorine so as it will not give a disagreeable flavor to the milk or cream. It is important in the washing process to use a brush and make sure all the dirt is removed.

In Kansas the farmers are advised to adjust their separators (12) to 35 to 45 per cent fat in the summer and 30 to 40 per cent in the winter, as this per cent of fat in the cream has been found to be easier to handle as cream in the cans and for churning. Also, the initial acidity decreases and the development of acidity is materially retarded with an increase in the butter fat content of the cream. The farmers have been advised to wash their separator after each separation, using hot water which contains a good washing powder, followed by a disinfectant solution or steam.

The extent to which the patrons of the creameries studied during this survey, have followed these advised practises is shown in Table VIII.

TABLE VIII

Practises used in the Care of the Farm Separators in Two Kansas Dairy Communities

Creamery No. 1

Questions*	Number of Replies			Per Cent of Replies		
	Yes	No	Not Stated	Yes	No	Not Stated
Question No.1	267	157	84	52.55	30.90	16.53
Question No.2	468	12	28	92.11	2.36	5.51
Question No.3	471	10	27	92.71	1.96	5.31
Question No.4	Once	Twice		Once	Twice	
	334	140	33	65.74	17.55	6.49
Question No.5	Steam	Boiling Water		Steam	Boiling Water	
	2	441	65	.39	87.00	12.78

Creamery No.2

Question No.1	65	78	37	36.11	43.33	20.55
Question No.2	160	4	19	88.87	2.22	10.55
Question No.3	163	2	15	90.55	1.11	8.33
Question No.4	Once	Twice		Once	Twice	
	139	37	3	77.22	20.55	1.66
Question No.5	Steam	Boiling Water		Steam	Boiling Water	
	1	163	16	.55	90.54	8.88

* 1. Do you adjust to separate 40 per cent in summer and 35 per cent in winter?
2. Do you flush separator with cold water after separation?
3. Do you wash separator with hot water and washing powder?
4. How many times do you wash your separator daily?
5. Do you disinfect with steam, boiling water or chemicals?

The most striking fact shown by the figures in Table VIII, is that the greater majority of all the farmers replying to these questions do follow, in most instances, the

practises advised in respect to the cleaning of the separator and its parts and the proper adjustment of the cream screw. There are two exceptions to this general statement. In the locality of creamery No. 2, only a fair number of the farmers (36.11 per cent) adjust their separators; and in both communities the majority of the farmers wash their separators once instead of twice daily as advised. Right here, the author wished to state that one farmer in each locality, washed their separator (the machine and its parts) three times daily, which is .18 and .55 per cent in the respective localities. The close similarity between the percentages in both localities is very evident; and also that the older section around creamery No. 1 leads in the percentage in respect to the adjustment of the separators, the flushing of the machines, and the use of hot water and powder, but falls somewhat below the locality of creamery No. 2 in respect to the times washed and the use of steam for sterilization.

Cream Cooling. The cooling of the cream is of great importance for the production of quality cream. The cream just after separation is quite warm, usually about 90 degrees and if left standing in this condition for any length of time will develop acid, off-flavors and odors due to bacterial growth. Cream at a high temperature is more susceptible to the absorption of undesirable flavors and odors. To

offset any possibility of contamination the cream should be cooled immediately after separation to 60°F. or lower to retard the development of bacterial growth. The cream should be held at this temperature until it is called for by the cream trucks or until it is taken to the creamery.

In mixing batches of cream, it is best to have them both near the same temperature. If cream is added to previously cooled cream, it will raise the temperature of the mixture to a point favorable for bacterial growth, which results in poor flavored cream. As shown by Hunziker and his co-workers (4), the cooling of the cream immediately after separation and the keeping of the cream at low temperatures does prevent the development of the contained bacterial organisms or by-products of their action and indirectly prevents the contamination of off-flavors and dirt from outside sources as usually when care is taken to cool the cream, care is also taken to prevent outside contamination.

There are a variety of places and many methods of keeping the cream cool until time for its removal to the creamery. Wells, cellars, caves, or in running water, are some of the best places to keep it, provided that the place is cool enough and that the cream will not come in direct contact with any source of dirt or contaminating odors. One of the most efficient way to cool the cream and to keep it

cool is with the use of a cooling tank. The essential factors connected with a cooling tank are running water, a cover and low expense. There are many types and kinds that can be used for this purpose. They are described best by Hunziker and his co-workers (4) and by Martin and Caulfield (12).

Kansas dairy farmers do not have much choice as to where they are going to cool their cream. Many of them are renters and move from farm to farm. It is highly impossible that they will put in any special form of cooling tank on a farm belonging to someone else. They can, however, make the best of a difficult situation and take the best care possibly afforded by their facilities for the proper care and handling of the cream. Such factors as proper cooling immediately after separation and before mixing cold and warm cream keeping it away from all outside sources of contamination, and keeping the cream at as low a temperature as possible can all be done on every farm. The extent to which the farmers in these two Kansas communities cool their cream immediately after separation, and if they cool the new cream before adding to the old is shown by per cent and the number reporting in Table IX. The various places used for cooling the cream and keeping it until it is removed to the plant is shown in Table X. The average temperatures found

in this table have been computed from the temperature of the cream taken from these places. An example will illustrate. All the temperatures of the cream found in cellars (which were taken on the spot) were added together and the sum divided by the total frequency number. This procedure was carried out to obtain the average temperature in each storage place.

TABLE IX

The Extent to Which Proper Cooling Methods and Practices are Followed for the Care of Cream in Two Kansas Communities

Questions *	Number of Replies			Per Cent of Replies		
	Yes	No	Not Stated	Yes	No	Not Stated
Creamery No. 1						
Question No. 1	374	89	45	73.62	17.51	8.87
Question No. 2	450	40	18	88.58	7.87	3.54
Question No. 3	79	412	17	15.57	81.10	3.34
Creamery No. 2						
Question No. 1	137	30	12	76.11	16.66	6.66
Question No. 2	168	7	4	93.33	3.88	2.22
Question No. 3	29	144	7	13.11	80.00	3.88

*1. Do you cool cream immediately after separation?
2. Do you cool fresh cream before adding to previous skimmings?
3. Do you have a cooling tank?

TABLE X

Storage Places and Temperatures of Cream in Two Kansas Dairy Communities

Place	Number of Replies		Per Cent of Replies		Aver. Temperature (degree F.)	
	Creamery Number					
	1	2	1	2	1	2
Cellar	493	118	51.8	44.5	75.8	75.9
Cave	153	45	16.1	16.9	74.3	70.0
Cooler	143	18	15.0	6.8	72.7	68.7
House	90	35	9.3	13.2	78.4	73.1
Refrigerator	23	21	2.6	7.9	65.1	63.4
Well	19	8	1.9	3.0	69.2	67.7
Porch	13	4	1.3	1.5	78.6	72.8
Shed	9	9	0.9	3.4	76.0	81.0
Milk House	4	2	0.4	0.8	79.3	72.9
Shade	3	1	0.3	0.3	79.7	72.5
Store	1	0	0.1	0.0	81.0	-
Tub of water in yard		4	-	1.5	-	76.0
Total	951	265	99.7	99.8		

The fact that the majority of the farmers in the areas studied are highly interested in the proper dairy practises and methods is illustrated in Table IX. Here it is seen that 75.62 per cent of the farmers at creamery No. 1 and 76.11 per cent at creamery No. 2 cool their cream immediately after separation and that 88.58 and 95.33 per cent, respectively, cool fresh cream before adding it to the old cream. The per cent of coolers owned by the farmers, however, is not as great, it being 15.57 per cent at creamery No. 1 and 16.11 per cent at creamery No. 2.

Cream Storage on the Farms. This information (Table X) was collected at the time the routes were made and not with

the use of the questionnaires, consequently, there is a larger number of patrons represented than in the other tables. There are a large number of places in which the cream is kept for cooling purposes and for storage until time for transporting it to the creamery. Chief among these storage places at creamery No. 1 are the cellar, cave and cooler with 51.8 per cent, 16.1 per cent and 15.0 per cent, respectively. The order of predominance is somewhat changed in the district of creamery No. 2. Here they are cellar, cave, house, refrigerator and then cooler, with 44.5 per cent, 16.9 per cent, 13.2 per cent, 7.9 per cent and 6.8 per cent, respectively.

If this table were to be rearranged and placed on the basis of the lowest temperature of the storage place, the order of the first five at creamery No. 1 would consist of refrigerator with an average temperature of 65.1°F.; well with 69.2°F.; cooler with 72.7°F.; cave with 74.3°F. and cellar with 75.8°F. At creamery No. 2 there would be but a slight change in the order as compared with creamery No. 1. It would consist of refrigerator, well, cooler, cave and porch with average temperatures of 63.4°F., 67.6°F., 68.7°F., 70.0°F. and 72.8°F., respectively. It can be noticed that the temperatures of the cream found in the storage places at creamery No. 1 are in the most part, higher. This is

no doubt due to the difference in the time the survey was made of the two localities. The survey of the later being made later and after the spell of intense heat had broken and the rainy season had begun. The highest mean outside temperature experienced at creamery No. 2 was 84°F. as compared to 98.9°F. at creamery No. 1.

The word cellar is used in this table to designate those cellars connected directly with the house and were usually found underneath the house itself or the back porch. The word cave is used here to designate an outside cellar dug into the ground and found some distance from the house. The roofs of these caves were either above the level of the ground, even with the ground or below the level of the ground. In nearly every instance they were covered with dirt. One peculiarity observed relative to this phase of the work was the ability of the cream to resist absorbing dominating off-flavors from the surroundings in which it was kept. Many of the caves and cellars smelled of must and mold. In others, rotten potatoes and other vegetables were present, as was other sources of undesirable flavors. Yet, though much of the cream was kept in this abnoxious environment, the greater portion of it absorbed no undesirable flavors. This does not mean, however, that these practises should be encouraged as untidiness and uncleanliness in any place is not desirable.

A number of coolers of various kinds were found. Many of the farmers used a combination water-trough-cream cooler. Others had the standard cement cooler. A few used barrels for this purpose. It was found that when the water was pumped through the coolers a number of times in a day, the cream was relatively cool, but when this was not done the temperature of the cream raised accordingly and the purpose of the cooler was destroyed.

The refrigerators in every instance were electric or mechanical of some type. A few were home-made with some kind or another of insulating material used.

The wells used to hold the cream were either old abandoned ones or they were in actual use for a source of water. In all instances they extended deep into the earth. The can of cream was lowered by means of a rope to a depth sufficiently cold enough to keep the cream quite cool. In fact the cream kept in these wells and that kept in the refrigerators was the coldest of all. In general, however, none of the cream was as cold as advised for the best production of first grade cream, indicating much room for improvement towards bettering these conditions.

The cream in some instances was also kept in the house, or a shed in the yard. A room of the house, usually the kitchen or the pantry and the porch were the choice places of holding the cream when no other more desirable place was

to be had. Sheds, wood sheds, wash houses and storage sheds were used. When the cream was kept in the yard it was given as much shade as possible.

Care of the Cream on the Routes. The proper care of the cream in transit and frequent deliveries are also essential for the production of first grade cream. The time required to complete the route, the atmospheric temperature and general weather conditions and the conditions of the roads are factors that may affect a change in the grade of the cream from the time it is collected on the farms until it is delivered at the door of the creamery. The outside temperatures and condition of the roads are variable factors governed by the existing weather conditions and over which there is very little control. The time taken to complete the route is, somewhat, under the control of the driver for he can tarry or hurry through the route. The weather factor also has a great deal to do with the time to complete the route. The proper handling methods and care the cream receives on the trucks, however, is the most controlable factor of all. It is necessary to keep the cream cool and away from outside contamination of dirt, bacteria or undesirable flavors. Both creameries have taken these factors into account and are using fast trucks, on which special constructed bodies have been built for the purpose of keeping the dust and dirt out and for protecting the cream from

the direct rays of the sun. The trucks cover the routes as rapidly as the condition of the roads will permit and little time is spent at the farms in picking up the cream.

Frequency of Collection. From the standpoint of quality cream to safeguard against too long a period of time between deliveries of the cream to the plant, it is necessary to make collections often enough so it will not acquire an old flavor, or as the time between deliveries and collections lengthens, an acid or yeasty flavor.

It is also true that butter made from fresh cream, properly cooled will score higher and bring a higher price per pound on the New York market. Each creamery has one or more problems to work out in connection with cream gathering. There are all the previous factors to take into consideration and also the expense item. It is often necessary to decide which is to be the most profitable, to make frequent deliveries or collections at a greater expense and somewhat higher price for the resulting butter, or to make fewer collections at a lower initial expense and receive a lower price for the butter. It is often a choice between these extremes, yet a happy medium may be worked out by which the benefits of both systems may be realized and the defects lessened. Such is the case with most Kansas creameries who collect the cream for the plant by trucks owned and operated by themselves. This is especially true of the

two cooperative creameries studied, which collect the cream twice a week. The trucks are on the road every day except Sunday. As a result the cream collected the first half of the week is four days old, while that collected the last half is three days old.

Change in the Quality of the Cream Enroute from the Farm to the Plant. To determine the affect upon the quality of the cream by these variable factors, information was obtained relative to the effect caused by the temperature and the time required to cover the route. The temperature of the cream was taken at the farm and then at the plant to determine what effect the change in temperature had upon the quality of the cream as evidenced by a change in grade. The results of this study may be found in Tables XI and XII, XIII and XIV. (See following pages)

That there is an increase in the amount of second grade cream during transit from the farm to the plant, is evident from the figures presented in Table XII. There are but three exceptions, and these occur on routes number 20 and 22 at creamery No. 1 and route number 8 at creamery No. 2. This increase in second grade cream was in every instance due to an increase in the acidity content. To what this increase in second grade cream was due cannot be definitely attributed to one factor. There is, however, one factor, the existing temperatures, that no doubt has the greater

TABLE XI

The Lowest, Highest and Average Temperatures of Cream on the Farm and at the Plant and of the Atmosphere. The Condition of the Roads and the Time required to Complete the Cream Routes of Two Kansas Cooperative Creameries

Creamery No. 1

Route Number*	On Route Time (min)	Temperatures on Farm			Temperatures at Plant			Atmospheric Temperature			Condition of Roads**
		Lowest	Highest	Average	Lowest	Highest	Average	Lowest	Highest	Average	
1	371 min.	67	81	75.2	80	89	84.6	79	105	80.0	dt.gd.
2	396 "	58	84	72.0	74	85	78.2	74	96	85.0	dt. gd.
3	398 "	69	84	74.2	80	86	82.6	73	91	82.0	dt.Sn.Fr.
4	412 "	64	76	70.2	72	82	78.1	69	89	79.0	dt. gd.
5	384 "	58	84	72.7	73	85	75.5	72	98	87.0	dt.pr.R.
6	302 "	60	83	74.5	78	87	83.6	78	98	88.0	dt.Gd.
7	307 "	68	84	76.4	74	84	80.7	72	88	80.0	good
8	504 "	66	86	76.5	78	88	81.0	78	98	87.0	dt. gd.
9	287 "	64	80	71.6	70	86	81.1	78	90	88.0	dt. pr.
10	334 "	60	89	72.9	78	87	79.0	76	95	84.0	dt. gd.
11	324 "	74	84	74.5	76	92	81.7	78	96	87.0	dt. fr.
12	390 "	66	84	72.2	78	90	80.3	77	106	88.0	dt. gd.
13	433 "	60	79	73.3	74	83	81.4	71	74	73.0	dt. gd.
14	401 "	67	81	73.5	74	82	79.1	76	96	81.0	dt. gd.
15	536 "	64	74	69.7	77	84	79.1	64	96	80.0	dt. gd.
16	365 "	72	88	80.2	78	98	84.3	74	86	80.0	dt. pr.
17	264 "	64	82	73.5	74	82	76.4	80	100	90.0	dt. gd.
18	335 "	68	80	74.7	78	88	82.9	78	96	86.0	dt. gd.
19	442 "	64	94	68.2	69	76	71.2	69	82	75.0	dt. md.
20	310 "	67	74	70.9	70	75	73.4	68	86	75.0	dt.s.md.
21	354 "	71	85	78.0	80	92	86.6	78	103	90.0	dt. gd.
22	360 "	61	82	71.5	76	84	77.7	72	88	80.0	dt. gd.
23	395 "	68	76	70.1	72	78	74.9	68	80	74.0	dt. gd.
24	484 "	60	82	73.0	71	84	77.4	72	92	82.0	dt.s.md.
25	474 "	70	88	77.3	80	88	81.2	78	92	85.0	dt.fr.
26	370 "	68	86	76.4	76	86	80.6	70	86	78.0	dt.v.pr.
27	380 "	72	84	79.1	76	92	84.6	80	94	87.0	dt. gd.
28	405 "	68	85	78.3	78	88	84.1	81	104	89.3	dt. gd.
29	561 "	66	87	73.8	81	94	87.2	82	112	98.9	dt. gd.
30	351 "	68	80	76.0	74	78	75.7	73.	78	76.0	dt. gd.

TABLE XI - Continued

Creamery No. 2

Route Number*	On Route Time (min.)	Temperatures on Farm Lowest	Highest	Average	Temperatures at Plant Lowest	Highest	Average	Atmospheric Temperatures Lowest	Highest	Average	Condition of Roads**
1	364 min.	57	81	73	71	82	74	72	82	77	dt.md.
2	554 "	62	86	74	72	86	79	76	92	84	dt. md.
3	337 "	60	78	75	66	80	77	70	86	78	dt. gd.
4	236 "	56	76	72	65	79	74	68	83	75	dt. gd.
5	359 "	52	72	68	63	70	68	62	72	67	dt. fr.
6	606 "	65	81	71	68	86	75	69	83	76	Md. pr.
7	244 "	58	71	69	64	74	71	66	86	76	dt. fr.
8	337 "	61	76	74	73	77	76	70	84	77	dt. gd.

**Description of the condition of the roads:

dt.- dirt pr.- poor
fr.- fair sn.- sandy
gd.- good s.- slightly
md.- mud v.- very

*Proper names of the routes will be found in supplementary at the end of this article.

TABLE XII

The Pounds of First Grade and Second Grade Cream and Butter Fat on the Farms and at the Plant of Two Kansas Cooperative Creameries

Creamery No. 1

Route Number	Pounds of Cream: First Grade Farm	First Grade Plant	Second Grade Farm	Second Grade Plant	Pounds of Butter Fat: First Grade Farm	First Grade Plant	Second Grade Farm	Second Grade Plant	Total Pounds of Cream	Total Pounds of Butter Fat
1	265	214	20	71	98.83	77.23	8.80	30.40	285	107.63
2	329	315	56	70	122.27	115.87	13.76	20.16	385	136.03
3	614	614			217.11	217.11			614	217.11
4	691	651	27	67	251.15	233.78	13.23	30.63	718	264.41
5	1022	967	177	232	366.57	350.12	62.30	78.75	1199	428.87
6	498	449	183	232	281.27	161.75	61.03	80.55	681	242.30
7	821	739	154	236	274.11	266.18	67.69	75.62	975	341.80
8	1055	1031	56	80	367.53	358.00	19.19	28.72	1111	386.72
9	692	676	197	213	256.58	253.75	61.29	64.12	889	317.87
10	862	868	76	170	317.87	284.55	16.72	49.04	938	333.59

TABLE XII - Continued

Creamery No. 1

Route Number	Pounds of Cream: First Grade: Farm	Pounds of Cream: First Grade: Plant	Pounds of Cream: Second Grade: Farm	Pounds of Cream: Second Grade: Plant	Pounds of Butter Fat: First Grade: Farm	Pounds of Butter Fat: First Grade: Plant	Pounds of Butter Fat: Second Grade: Farm	Pounds of Butter Fat: Second Grade: Plant	Total Pounds of Cream	Total Pounds of Butter Fat
11	877	766	344	455	355.09	321.09	137.00	171.00	1221	492.09
12	797	731	168	234	275.00	252.70	50.10	72.40	965	325.10
13	640	640			262.02	262.02			640	262.02
14	502	483	15	34	174.12	167.28	3.45	10.29	517	177.57
15	1013	1013			375.80	375.80			1013	375.80
16	708	639	264	333	270.85	243.95	103.80	130.70	972	374.65
17	1108	1002		178	404.53	347.18		57.35	1180	404.53
18	553	505	62	110	198.77	181.40	25.82	43.19	615	222.59
19	1927	1921	22	28	266.00	264.50	7.40	8.90	1949	273.40
20	980	1045	125	60	339.98	363.06	44.57	21.49	1105	384.55
21	516	486	66	96	182.60	170.60	24.80	36.80	582	207.40
22	706	780	413	339	299.78	287.70	104.87	116.95	1119	404.65
23	747	686	15	76	253.37	232.63	4.35	25.09	762	257.72
24	1520	1493	7	34	516.55	505.21	2.38	13.72	1527	518.93
25	658	586	22	94	244.25	218.09	10.24	36.40	680	254.49
26	894	842	124	176	317.25	292.35	38.19	63.09	1018	355.44
27	1028	983	26	71	365.06	353.36	6.24	17.94	1054	371.30
28	678	555	111	234	263.90	214.80	47.30	96.40	789	311.20
29	1041	1057	65	149	384.11	357.72	25.58	51.97	1106	409.69
30	843	796		47	290.90	270.01		20.89	843	290.90
Total	24660	23336	2795	4119	8,493.25	7,999.79	960.10	1,452.56	27455	9,452.35

Creamery No. 2

1	998	948	31	81	324.98	337.78	24.12	11.32	1029	349.10
2	1269	1238	33	64	436.26	423.98	11.80	24.08	1302	448.06
3	1988	1896	63	255	649.39	585.75	20.16	83.80	2051	669.55
4	1178	1095	67	150	389.85	360.02	26.37	56.18	1245	416.22
5	927	903		24	309.03	301.03		8.00	927	309.03
6	1234	1230	98	102	448.51	439.91	32.35	31.95	1332	470.86
7	990	827	13	176	371.51	313.36	4.55	62.70	1003	376.06
8	1286	1288	83	81	469.66	457.00	16.19	28.85	1369	485.85
Total	9850	9305	388	933	3,399.19	3,218.83	125.64	305.88	10238	3,524.73

TABLE XIII

Pounds Increase of Second Grade Cream for each route of Two Kansas Cooperative Creameries and the highest temperatures and Average Tempertures per each route

Route Number	Increase in Second Grade Cream	Atmospheric Temperatures Highest	Average
	Creamery No. 1		
1	51 pounds	105°F.	80°F.
2	14 "	96	85
3			82
4	40 "	89	79
5	55 "	98	87
6	49 "	98	87
7	82 "	88	80
8	24 "	98	87
9	16 "	90	88
10	94 "	95	84
11	111 "	96	87
12	66 "	106	88
13		74	73
14	19 "	96	81
15		96	80
16	69 "	86	80
17	178 "	100	90
18	48 "	96	86
19	6 "	82	75
20	*-65 "	86	75
21	30 "	103	90
22	*-74 "	88	80
23	61 "	80	74
24	27 "	92	82
25	72 "	92	85
26	52 "	86	78
27	45 "	94	87
28	123 "	104	89
29	84 "	112	98
30	47 "	78	76
	Creamery No. 2		
1	50 "	82	77
2	31 "	92	84
3	192 "	86	78
4	83 "	83	75
5	24 "	72	67
6	4 "	83	76

TABLE XIII - Continued

Creamery No. 2

Route Number	Increase in Second Grade Cream	Atmospheric Temperatures Highest	Average
7	163 pounds	86	76
8	*- 2 "	84	77

* Decrease in second grade cream.

TABLE XIV

Per Cent Increase of Second Grade Cream at Two Kansas Cooperative Creameries and Lowest, and Total Average of the Average Atmospheric Temperatures

	Creamery No.1	Creamery No. 2
Per Cent of Second Grade Cream		
a. On Farm	10.18	3.79
b. At Plant	15.00	9.13
c. Increase	4.82	5.32
Average Atmospheric Temp.		
a. Lowest	73°F.	75°F.
b. Highest	98	84
c. Average	83.1	76.3

influence.

It is soon evident by a few trials and by reasoning, that the time spent on the trip, has no consistent relation or direct correlation with an increase in the second grade cream. There are too many other factors such as the length of the route and the condition of the road that affect the time spent for completion of each route. Bad weather, mud, rain, poor roads and a long route increases the possibilities

of the grade of cream being affected. Yet, it is in very few instances that extremely hot weather occurs at exactly the same time that rain is falling. The real danger arising from these conditions is just after a storm, when the next day is hot and sultry and the roads are muddy and badly torn up with ruts, making it hard for the route to be taken in the usual time. The effects of this combination may be found in a few places in Table XIII as for example routes 5, 11, 16 and 25 at creamery No. 1. These conditions of poor roads is correlated with relative high atmospheric temperatures. This is not to be found so much in evidence when the atmospheric temperatures are relatively low as in routes 3, 9 and 19. The effect of a combination of conditions of high atmospheric temperatures and good roads are in evidence more often and show an increase in the number of pounds of second grade cream in nearly each instance. This is presumably enough evidence for proof that the high existing atmospheric temperatures were the chief cause for the increase in the amount of second grade cream occurring while the cream was being transported from the farm to the plant. This correlation between high atmospheric temperatures and an increased number of pounds of second grade creams exists throughout the figures in Tables XI, XII, XIII and XIV more consistently than any other "grade affecting" combination.

To illustrate the fact in a somewhat more comprehensive way, the increase in second grade cream and the highest and average atmospheric temperature, have been retabulated in Table XIII where a direct comparison may easily be made. It might be noted here that there is a greater increase in the amount of second grade cream where both the highest atmospheric temperature recorded for the day the trip was made and the average atmospheric temperature for the same day are close together. The closeness of these two figures is evidence of an extremely hot day for a long period of time than one with a low average temperature and the very highest temperature during the day.

The actual increase in the amount of second grade cream varied from 6 to 178 pounds at creamery No. 1 and from 4 to 193 pounds at creamery No. 2. The total percentage increase (Table XIV) of all the routes at creamery No. 1 was 4.82 per cent, while at creamery No. 2 it was 5.32 per cent. The total amount at the plants was 15 per cent and 9.13 per cent respectively for creameries No. 1 and 2. The greater percentage of second grade cream at plant No. 1 (approximately 5.87 per cent) was due, no doubt, to the extremely hot weather existing at time of the survey, which fact is brought out by Tables XI and XIII. As shown by these tables the average atmospheric temperatures at the time the survey was

made at creamery No. 1 are higher in every instance than those at the time of the survey of creamery No. 2. The lowest average atmospheric temperature at creamery No. 1 was 73 degrees F. and the highest 98 degrees F., while at creamery No. 2 these temperatures were 75 and 84 degrees F.

Factors Affecting Cream Procurement Costs. There are numerous factors, both direct and indirect that have a bearing on determing the cost of procuring a pound of butter fat by the trucking system. The direct factors may be listed as the initial cost of the trucks, depreciation, interest, tires, garage rent, license, gas, oil, stationery and other expenses such as the office supplies used in relation to the trucking system. The indirect factors may be cited as the general locality, the cow population, volume of cream, the distance traveled, the condition of the roads and the usual prevailing weather conditions.

The volume of the cream collected is a deciding factor upon the cost of procurement. With a small volume it would not pay to cover a particular locality. The general character of the roads influence the cost of procurement in that they affect the time it takes to cover the route, the wear and tear on the truck and the amount of gas and oil used. The general prevailing weather conditions have a great deal to do with the lowering or raising of the procurement cost.

The volume of cream and butter fat handled during the survey are found in Table XII which lists the pounds of butter fat collected per route and the total pounds collected over all the routes. The condition of the road at the time the route was made is also found in Table XI. The roads in the two communities are for the most part graded dirt roads. During dry weather they are firmly packed and afford rapid traveling, but when it rains they begin to gum up and become a sticky compact mud which considerably hampers the movement of the trucks.

To determine the actual cost of a pound of butter fat by this system, both the direct and indirect factors must be taken into account. The total distance of each route, the time spent to cover the route and the time spent at the stops and between stops are given in Tables XV and XVI. (See following pages)

To facilitate a clearer understanding of the data presented in Tables XV and XVI, the data has been recalculated to total averages for all the routes of each creamery and are presented in Table XVII.

TABLE XV

The Total, Average, Longest and shortest Time Spent on the Routes, between Stops and at the Stops and the Time Spent in Collecting Eggs by the Trucking System of Two Kansas Cooperative Creameries

Creamery No. 1

Route Number	Number of Stops	Total Time Spent: At all Stops	Total Time Spent: Between Stops	Total Time Spent: To complete Route	Shortest Time: At a Stop	Shortest Time: Between Stops	Longest Time: At a Stop	Longest Time: Between Stops	Average Time: At a Stop	Average Time: Between Stops	Time to Pick up eggs: Total	Time to Pick up eggs: Average
1	28	158	232	371	1	1	12	28	3.95	5.65	89	2.28
2	39	132	304	396	1	2	9	40	4.71	10.48	37	1.32
3	32	137	261	398	1	1	9	45	4.28	7.81	48	1.50
4	37	142	270	412	1	1	9	70	3.83	7.10	32	.86
5	46	195	189	384	1	1	9	57	4.23	4.02	108	2.34
6	38	112	190	302	1	1	8	38	2.94	4.87	36	.94
7	37	140	167	307	1	1	8	27	3.78	4.39	55	1.48
8	46	270	234	504	2	1	14	53	5.86	4.97	109	2.36
9	31	145	142	287	1	1	10	13	4.67	4.45	50	1.61
10	29	141	193	334	1	1	26	54	4.65	6.43	14	.49
11	37	176	148	324	2	1	15	11	4.75	3.89	67	1.81
12	43	190	200	390	1	1	11	26	4.41	4.54	48	1.11
13	30	125	308	433	1	1	11	55	4.03	9.62	9	.30
14	28	108	293	401	1	1	11	55	3.85	10.10	30	1.07
15	39	147	389	536	1	1	9	56	3.76	9.72	22	.56
16	41	148	217	365	1	1	9	28	3.43	5.16	57	1.39
17	34	146	118	264	2	1	8	8	4.29	3.37	61	1.79
18	36	147	188	335	1	1	7	31	4.20	5.22	53	1.51
19	46	187	255	442	1	1	17	27	4.06	5.42	64	1.39
20	39	149	161	310	1	1	7	13	3.56	4.02	41	1.05
21	40	160	194	354	1	1	14	34	4.00	4.73	53	1.32
22	39	183	177	360	1	1	18	32	4.69	4.42	55	1.41
23	41	195	200	395	2	1	18	25	4.75	4.76	98	2.39
24	50	174	310	484	1	1	12	49	3.48	6.07	19	.38
25	39	178	296	474	2	1	9	55	4.56	7.40	92	2.35
26	40	153	217	370	2	1	15	14	3.82	5.42	36	.90
27	43	172	208	380	2	1	8	10	4.00	4.72	54	1.25
28	37	196	209	405	1	1	13	25	5.44	5.37	62	1.72
29	52	258	303	561	1	1	11	26	4.96	5.71	75	1.44
30	38	191	160	351	1	1	10	20	5.02	4.10	96	2.52
Creamery No. 2												
1	31	157	207	364	1	1	15	19	4.40	5.90		
2	45	183	371	554	1	1	21	25	4.06	8.24		
3	42	154	183	337	1	1	16	9	3.75	4.35		
4	33	86	150	236	1	1	5	13	2.86	5.00		
5	33	222	137	359	1	1	25	10	3.35	4.00		
6	50	240	366	606	1	1	26	32	3.95	6.04		
7	34	100	144	244	2	1	6	9	3.00	4.56		
8	38	129	208	337	1	1	11	26	3.39	5.47		

TABLE XVI

The Total Distances Traveled, the Average Distance per Stop and the Longest and Shortest Distance Traveled Between Stops on the Routes of Two Kansas Cooperative Creameries

Creamery No. 1

Route Number	Total Distance miles	Distance Traveled per Stop: Average per Stop (miles)	Shortest (miles)	Longest (miles)
1	83.4	2.03	.2	14.2
2	81.6	5.04	.2	50.0
3	72.1	2.15	.1	15.5
4	102.1	2.69	.1	27.3
5	63.1	1.34	.1	14.9
6	68.1	1.74	.1	17.0
7	40.3	1.06	.1	9.0
8	44.4	.94	.1	6.0
9	29.4	.91	.1	3.4
10	64.1	2.14	.1	14.7
11	42.5	1.11	.2	4.1
12	62.7	1.42	.2	10.5
13	93.3	2.91	.1	22.5
14	82.1	2.83	.2	22.7
15	108.8	2.62	.2	22.4
16	45.7	1.88	.2	8.2
17	29.3	.83	.2	2.0
18	48.3	1.30	.1	11.3
19	60.4	1.28	.1	10.9
20	42.6	1.65	.1	3.8
21	57.1	1.39	.1	13.3
22	54.0	1.35	.1	12.5
23	49.3	1.17	.1	6.8
24	75.0	1.47	.1	11.6
25	73.1	1.82	.1	19.0
26	42.3	1.05	.2	33.0
27	40.5	.92	.1	21.0
28	59.8	1.61	.1	9.0
29	71.9	1.35	.2	9.8
30	39.9	1.02	.1	6.2

TABLE XVI - Continued

Creamery No. 2

Route Number	Total Distance (Miles)	Distance Traveled per Stop: Average per Stop (miles)	Shortest (miles)	Longest (miles)
1	41.2	1.18	.1	5.9
2	51.1	1.13	.1	3.8
3	50.1	1.19	.2	5.2
4	45.5	1.51	.1	5.8
5	29.2	.86	.1	2.1
6	61.8	1.11	.1	9.6
7	33.7	1.02	.2	2.5
8	59.1	1.52	.1	11.9

TABLE XVII

The Total Average of all the Distances Traveled; of all the Time Spent; of all the cream and Fat Collected on All the Routes of Two Kansas Cooperative Creameries

	Creameries Number 1	2
Average Length of Distance	60.90 mi.	46.46 mi.
Shortest Distance Traveled	.14 "	1.25 "
Longest Distance Traveled	6.68 "	5.85 "
Average Distance per Stop	1.36 "	1.19 "
Time Between Stops	252.5 min	220.75 min.
Shortest Time Between Stops	1.0 "	1.0 "
Longest Time Between Stops	20.40 "	17.88 "
Average Time Between Stops	6.19 "	5.42 "
Time at Stops	181.5 "	158.88 "
Shortest Time At Stops	1.14 "	1.13 "
Longest Time at Stops	17.85 "	15.63 "
Average Time at Stops	4.11 "	3.10 "
Time to Complete Route	433.8 "	379.63 "
Pounds of Cream	1465.42 lb	1279.75 lb.
Smallest Amount of Cream per Stop	8.85 "	7.75 "
Largest Amount of Cream per Stop	106.14 "	92.88 "
Average Amount of Cream per Stop	39.67 "	34.71 "
Pounds of Butter Fat	503.53 "	440.59 "

TABLE XVII - Continued

	Creameries Number 1	2
Smallest Amount of Butter Fat per Stop:	2.07 lbs:	1.81 lbs
Largest Amount of Butter Fat per Stop :	35.82 " :	31.35 "
Average Amount of Butter Fat per Stop :	13.84 " :	12.11 "

An examination of Tables XV, XVI and XVII, shows that the total time spent on the routes ranged from 264 minutes to 561 minutes and that the distance traveled for each route varied from 29.3 miles to 108.8 miles. The shortest time given is listed for the shortest route, No. 17, although another route, No. 9, is very nearly as short but requires 287 minutes for its completion. The total time necessary to complete each route is very closely connected with the distances of the routes. There is in most instances so great a difference in the distances of these routes that even in bad weather this correlative of time to complete route and length of route still exists.

The shortest time spent at a stop as shown by these tables is but one minute in nearly every instance at both creameries. This holds true for the time between stops. However, when the longest time between stops is considered it was found that there were more longer distances between some of the stops at creamery No. 1 than at creamery No. 2.

The longest time spent at a stop is similar for both creameries.

It will be noticed that at creamery No. 1, eggs are collected on the routes. This, of course, takes up the drivers time and increases to some extent the time required to complete the route. Figures not included in the tables but which have been computed show that the time to pick up the eggs vary according to the number to be handled and to some extent the kind of containers. It was found that the time varied from one or two minutes to sometimes as high as 7 to 11 minutes for the eggs alone. Sometimes a small batch of eggs would cause more trouble and take up more time for handling than would a whole crate or half crate. In the latter instances all that was necessary was to switch crates, while in the former, it was necessary to pack the eggs from a bucket or other such container into the crates.

The average time found listed for the picking up of the eggs was computed on the number of stops for both cream and eggs on the route and is not for the number of egg stops alone. The time averages at a stop and between stops on the route was also computed on this basis and not of the cream routes alone. At creamery No. 2 there were no egg collections and these averages are on the basis of the number of cream stops alone. The number of stops given in tables are cream stops alone.

An examination of Table XVII brings out a more concrete knowledge of the situation at the two plants and affords an excellent comparison of them. Here the averages of all the data of all the routes of both plants are found. It is shown that the average route distance at creamery No. 1 is 60.9 miles while at creamery No. 2 it is 46.46 miles. The average shortest distance traveled at creamery No. 1 was .14 miles while at creamery No. 2 it was 1.25 miles. The longest distances were 6.68 miles and 5.85 miles respectively. The average distance per stop was found to be for all routes, 1.36 miles at creamery No. 1 and 1.19 miles at creamery No. 2. The average time at all stops was found to be 4.11 minutes and 3.10 minutes respectively for the two plants, while between stops, it was 6.19 minutes and 5.42 minutes. The The average volume figures show an average of 39.67 pounds of cream per stop at creamery No. 1 and 34.71 pounds at creamery No. 2, with butter fat averages of 13.84 pounds and 12.11 pounds per stop.

Cream Procurement Cost Figures. To aid in determining the cost of procuring a pound of butter fat by the trucking system, the expense figures for operation of the trucks were obtained from the two creameries. They are listed in Table XVIII. These expense items were computed on a one truck basis, based upon the number of working days. The number of

working days at creamery No. 1 was 313, with the consideration that there are 52 Sundays in a year. At creamery No. 2, which had been in existance but nine and one half months, the working days were figured at 252 days.

TABLE XVIII

The Expense of Operating each Truck per Route and all the Trucks per day and for one Year on the Routes of Two Kansas Cooperative Creameries

	Operating Costs per Truck		Operating Costs All Trucks		Operating Costs for one year	
	Creamery Number					
	1	2	1	2	1	2 *
Oil - Gas	$1.080		$10.76		$3368.68	
Repairs	1.490		14.90		4614.12	
Salaries	4.780	$3.011	47.85	$9.033	14979.80	$2280.00
Rent	0.038		0.38		120.00	
Fire Ins.	0.033		0.33		104.25	
Liability Insurance	0.130		1.30		425.00	
License	0.054		0.54		170.00	
In't on Investment	0.255	0.359	2.55	1.079	800.00	272.10
Depreciat'n	0.298	1.486	2.98	4.459	935.00	1133.75
Frt.,Dray.	0.236		2.358		738.28	
Telephone, Telegraph	0.044		0.439		137.50	
Stationery Postage	0.045		0.453		142.06	
Advertising	0.0205		0.205		64.20	
Miscell.	0.058		0.58		183.96	
All Others		2.027		6.081		1532.61
Total	8.746	6.883	85.670	20.652	26782.85	5218.46

The expense found for each truck for each route was used as a standard for computing the expense of operating all the trucks. At creamery No. 1 there are twelve trucks, ten of which are in the field each day, while at creamery No. 2

there are but three trucks and which are in use each day. The initial cost of the trucks was $1090.00 and $1,511.66 per truck respectively for the two creameries.

The actual cost of operating these trucks per pound of fat, per stop, per mile and per minute was obtained by dividing the average pound of fat found for all the trucks into the total expense of operating one truck for one trip. The costs of operation as found are listed in Table XIX and show that at creamery No. 1 the cost of operation per pound of fat was 1.75 cents, the cost per stop was 22.71 cents, the cost per mile was 14.36 cents and the cost per minute was 2.01 cents. The respective costs at creamery No. 2 were 1.56 cents per pound of fat, 20.85 cents per stop, 14.81 cents per mile, and 1.83 cents per minute.

TABLE XIX

The Operating Expenses of the Trucking Systems of Two Kansas Cooperative Creameries including Egg Expense at Creamery No.2.

Creamery Number	Truck Operating Expense			
	Per Pound Fat	Per Stop	Per Mile	Per Minute
1	1.75¢	22.71¢	14.36¢	2.01¢
2	1.56¢	20.85¢	14.81¢	1.83¢
Averages	1.655¢	21.78¢	14.585¢	1.92¢

TABLE XX

The Operating Expenses of The Trucking Systems of Two Kansas Cooperative Creameries Computed from the Cream Expenses Alone

Creamery Number	Truck Operating Expenses			
	Per Pound Fat	Per Stop	Per Mile	Per Minute
1	1.07¢	15.02¢	8.80¢	1.23¢
2	1.56¢	20.85¢	14.81¢	1.83¢
Averages:	1.315¢	17.935¢	11.805¢	1.53¢

The figures in Table XIX have been computed from all the expense accounts, which at creamery No. 1 includes the cost of collecting eggs, while at creamery No. 2 they are for cream cost operation alone. The figures as stated(Table XIX) show a lower cost of operation at Creamery No. 2. However, when the cost of operation is computed on the butter fat-cost basis alone it was found that creamery No. 1 has the advantage of lower costs (Table XX). These second cost figures from creamery No. 1 were computed by eliminating the per cent of the cost of collecting the eggs from the total cost of operation. The trucking system at creamery No. 1 receives 23.1 cents per stop from the creamery for collecting the butter fat and 21 cents per stop from the packing company for whom the eggs are collected. The total amount received for these purposes was $16,614.18 from the creamery and was $10,495.76 from the packing company or a total of $27,109.94.

The amount received from the packing company was 38.71 per cent of the total. Now when this amount, 38.71 per cent, is eliminated from the expense of operation per pound of fat, per stop, per mile, and per minute, the actual cost of operation for these items were found to be 1.07 cents per pound of fat, 15.02 cents per stop, 8.80 cents per mile and 1.23 cents per minute.

The actual average cost of collecting a pound of butter fat by the trucking system was 1.315 per pound, the cost per stop was 17.935 cents, the cost per mile 11.805 cents, and the cost per minute 1.53 cents.

These figures (Table XIX) have been computed for the routes at the time the survey was made and do not indicate the affect of the weather, the condition of the roads, the season of the year, and the volume of production upon the cost of procuring butter fat. The survey was made at a time when perhaps the optimum condition for road travel was present in both localities. While the weather and road conditions were very favorable, the volume of production had fallen off to a considerable extent. Both of these factors have considerable bearing on procurement costs. There is a possibility that to a certain extent the advantages of one have been offset by the disadvantages of the other.

To obtain some idea as to this above mentioned possibility and to determine the variation between the fall season

and yearly cream procurement costs the cost of collection of butter for the year per pound, was determined. To determine the cost of collecting a pound of butter fat on the yearly basis, the total expenses for the year was divided by the total pounds of butter fat. These totals were obtained from books of the creameries. The total expenses are found in Table No.XVIII. The total pounds of fat for the year purchased at creamery No. 1 was 960,517 pounds, while at creamery No. 2, it was 263,409 pounds for the year(9½ months)

The results of this data show the yearly cost at creamery No. 1 to be 2.788 cents per pound when the expense of collecting eggs is included and to be 1.708 cents per pound when the expense of collecting cream alone is considered. At creamery No. 2 the cost of collecting a pound of butter fat on the yearly basis amounted to 1.981 cents per pound, showing a higher yearly cost than creamery No. 1.

These figures show a difference between the fall season and yearly collection costs for procuring cream and show that the cost was lower during the time of the survey. They also indicate that though during the winter and spring seasons, the production is high which should point toward lower costs, the conditions of the roads and general weather conditions have strong influence on the procurement cost and tends to increase them. The situation is the reverse in the summer months with the advantages of good roads having a

stronger influence towards decreasing procurement costs than does the disadvantage of lower production tend to increase the cost..

Kansas Cream Procurement Costs as Compared to Other Localities. The expense of cream procurement varies with the method used. At the Missouri station (19), it was found that the cost of procuring a pound of butter fat with the use of the direct shipper system, varied from 1.10 cents to 4.25 cents per pound with an average cost of 2.21 cents per pound. They also found that the cost of collecting per pound by the station method varied from 6.02 cents to 9.4 cents per pound with an average of 6.58 cents per pound. These average figures show a decrease of 4.37 cents in cost per pound in favor of the direct shipper method. The figures found by the investigators doing the work on Missouri cream procurement costs, are listed in Table XXI and will serve for a comparison with the results found in connection with this survey.

TABLE XXI

Cost of Procurement of Cream Obtained from Stations and Direct Shippers in Missouri by Months, in cents, and per Pound*

Months	Cream Costs in Cents per lb.		Weighted Combined Average
	Stations	Direct Shippers	
January	7.01	2.25	6.21
February	7.09	2.42	6.77
March	9.40	4.25	8.13
April	7.50	4.03	5.28

TABLE XXI - Continued

Months	Cream Costs in Cents per lb.		Weighted Combined Average
	Stations	Direct Shippers	
May	6.09	1.80	5.77
June	6.02	1.52	4.80
July	6.37	1.10	5.33
August	6.28	1.42	5.56
September	6.44	2.74	6.06
October	6.27	2.49	5.89
November	6.39	2.66	6.15
December	7.01	2.62	7.00
Weighted Average	6.58	2.21	5.85

*Factors involved in Buying Missouri Cream, University of Missouri Agriculture Experiment Station Research Bulletin 137, page 4.

Figures have been obtained from the Bennett Creamery Company, through a letter to Professor W. H. Martin, showing the cost of collecting a pound of butter fat by four methods of cream collection which they use. Table XXII shows the average costs of these various methods for the year 1930. This company uses the direct shipper, the cream station, contact station and concentration methods of cream procurement.

TABLE XXII

Butter fat Procurement Costs at the Bennetty Creamery per Pound of Fat and in Cents per Pound

Months	Cost of Procurement per Pound of Butter Fat			
	Regular Stations	Contact Stations	Concentrators	Direct Shippers
January	6.49	1.87	5.31	3.64
February	7.37	2.47	4.70	4.89
March	7.91	2.16	4.18	3.98

TABLE XXII - Continued

Months	Cost of Procurement per Pound of Butter Fat			
	Regular Stations	Contact Stations	Concentrators	Direct Shippers
April	6.09	1.66	3.79	2.94
May	4.36	1.02	3.30	2.03
June	4.18	.95	3.19	2.28
July	4.38	1.13	3.65	2.50
August	4.55	1.13	3.61	3.41
September	4.79	1.27	3.79	3.09
October	5.98	1.73	3.99	3.02
November	6.37	1.85	4.16	3.87
December	7.11	2.29	4.51	4.40
Average	5.798	1.627	4.015	3.337

It is evident from the data in Table XXII that it costs this centralizer less to procure its butter fat by the contact station method at an average cost of 1.63 cents per pound of fat. The next least expensive method is the direct shipper method with an average cost of 3.34 cents. Then comes the cost of the concentrators at 4.02 cents per pound. The regular station method of butter fat procurement with an average cost of 5.80 cents per pound is the most expensive of all.

A very interesting fact as shown by these figures is the seasonal variation of these costs. In every instance except one there is a variation curve of these expenses. Beginning with the four winter months, December, January, February and March, as the months of highest procurement costs, the curve gradually drops to a low point during the

months of May, June and July and in some instances August, with June as the low month; then the cost gradually increases until the winter months and highest costs are reached.

The data given by the Missouri station(Table XXI) shows a somewhat similar cycle, though not as evident as the data from the Kansas centralizer. At Missouri the highest cost month is June. The other winter months are high as well. The low drop in costs is during the months of May, June, July and August, as was found with respect to the costs of the Kansas centralizer.

Table XXIII shows the cost averages of collecting a pound of butter fat as found at the Missouri station and as reported by the Kansas centralizer and as found during this survey.

TABLE XXIII

The Average Costs of Procuring a Pound of Butter Fat by Various Methods of Procurement in Cents per Pound

	Regular Stations	Contact Stations	Concentrators	Direct Shipper	Trucking System
Missouri	6.58			2.21	
Centralizer	5.80	1.63	4.02	3.34	
Cooperatives					1.315

A comparison of the costs of procuring a pound of butter fat (Table XXIII) by these methods show the trucking system as the least expensive. The cost of procuring a pound of butter fat by this method was 1.315 cents, which was at least .315 cents cheaper than the next low cost method, the contact station. The comparative methods of butter fat procurement of the Missouri and Kansas centralizer show that it is cheaper to procure butter fat by the station method as used by the Kansas centralizer by .78 cents than the same method as used by the Missouri centralizer. The direct shipper method of butter fat procurement, however, is cheaper by 1.13 cents as reported from Missouri than as reported from the Kansas centralizer.

DISCUSSION OF RESULTS

The results of this investigation show a high percentage of renter farmers in these localities, indicating one large difficulty that is no doubt experienced by the cooperations in their attempt to interest the patrons to use the correct type of dairy implement. As the renters do not own the farms themselves and in some instances do not realize the importance of correct control for the production of first grade cream, it is difficult to interest them in placing permanent dairy equipment on the farm.

The average farms are unusually large and due, no doubt, to the large number of the patrons interested in the beef industry and whom need much pasture. There is also a large amount of the land used for raising cash crops, which has a tendency to increase the total farm acreage.

The majority of the cows used for milking purposes are of the non-dairy type, showing that these farmers are attempting to work a combination, when it is a well known fact that a strictly dairy program is more successful. This large majority of non-dairy animals indicates much room for an extensive culling program, which without any doubt would increase the total production of the area and cut down some of the existing expense.

Although there is a fairly large number of purebred dairy cattle in the localities, it would be more profitable if more were present. A glance at the tables giving the cow distribution shows a great deal of room for advancement along this line. This table also shows the Holstein as the most predominating breed in the localities. With this knowledge in mind, it might be advisable to stress the advantage of this breed for the ultimate purpose of developing a Holstein dairy section. The advantages derived from a one breed locality are evidenced by the success of Waukesha county in Wisconsin which is a well known Guernsey breed locality and Jefferson county in Wisconsin where

Holstein cattle are greatly in majority.

Athough over 50 per cent of the dairy sires are purebred only approxiamtely one-fifth of all the sires, both grades and purebreds are purebred representatives of the dairy breeds. Here again is the need for stressing the importance of purebred dairy animals and that there is much room for development and advancement.

That many of the patrons are interested in keeping proper care of their cream, is evidenced by the majority of the people cooling their cream immediately after separation, the majority who cool the fresh cream before adding to the previous skimmings and that the selection of places for storage for the cream is good. However, where consideration is made of the few people feeding their cows the standard ration and the few feeding grain in the summer, the small number owning silos, milking machines and cooling tanks, the number who wash their separators more than once are too far in the minority; and that boiling water instead of boiling water and some disinfectant or steam is used for sterilization, it is readily seen that here again there is much room for an expansive and educational program. This program to be carried on to realy interest the patrons in the proper methods of cream production and the proper methods and practices of handling it after it has been produced.

The results of the trucking survey show a small increase of second grade cream from the time it leaves the farm until it reaches the plant. This was due almost entirely to the existing high temperatures which resulted in high acid cream.

The small amount of second grade cream found on the farms is far below the usual amount found on the farms in other localities. This is due, not so much to the care it received on the farm, as by far the greater majority of the cream was held at higher temperatures than advised for the production of first grade cream, but more so to the frequency of collection of the cream.

At the time the survey of the route system was made many of the trucks traveled part of another truck's route. In many instances there were many duplications of this sort. As a result of the survey many of the routes have been changed around, either shortening or lengthening until the duplication is now at a minimum. One route was taken off completely. This change has been made at creamery No. 1, and it is believed will result in a cutting down of the expense of operating the trucks and at the same time afford faster trips which will result in a smaller amount of second grade cream developing on the journey from the farms to the plant.

The lower cost of operating the trucks and for collect-

ing a pound of butter fat under the ordinary station, direct shipper and concentrator, shows that if there is a choice to be made in any of these methods the former system has the advantages of lower costs, frequent deliveries and insures the creamery of obtaining cream of good uniform quality.

Throughout the survey a close similarity of the results of both localities was found. The greater advantages were nearly always found to be in favor of creamery No. 1. This was especially true when the expense of operating the trucks was taken into consideration, as the procurement costs at creamery No. 1 are all below those at creamery No. 2.

SUMMARY

1. Approximately 57 and 47 per cent of the land farmed is owned, while 42 and 52 per cent is rented.

2. The average acreage per farm was 211.5 and 185.6 acres respectively.

3. Seven and two tenths and 5.42 per cent of all the land was in alfalfa, 11.33 and 3.31 per cent in sweet clover, and 17.35 and 15.23 per cent in native grass.

4. Of the dairy cows used for milking purposes, 67.06 and 63.83 per cent are non-dairy breeds. The Holstein breed is the most predominate dairy cattle with 90 and 46 herds

respectively. The Jersey breed is second with 42 and 19 herds.

5. The average herd was found to consist of 11.97 and 13.52 cows and heifers. The average number of cows milked was 7.31 and 8.73 per farm. The calf and cow ratio was approximately 1: 2 for both localities.

6. A percentage of non-dairy bulls of 51.96 and 48.33 per cent was found to be present in the localities. The percentage of dairy animals was 30.11 and 42.22 per cent.

7. Figures relative to the purebred sires present in the community show that of all the purebred sires of all the sires present, only 17.91 and 16.66 were purebred. The purebred sire figures alone show a percentage of 50.54 and 51.72 dairy bulls and 49.44 and 48.27 non-dairy purebred bulls.

8. The percentages of the general dairy farm practises found to be in use are:

23 and 36.1 per cent fed cows grain in summer

12.5 and 14.4 per cent fed standard dairy ration

27.7 and 16.6 per cent owned a silo

3.14 and 2.77 per cent owned a milking machine

9. Of the various makes of separators present in the localities the De Laval led with 54.44 and 35.55 per cent. The McCormick-Deering was second with 25.19 and 33.33 per cent. Many of the machines were in use for more than 10

years.

10. The chief places for the location of the separator on the farm were the house with 20.27 and 16.11 per cent, the milk house with 18.3 and 23.33 per cent, the kitchen with 11.41 and 7.22 per cent.

11. (a) With respect to the care of the separator, 52.55 and 36.11 per cent of the farmers adjust their separator to 35 to 45 per cent in the summer and 30 to 40 per cent in the winter. (b) 92.11 and 88.87 per cent flush their separator with cold water after each separation. (c) 92.71 and 90.55 per cent wash separators with hot water and washing powder. (d) 65.74 and 77.22 per cent wash their separators once a day. (e) .39 and .55 per cent use steam and 87 and 90.54 per cent use boiling water for sterilization.

12. 73.62 and 76.11 per cent cool their cream immediately after separation. 88.38 and 93.33 per cent cool the fresh cream before adding to old skimmings. 15.57 and 16.11 per cent owned cooling tanks.

13. The cellar with 51.8 per cent, the cave with 16.1 per cent and the cooler with 15 per cent are the most predominating places for storage of the cream until called for at creamery No. 1. At creamery No. 2, the cellar with 44.5 per cent, the cave with 16.9 per cent, the house with 13.2 per cent, the refrigerator with 7.9 per cent and the cooler with 6.8 per cent are the most predominating places.

14. The lowest temperature of cream in these storage places were found in the refrigerator, wells and cooling tanks.

15. Information collected on the farms and at the plant show that the total percentage of increase in second grade cream from the farm to the plant of all the routes was 4.82 and 5.32 per cent. This increase in second grade cream was no doubt due to the high atmospheric temperatures existing at the time each route was made.

16. The time spent on the route varied from 264 to 561 minutes and the distance from 29.3 to 108.8 miles.

17 the shortest time spent at a stop and between stops were found to be 1 minute. The longest time at a stop and between stops at creamery No. 1 was 26 and 56 minutes, respectively, while at creamery No. 2 it was 26 and 32 minutes.

18. The time spent at each stop to collect eggs at creamery No. 1 varied from 1 or 2 minutes to 7 or 11 minutes depending upon how much they had to be handled.

19. The average distance of the routes was found to be 60.9 and 46.46 miles and the average distance per stop 1.36 and 1.19 miles.

20. The average time at all stops was found to be 4.11 and 3.10 minutes, while the average time between stops was 6.19 and 5.42 minutes.

21. There was an average of 39.67 and 34.71 pounds of

cream collected per stop and an average of 13.84 and 12.11 pounds of butter fat per stop.

22. The cost of procuring a pound of butter fat by the trucking system was computed from the information collected on the routes and from the trucking expense records of the creameries.

23. The expense of operating a single truck per day was found to be $8.746 and $6.883. For all the trucks running one day, this amounted to $85.67 and $20.652.

24. The cost of collecting a pound of butter fat was found to be 1.07 and 1.56 cents, the cost per stop 15.02 and 20.85 cents and the cost per mile was 8.80 and 14.81 cents.

25. The average costs for both creameries was found to be 1.315 cents per pound of fat, 17.935 cents per stop, and 11.805 cents per mile.

26. (a) The cost of collecting a pound of butter fat by the trucking systems was found to be considerably lower than the costs as given by Missouri investigators of stations and direct shippers and of a Kansas centralizer's stations and direct shippers. (b) The cost of collecting a pound of butter fat by these latter methods at Missouri were 2.21 cents per pound for the direct shipper method and a cost of 6.58 cents per pound for the station method. (c) The Kansas centralizer reports an average yearly cost for 1930 by the direct shipper

method at 3.337 cents per pound, by the regular station method at 5.798 cents per pound, by the contact stations at 1.627 cents per pound and by the concentrators at 4.015 cents per pound.

CONCLUSIONS

The conditions relative to the general dairy farm practises found on the farms in these localities, though better than the average of other localities in Kansas, indicate there is much room for an expansive and intensified dairy program to be carried on before these localities can be considered as purely dairy communities.

The results of the trucking survey show that this system has the advantage of lower costs, quick delivery, brings the market to the door of the patron and insures the creamery of obtaining a good uniform quality of cream.

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