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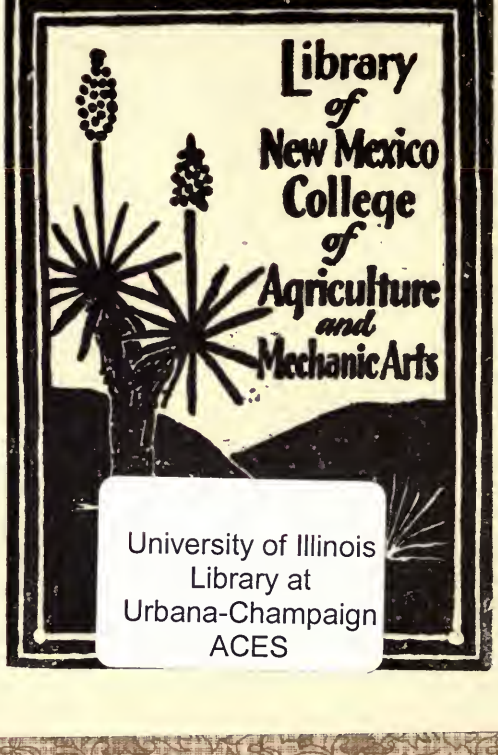

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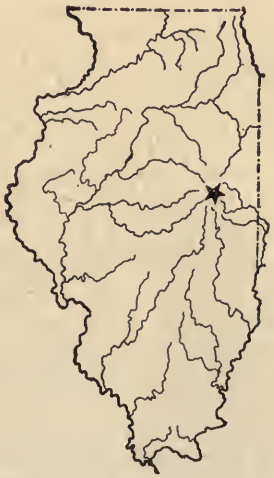
UNIVERSITY OF ILLINOIS

Agricultural Experiment Station

BULLETIN No. 138

PASTEURIZATION AS A FACTOR IN MAKING BUTTER FROM CREAM SKIMMED ON THE FARM

By CARL E. LEE



URBANA, ILLINOIS, SEPTEMBER, 1909

Summary of Bulletin No. 138

1. In 1905, the comparisons represented by one tub of butter from each churning and scored by only one judge, gave an average of seven-tenths (0.7) of one point higher score in favor of the butter made from the pasteurized cream.

2. During four months in storage the butter made from unpasteurized cream decreased in quality 0.3 and the butter from the pasteurized cream 0.45 of one point.

3. The 1906 butter inspected upon arrival in Chicago gave an average score of 0.5 of one point in favor of the butter made from the unpasteurized cream. Twenty-six days after the last lot of butter was made it was again scored by two judges, with an average of 0.97 and 0.27 of one point respectively in favor of the unpasteurized butter.

4. After the butter had been in storage another 101 days it was again examined by the same men. According to one of these judges, there was no difference in the decrease of quality between pasteurized and unpasteurized butter, while the average of all the scores by the other judge showed that the butter made from the pasteurized cream decreased in quality 0.71 of one point more than the butter made from unpasteurized cream.

5. The 104 tubs of 1907 butter were scored by five judges 44 days after the first lot was made. According to three of these judges the unpasteurized butter scored higher by 0.56, 0.27 and 0.10 of one point respectively. The other two judges scored the pasteurized butter higher by 0.3 and 0.41 of one point. Following a period of four months in storage this butter was rescored by four of the former judges. According to three of them the unpasteurized decreased in quality 0.13, 0.72 and 0.04 of a point more than the pasteurized butter, while the fourth judge scored the unpasteurized butter higher by 0.34 of one point.

6. The 1908 comparisons were represented by 160 tubs of butter shipped to both the Chicago and New York markets. The butter shipped to Chicago was scored by five different judges, thirteen days after the last butter was made with the following average results: Two of the judges favored the pasteurized butter by 0.2 and 0.1 of one point respectively. After six to seven months in storage this same butter was rescored by four of these same judges. The butter made from the unpasteurized cream decreased to the extent of 0.15, 2.02, 0.25 and 0.65 of a point respectively, more than did the butter made from the pasteurized cream.

7. The butter that was shipped to New York was scored by one judge before it was placed in storage with the result of 0.1 of one point in favor of unpasteurized butter. According to this same judge the unpasteurized butter decreased in storage 0.35 of one point more than the pasteurized butter. The average of all the scores placed upon this butter after storage, by four judges, was 1.51 points in favor of the pasteurized butter.

8. Pasteurization does not affect the body or texture of butter. Curdling of cream by pasteurization increases the loss of fat in buttermilk. Pasteurization reduces the viscosity of sour cream and produces buttermilk of a watery appearance.

Pasteurization does not improve the quality of butter made from sour farm-skimmed cream.

PASTEURIZATION AS A FACTOR IN MAKING BUTTER FROM CREAM SKIMMED ON THE FARM

By Carl E. Lee, Assistant Chief in Dairy Manufactures

INTRODUCTION

For the past four years the Illinois Agricultural Experiment Station has been studying the problems relative to the quality of butter manufactured in our creameries from farm-skimmed cream. The change from the whole milk to the cream gathering system has resulted in a decline in quality of butter. There is some doubt as to the real cause of this deterioration, but it is needless to say that a greater effort should be exerted toward the improvement of a condition so important to the public.

In this connection the following demand consideration.

1. Is there danger in allowing the farmer to keep cream until it deteriorates in quality before it is delivered to the creamery?
2. Does the age, flavor, and acidity of cream when delivered to the buttermaker, affect the quality of the butter?
3. What effect, if any, does the place where the milk is skimmed, have upon the flavor of creamery butter?
4. Is there anything that can be done in the factory, where this cream is churned, that might overcome the above mentioned defects?

Naturally the benefit that might be derived from the proper handling of the cream on the farm has not been overlooked in this work. Pasteurization of farm-skimmed cream has been advocated in the past but no facts are available to show that butter made from such cream has been improved by pasteurization alone.

PRELIMINARY OBSERVATIONS

The first part of the work consisted in a preliminary study of the methods of handling cream in the creameries thruout the State. Facilities for studying pasteurization were found in many of the plants affording ample opportunity for a general survey of the systems now in use.

Personal observations were made of the butter from factories where all the cream was pasteurized and this butter was compared with the product of creameries where pasteurization was not practiced. The cream at the various factories was in general of the same quality, but some butter made from pasteurized cream scored higher than that

from unpasteurized. The opposite was also true. From observations thus obtained, the following ideas were formed.

1. Pasteurized cream seemed to have the cleaner flavor.
2. Butter made from pasteurized cream was improved in quality from one to two points.
3. There was no apparent difference in the body of the butter made from pasteurized or unpasteurized cream.
4. Pasteurization curdled thin sour cream.
5. The curdling of cream by pasteurization increased the loss of butter fat in the buttermilk from 0.3 to 1.0 percent.
6. Where no curdling took place there was no greater loss in the buttermilk from pasteurized cream.
7. The amount of curdling varied with the make of pasteurizer used.
8. Curdling would increase on sour cream when the percent of fat was below 30.
9. The rapidity with which the cream was heated to a temperature of 180° F. was an important factor in reducing curdling.
10. Factories in the same locality, making butter from unpasteurized cream sold their product for the same price per pound as did those factories making butter from pasteurized cream.
11. The quality of the butter decreased as the quality of the cream received at the factory decreased.
12. Pasteurization greatly increased the labor and expense of operation in the small creameries.

After all these observations regarding quality of the butter there were still no data upon which to base conclusions. The writer had been the only judge of quality, and the butter in this comparison had not been made from cream of identical grade. Butter made from the same vat of cream one-half pasteurized and the other not, had never been submitted, side by side, to market inspection. The product made in two different factories or in the same factory on two separate days, was not comparable, for it could undoubtedly be said that the cream in one or the other might have had advantage in flavor.

Investigational work in the manufacture of butter must be conducted with the utmost care. The factors that influence results are very numerous, complex, and difficult to eliminate.

GENERAL PLAN

Since the previous work was too general and not exhaustive to a conclusive degree, it was continued further, as follows:

Quality of butter made from pasteurized sour cream was compared with quality of butter made from the same grade of cream not pasteurized. The two lots of cream for each day's comparison were handled in as nearly the same manner as circumstances would permit, and in no case was cream used unless it was first thoroly mixed and then divided into two lots, one to be pasteurized and the other left unpasteurized.

The general method of treating the cream and making the butter was the same for both the pasteurized and unpasteurized, except as noted under 1906, when for the first five days of that year's work, starter was added to the pasteurized cream and none to the unpasteurized. Thruout the experiment the object was to make butter that would score perfect in workmanship. In this we were successful, since all the cuts in scores were made on flavor alone.

BUTTER TO BE JUDGED

In the first two years' work of the experiments, one churning was made each day of pasteurized cream and one of unpasteurized. One 60-pound tub of butter was packed from each churning.

In 1907, all the cream received each day was divided into two lots, one of which was pasteurized. Both the pasteurized and unpasteurized lots of cream from vats 8 and 11 were cooled and churned two hours later. From the other 12 vats the pasteurized and unpasteurized cream was cooled; one-half of each lot was churned a few hours later and the remainder of the cream in each lot churned the next morning and two tubs of butter packed from each churning.

In handling this cream four tubs of pasteurized butter are compared with four tubs of unpasteurized butter.

In 1908, for each of the twenty comparisons the pasteurized cream was also churned in two churnings. From each churning four tubs of butter were packed; two of which were shipped to Chicago and the other two to New York City. The unpasteurized cream was handled in the same manner, giving 16 tubs of butter for each comparison.

All of the butter was scored soon after the last lot was made. It was again scored after several months in storage in order to determine its keeping quality. The butter made in 1907 and 1908 was judged by a greater number of judges than that of the previous two years. In each case the name of the person acting as judge is recorded over his score.

MEANS AND METHODS OF RATING QUALITY

As previously stated, the first two years' work was represented by one tub of butter packed from each churning. It was evident from the results obtained by comparing the various scores on this butter, that there was a difference in the score, placed upon the same package by different judges. It was also evident that one man might favor the butter made from the pasteurized cream while another judge might favor the butter made from unpasteurized cream. This led to the belief that standards varied with different judges or that their taste and perception for detecting flavors were unlike.

It is not to be expected that a judge's score on a package of butter is infallible for the reason that the taste is variable from day to day and that what may be standard for one judge may not be for another. At best the score is an estimate rather than actual measure of the quality of the butter in question. The chemist may determine the exact amount of salt or fat in a sample of butter, but there are no mechan-

ical weights or measures by which a judge can determine quality or flavors with anything like the same degree of accuracy. If Mr. A should place a score of 92 on the pasteurized and 93 on the unpasteurized butter, it could not be said that the butter receiving the highest score was one point better in quality. If perchance Mr. B should reverse this decision the average of these scores would not signify that there was no difference in quality.

A study of the tabulation of all the scores obtained on this butter leads one to believe that if the score on a certain tub was 92 it simply means that it would fall within the limits of 91 and 93 or in rare instances 90 and 94.

Since these variations and irregularities must always be reckoned with, the task of eliminating this influence, or reducing it to a minimum, was undertaken in 1907 and 1908, by employing a greater number of judges, and by using duplicate churnings from each lot of cream as well as duplicate tubs from each churning.

For example, May 6, the comparison might have been represented by one tub of butter from each of the pasteurized and unpasteurized lots of cream. We would then have had from Table 21, May 6, 1908, pasteurized butter tub No. 201, unpasteurized butter tub No. 205.

As a matter of fact, it was represented by two churnings from each lot and two tubs from each churning for two different markets, making a total of 16 tubs for comparison.

Example, May 6, 1908, from Tables 21 and 32

Tubs pasteurized butter				Tubs unpasteurized butter			
Churn 1	201, 203 Chicago	Churn 2	202, 204 Chicago	Churn 3	205, 207 Chicago	Churn 4	206, 208 Chicago
	401, 403 New York		402, 404 New York		405, 407 New York		406, 408 New York

In the same manner the scores might all have been placed by one judge, thus giving the score on the one tub as against an average of the scores placed on 8 tubs.

Example, from Table 21.

Pasteurized, tub 201, score by Crawford, July 14, 1908, 93.
Unpasteurized, tub 205, score by Crawford, July 14, 1908, 93.
Score in the 8 tubs, same judge, July 14, 1908:

Pasteurized		Unpasteurized	
Tub No.	Score	Tub No.	Score
201	93	205	93
203	93	207	93
202	93	206	93
204	93	208	92.5

The same comparison could be made for any of the 20 days. By employing five judges, errors are further eliminated by having 20 scores on the 4 tubs as against 5 scores on the one tub of either pasteurized or unpasteurized butter.

Example from Table 21. Butter made May 6, 1908.

If only one tub had been packed the results would have been as follows:

First tub packed from pasteurized cream was numbered 201 and was scored by 5 judges, July 14, 1908, as follows:

93; 94; 92¾; 93½; 92½. Average 93.15.

First tub from unpasteurized butter No. 205.

93; 94; 93; 94; 93. Average 93.4.

Tabulation of scores made by same 5 judges July 14, 1908, on four tubs of butter representing the same cream.

Pasteurized lot from Table 21.

	Scores				
Tub No.	Crawford	Newman	McKay	Woolverton	Lee
201	93.00	94.00	92.75	93.50	92.50
203	93.00	92.00	91.50	93.00	93.00
202	93.00	93.00	92.25	93.50	93.00
204	93.00	92.50	92.50	93.50	93.00

Average of the 20 scores, 92.87.

Unpasteurized lot.

	Scores				
Tub No.	Crawford	Newman	McKay	Woolverton	Lee
205	93.00	94.00	93.00	94.00	93.00
207	93.00	93.00	91.00	93.00	93.50
206	93.00	93.00	92.75	92.00	93.00
208	92.50	91.50	92.25	93.00	92.50

Average of the 20 scores, 92.8.

From the first line of Table 23, the folowing data is obtained as a summary of the above scores:

Tub No.	Average	Highest	Lowest	
201–204	92.87	94.00	91.50	Pasteurized butter
205–208	92.80	94.00	91.00	Unpasteurized butter

The butter in each case except 1906 was made by the writer and the regular buttermakers at each place.

AUGUST 7 TO 25, 1905

The first six experimental churnings were made at the John Newman Company's creamery at Freeport and the remaining fourteen churnings were conducted at their Galena plant.

Each day's cream was thoroly mixed and then divided into two equal quantities; one of these was pasteurized to a temperature ranging from 160° to 180° F. and then cooled at once to a temperature of 44° F. The other was placed in the ripening vat unpasteurized. The cream when delivered varied in acidity from 0.54 to 0.72 percent, and the fat from 28 to 35 percent. See Table 4.

No starter was added to the cream that was churned the first day. But each succeeding day from 4 to 5 percent of starter was added to both the pasteurized and unpasteurized cream. After the cream had been cooled it was held from 8 to 12 hours and then churned at a temperature of 47° to 48° F. The unpasteurized cream was cooled, held, and churned at the same temperature as the pasteurized.

One 60-pound tub of butter was taken from each churning and stored with the Monarch Refrigerating Company, in Chicago. September 6 the 20 tubs were judged by John Mittelstadt of the Chicago Butter and Egg Board, assisted by J. B. Newman, of the firm of W. S. Moore and Company.

TABLE 1. RESULT OF SCORING SEPTEMBER 6, 1905

Unpasteurized				Pasteurized			
Tub No.	Score	Tub No.	Score	Tub No.	Score	Tub No.	Score
1	91.50	11	87.50	2	92.00	12	88.00
3	91.50	13	86.00	4	93.00	14	86.50
5	91.00	15	87.00	6	92.00	16	88.00
7	86.00	17	87.50	8	86.50	18	87.50
9	87.00	19	86.00	10	87.50	20	86.50
Average .			88.05				88.75

For every day's make the pasteurized butter scored higher than the unpasteurized by one-half to one and one-half points.

January 5, four months later, the butter was again scored by John Mittelstadt and John Crawford.

TABLE 2. RESULT OF SCORING BUTTER JANUARY 5, 1906

Unpasteurized			Pasteurized		
Tub No.	Mittelstadt	Crawford	Tub No.	Mittelstadt	Crawford
1	90.50	92.00	2	91.00	91.00
3	90.50	92.00	4	92.00	91.00
5	91.00	91.00	6	90.50	90.00
7	85.00	86.00	8	85.50	88.00
9	86.00	85.00	10	88.00	86.00
11	86.50	87.00	12	87.50	90.00
13	85.00	82.00	14	85.50	84.00
15	86.00	83.00	16	88.00	90.00
17	86.50	85.00	18	87.50	87.00
19	85.50	86.00	20	87.50	89.00
Average....	87.25	86.90		88.30	88.60

According to the scoring by Mittelstadt, the butter made from the pasteurized cream was 1.05 of a point better in quality, and according to Crawford's scoring 1.7 of a point better than the butter made from the corresponding lots of unpasteurized cream.

The greatest difference found between the butter made on the same day was, according to Mittelstadt's scoring, 2 points and Crawford's 7 points.

TABLE 3. CHANGE IN QUALITY ACCORDING TO FIRST AND SECOND SCORING BY MITTELSTADT

Unpasteurized			Pasteurized		Unpasteurized			Pasteurized	
Vat No.	Gain	Loss	Gain	Loss	Vat No.	Gain	Loss	Gain	Loss
1	...	1.0	...	1.0	6	...	1.0	...	.05
2	...	1.0	...	1.0	7	...	1.0	...	1.0
3	Same	Same	...	1.5	8	...	1.0	Same	Same
4	...	1.0	...	...	9	...	0.5	Same	Same
5	...	1.0	0.5	...	10	...	0.5	1.0	...

According to Table 3 one tub of butter made from unpasteurized, and two tubs from pasteurized cream, did not change in quality. Two tubs of butter made from unpasteurized and one from pasteurized decreased in quality one-half of a point. Seven tubs made from the unpasteurized and four from pasteurized cream decreased in quality one point. One tub of butter from pasteurized cream decreased 1.5 points, one gained 1.0 point and another 0.5 of one point.

TABLE 4. CHURNING DATA

Vat No.	Acidity of Cream Per cent	Av'ge percent		Temperature			Hours cream was held	Effect of pasteurization	Loss in buttermilk	
		Fat	Starter added	Cream cooled to	Cream churned at	One-half cream pasteurized at			Unpasteurized	Pasteurized
1	.57	28.0	None	44°F.	47	160 to 170	10	Curdled	0.15	0.3
2	.54	28.0	5	44	47	165 to 170	8	Curdled	0.10	0.6
3	.64	28.0	5	44	48	170	12	Curdled	0.10	0.5
4	.72	29.5	4	44	48	170	8	Curdled	0.10	0.6
5	.63	35.0	4	44	48	165 to 175	8	Did not Curdle	0.10	0.2
6	.69	29.0	5	44	48	170 to 180	10	Curdled	0.10	0.4
7	.70	30.0	4	44	48	170 to 180	12	Curdled	0.08	0.7
8	.70	32.0	4	44	48	170 to 180	10	Did not curdle	0.08	0.15
9	.70	32.0	4	44	48	170 to 180	10	Did not curdle	0.10	0.20
10	.68	30.0	4	44	48	170 to 180	12	Curdled	0.05	0.50

AMBOY, ILLINOIS—JULY 23 TO AUGUST 17, 1906

Nineteen vats of cream were used. The acidity of the cream when delivered varied from 0.50 to 0.62 percent and the fat from 30 to 38 percent.

The cream was thoroly mixed, then divided into two parts. These different lots of cream were handled the same except that one was pasteurized to a temperature of 160° to 180° F., and corresponding lots churned unpasteurized.

During the first five days, 5 to 13 percent of starter was added to the pasteurized cream and none to the unpasteurized. For the other fourteen days 5 to 20 percent of starter was added to both the pasteurized and unpasteurized cream. From each churning a 60-pound tub of butter was packed and stored with the Monarch Refrigerating Company, Chicago.

The cream used in this experiment was of better quality than that used the previous year, altho it was all skimmed on the farm.

As soon as each lot of butter arrived in Chicago, it was scored by J. B. Newman.

TABLE 5. SHOWING DIFFERENCE IN QUALITY OF BUTTER MADE THE SAME DAY

Pasteurized				Unpasteurized		
Vat No.	Tub No.	Score	Gain	Tub No.	Score	Gain
11	22	93.75	0.25	21	93.50	....
12	24	94.00	Same	23	94.00	Same
13	26	94.50	0.5	25	94.00	....
14	28	93.50	....	27	94.00	0.5
15	30	93.75	....	29	94.50	0.75
16	32	93.50	....	31	94.00	0.5
17	34	94.00	....	33	94.75	0.75
18	36	92.00	1.0	35	91.00	....
19	38	92.00	....	37	95.00	3.0
20	40	92.00	Same	39	92.00	Same
21	42	93.50	1.0	41	92.50	....
22	43	93.75	1.25	44	92.50	....
23	46	93.00	....	45	93.50	0.5
24	48	92.75	....	47	93.75	1.0
25	50	93.50	Same	49	93.50	Same
26	52	89.50	....	51	93.00	4.50
27	54	92.00	....	53	94.50	2.5
28	56	92.00	....	55	93.00	1.5
29	58	90.50	0.5	57	90.00	....
Average ..		92.81	....		93.31	....

TABLE 6. RESULT OF SCORING BUTTER SEPTEMBER 12 BY NEWMAN AND CRAWFORD

Pasteurized				Unpasteurized		
Vat No.	Tub No.	Newman	Crawford	Tub No.	Newman	Crawford
11	22	91.50	89.00	21	91.50	90.00
12	24	93.00	93.00	23	89.00	90.00
13	26	92.50	92.50	25	93.00	94.00
14	28	91.50	92.50	27	96.00	93.00
15	30	91.50	94.00	29	90.50	90.00
16	32	93.00	93.00	31	93.50	92.50
17	34	92.00	91.00	33	94.50	94.00
18	36	91.50	92.50	35	92.50	93.00
19	38	91.50	90.00	37	92.00	94.00
20	40	91.50	93.00	39	96.50	94.00
21	42	93.00	93.00	41	93.00	93.00
22	43	93.00	93.00	44	90.00	90.00
23	46	91.00	92.00	45	90.00	92.00
24	48	95.00	93.50	47	93.00	93.50
25	50	92.50	92.00	49	93.50	91.00
26	52	89.50	92.00	51	93.50	94.00
27	54	90.00	91.00	53	92.00	91.00
28	56	89.00	91.00	55	93.50	92.00
29	58	88.00	89.00	57	91.50	91.00
Average ..		91.65	91.94		92.62	92.21

The result of this judging gave an average of one-half of one point in favor of the butter made from the unpasteurized cream. The butter made from three out of the nineteen vats of cream scored alike for both the pasteurized and unpasteurized.

The butter made from six lots of the pasteurized cream scored from one-fourth to one and one-fourth points higher, while the butter made from the unpasteurized cream in the other ten lots scored from one-half to three points higher than that made from the pasteurized cream.

September 12, or 26 days after the last lot of butter was made, it was again scored by Newman and Crawford with the results as shown in Table 6.

According to the score placed by Newman, the average for the butter made from the pasteurized cream was 91.65 and unpasteurized 92.62, an average of 0.97 of a point higher for the unpasteurized butter.

From two vats of cream the butter scored the same for both pasteurized and unpasteurized. From five of the vats one to four points higher for the pasteurized, while from the other twelve vats the butter made from unpasteurized cream scored higher by one-half to four and one-half points.

According to the score by Crawford the average for the pasteurized was 91.94 and the unpasteurized 92.21, an average of 0.27 of one point higher for the unpasteurized butter.

TABLE 7. RESULT OF SCORING BUTTER DECEMBER 22, BY NEWMAN CRAWFORD AND MITTELSTADT

Pasteurized					Unpasteurized			
Vat No.	Tub No.	Newman	Crawford	Mittelstadt	Tub No.	Newman	Crawford	Mittelstadt
11	22	91.00	91.00	91.00	21	89.00	90.00	89.00
12	24	91.50	92.00	91.00	23	92.00	90.00	90.00
13	26	91.00	92.00	92.00	25	92.00	93.00	93.00
14	28	90.00	88.00	88.00	27	91.00	93.00	93.00
15	30	88.00	90.00	90.00	29	91.00	93.00	93.50
16	32	91.50	90.50	90.50	31	92.00	92.00	92.00
17	34	89.00	91.00	92.00	33	90.00	90.00	91.00
18	36	90.00	91.00	91.00	35	91.50	93.00	93.00
19	38	90.00	92.00	91.00	37	89.00	92.00	91.50
20	40	90.00	90.00	89.00	39	91.00	92.00	92.00
21	42	90.00	91.50	91.00	41	92.00	92.50	93.00
22	43	90.00	91.00	92.00	44	89.00	89.00	89.00
23	46	90.00	90.00	90.00	45	89.00	91.00	91.00
24	48	89.00	91.00	91.00	47	88.00	90.00	90.00
25	50	85.00	90.00	90.00	49	91.00	91.00	92.00
26	52	91.00	89.00	89.00	51	91.50	90.00	90.00
27	54	90.00	88.00	88.00	53	92.50	92.00	92.00
28	56	90.00	90.00	90.00	55	93.00	92.00	92.00
29	58	86.00	89.00	88.00	57	87.00	90.00	90.00
Average		89.68	90.36	90.23		90.65	91.34	91.42
Gain.		.....	.....	.....		0.97	0.98	1.19

From four vats of cream the butter scored the same for both pasteurized and unpasteurized. From five vats one-half to four points in favor of the pasteurized cream, while the butter made from the other ten vats scored from one-half to four points higher for the unpasteurized.

December 22 the butter was scored the third time by Messrs. Newman, Crawford and Mittelstadt with the results as shown in Table 7.

According to the scores made by Newman, from one vat the pasteurized and unpasteurized butter scored the same. From five of the vats the butter from the pasteurized cream scored higher by one to two points, while from the other comparisons the butter made from the unpasteurized cream scored higher by one-half to three points.

According to Crawford, from five vats the butter made from the pasteurized cream scored higher by one to two points, while from thirteen of the vats that made from the unpasteurized cream scored higher by one to five points.

According to Mittelstadt, in five of the comparisons, the butter made from the pasteurized cream scored higher by one to three points, while in the other fourteen comparisons that made from the unpasteurized cream scored higher by one-half to four points.

TABLE 8. DIFFERENCE IN QUALITY ON SAME TUB OF BUTTER BETWEEN SEPTEMBER 12 AND DECEMBER 22

	Pasteurized				Unpasteurized			
	Gain		Loss		Gain		Loss	
Vat No.	Newman	Crawford	Newman	Crawford	Newman	Crawford	Newman	Crawford
11	...	2.	0.5	...	...	...	2.5	Same
12	...	...	1.5	1.0	3.0	...	...	Same
13	...	...	1.5	0.5	...	...	1.0	1.0
14	...	...	1.5	4.5	...	...	5.0	Same
15	...	...	3.5	4.0	0.5	3.0	...	...
16	...	...	1.5	2.5	...	...	1.5	0.5
17	...	...	3.0	Same	...	...	4.5	4.0
18	...	...	1.5	1.5	...	...	1.0	Same
19	...	2.0	1.5	...	...	...	3.0	2.0
20	...	...	1.5	3.0	...	...	5.5	2.0
21	...	...	3.0	1.5	...	...	1.0	0.5
22	...	...	3.0	2.0	...	...	1.0	1.0
23	...	...	1.0	2.0	...	...	1.0	1.0
24	...	....	6.0	2.5	...	...	5.0	3.5
25	...	...	7.5	2.0	...	...	2.5	Same
26	...	...	1.5	3.0	...	...	2.	4.0
27	...	...	Same	3.0	0.5	1.0	...	...
28	1.0	...	...	1.0	...	...	0.5	Same
29	...	...	2.0	Same	...	...	4.5	1.0

In Table 8 the scores according to Newman show that one tub of pasteurized butter received the same score September 12 and December 22, one tub scored one point higher, while the other 17 tubs de-

creased 0.5 to 7.5 points. Three tubs of unpasteurized scored higher by 0.5 to 3.0 points, while the other sixteen tubs decreased in quality during storage from 0.5 to 5 points.

According to Crawford two tubs of pasteurized scored the same September 12 and December 22, two tubs scored 2.0 points higher, while the other 15 decreased from 0.5 to 4.0 points. Six tubs of unpasteurized butter scored the same at both times, two tubs scored 1.0 and 3.0 points higher, while the other 13 tubs scored lower December 22 by 0.5 to 4.0 points.

TABLE 9. CHURNING DATA 1906 EXPERIMENTAL BUTTER

DATE	Vat No.	Pounds cream received	Av'ge fat percent	Acidity of cream percent	Temperature churned	Hours cream held cold	Loss in buttermilk	
							Pasteurized	Unpasteurized
July 23	11	2000	38	0.56	52	8	....	....
July 24	12	1231	34	0.50	52	9	....	....
July 25	13	1541	38	0.52	52	11	0.30	0.25
July 26	14	1200	34	0.54	54	9	0.10	0.15
July 27	15	1784	38	0.52	54	9	0.25	0.25
July 30	16	2004	36	0.58	54	9	....	0.15
July 31	17	1308	33	0.56	51	9	0.30	0.25
August 1	18	1700	33	0.50	50	9	0.20	0.17
August 2	19	886	32	0.60	52	9	....	....
August 3	20	1561	34	0.62	53	9	0.10	0.10
August 6	21	2156	34	0.60	53	9	0.05	0.10
August 7	22	1443	31	0.56	50	9	0.10	0.08
August 8	23	1836	32	0.60	50	9	0.15	0.10
August 9	24	889	37	0.56	50	9	0.15	0.10
August 10	25	1691	37	0.54	50	9	0.15	0.10
August 13	26	2097	35	0.52	52	9	0.07	0.10
August 14	27	1209	30	0.54	50	9	0.15	0.10
August 15	28	1716	34	0.50	51	11	....	0.10
August 16	29	986	33	0.57	51	9	0.08	0.10
August 17	30	1149	35	0.54	52	9	....	....

One-half of the above cream for each day was pasteurized to a temperature of 180° and no curdling took place.

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The experimental work for this season was carried on at the University creamery. All of the cream delivered from June 2 to July 15 was used with the exception of a small quantity delivered June 8. The total number of pounds of butter made was 7,796.

The work on pasteurization was continued. The butter made from cream held one to three hours after it was cooled to churning temperature, was also compared with the butter made from the same cream held 12 to 15 hours. In all, 16 vats of cream were used. All of the cream in the first and second vats was pasteurized and cooled; half of each vat was churned two hours later and the remainder churned the following morning. One 30-pound tub of butter was

packed from each churning and marked (1) and (2) for vat 1, and (3) and (4) for vat 2. These tubs were not used in the comparison of pasteurized and unpasteurized butter.

One half of the cream in vats 8 and 11 was pasteurized, cooled, and churned two hours later. The other half, in vats 8 and 11, was handled in the same manner but was not pasteurized. Two tubs of butter were packed from each churning; giving the tubs marked 45 and 46 unpasteurized, 47 and 48 pasteurized from vat 8; tubs 65 and 66 unpasteurized and 67 and 68 pasteurized butter from vat 11.

One half of the cream from each of 12 vats was pasteurized and at once cooled to churning temperature. After two to three hours one-half of this cream was churned. The other portion was churned 12 to 15 hours later. The remaining half of the 12 vats of cream was handled in the same manner, except that it was not pasteurized. Two tubs of butter were packed from each churning, giving us 24 tubs of butter made from the cream that was pasteurized and churned in the afternoon, and 24 from the pasteurized cream churned the following morning. A corresponding number of tubs of butter were made at the same time from unpasteurized cream, making a total of 108 tubs packed for scoring. Fifty-two tubs of butter made from the pasteurized cream were compared with fifty-two tubs of butter made from unpasteurized cream. Twenty-six tubs of pasteurized butter and twenty-four tubs of unpasteurized butter churned in the afternoon were compared with a similar number of tubs made from the same cream held a longer period. The butter was stored with the Monarch Refrigerating Company, Chicago.

The acidity of the cream before it was divided for pasteurization varied from 0.45 to 0.58 percent and the fat from 29 to 37 percent. The percent of starter added to the cream varied from 15 to 66 percent, but the amount used for the same day was identical in both the pasteurized and unpasteurized cream.

All the tubs of butter were shipped out in order as follows:

June 11, 12 tubs; June 18, 16 tubs; June 25, 20 tubs; July 2, 16 tubs; July 9, 20 tubs; July 16, 16 tubs, and July 18, 8 tubs.

Each shipment was scored by the writer the day it was shipped and the following day it was scored in Chicago by J. B. Newman. According to this scoring the average for the pasteurized butter by Newman was 92.23, Lee 92.73, and unpasteurized butter by Newman 92.14 and Lee 92.56.

TABLE 10. SCORES BY CARL E. LEE BEFORE SHIPPING, AND BY J. B. NEWMAN, ONE DAY LATER

Date when churned	Vat No.	Churn No.	Tub No.	Unpasteurized		Pasteurized	
				Newman	Lee	Newman	Lee
6/3 p. m.	1	1	1			91.	94.
6/4 p. m.		2	2			88.	93.
6/4 a. m.	2	3	3			92.5	93.5
6/5 a. m.		4	4			94.	94.
6/7 p. m.		5	5	93.5	93.5		
			6	93.	93.5		
6/7 p. m.		6	7			91.	94.
			8			92.	94.
6/8 a. m.	3	7	9	93.	93.5		
			10	92.5	93.5		
6/8 a. m.		8	11			89.	93.
			12			92.	93.
6/11 p. m.		9	13	94.	92.5		
			14	94.	92.5		
6/11 p. m.		10	15			92.	93.
			16			94.	93.
6/12 a. m.	4	11	17	93.	93.		
			18	93.5	93.		
6/12 a. m.		12	19			93.	92.5
			20			92.	92.5
6/14 p. m.		13	21	94.5	92.		
			22	94.5	92.		
6/14 p. m.		14	23			93.	93.
			24			92.	93.
6/15 a. m.	5	15	25	93.	92.		
			26	88.	92.		
6/15 a. m.		16	27			95.	92.
			28			92.	92.
6/18 p. m.		17	29	92.	93.		
			30	89.	93.		
6/18 p. m.		18	31			89.	92.
			32			88.	92.
6/19 a. m.	6	19	33	92.	93.		
			34	93.5	93.		
6/19 a. m.		20	35			89.	92.5
			36			94.5	92.5
6/21 p. m.		21	37	93.5	93.5		
			38	94.	93.5		
6/21 p. m.		22	39			92.	93.5
			40			93.	93.5
6/22 a. m.	7	23	41	94.5	93.		
			42	95.	93.		
6/22 a. m.		24	43			93.	94.
			44			89.	94.

TABLE 10—*Continued*

Date when churned	Vat No.	Churn No.	Tub No.	Unpasteurized		Pasteurized	
				Newman	Lee	Newman	Lee
6/24 p. m.	8	25	45	92.	88.		
			46	93.	88.		
6/24 p. m.		26	47			93.	88.
			48			93.	88.
6/25 p. m.		27	49	88.	93.		
			50	87.	93.		
6/25 p. m.		28	51			91.	93.5
			52			92.5	93.5
6/26 a. m.	9	29	53	89.	93.		
			54	86.	93.		
6/26 a. m.		30	55			91.5	93.
			56			91.	93.
6/28 p. m.		31	57	91.	93.		
			56	94.	93.		
6/28 p. m.		32	59			95.	93.
			60			93.	93.
6/29 a. m.	10	33	61	94.5	93.		
			62	93.5	93.		
6/29 a. m.		34	63			93.	93.
			64			94.	93.
6/21 p. m.	11	35	65	91.	92.		
			66	93.5	92.		
6/21 p. m.		36	67			90.	91.
			68			90.	91.
7/2 p. m.		37	69	93.	93.		
			70	93.	93.		
7/2 p. m.		38	71			86.5	93.5
			72			89.	93.5
7/3 a. m.	12	39	73	92.	93.		
			74	90.	93.		
7/3 a. m.		49	75			93.	91.
			76			89.	91.
7/5 p. m.		41	77	91.	92.		
			78	91.	92.		
7/5 p. m.		42	79			89.	91.
			80			93.5	91.
7/6 a. m.	13	43	81	88.	92.5		
			82	93.	92.5		
7/6 a. m.		44	83			93.	91.
			84			91.5	91.
7/9 p. m.		45	85	93.	93.		
			86	92.	93.		
7/9 p. m.		46	87			95.	92.5
			88			94.	92.5
7/10 a. m.	14	47	89	89.	93.		
			90	94.	93.		
7/10 a. m.		48	91			95.	93.
			92			95.	93.

TABLE 10—*Continued*

Date when churned	Vat No.	Churn No.	Tub No.	Unpasteurized		Pasteurized	
				Newman	Lee	Newman	Lee
7/12 p. m.		49	93	95.	93.		
			94	91.5	93.		
7/12 p. m.		50	95			95.	93.
			96			94.5	93.
7/13 a. m.	15	51	97	91.	93.		
			98	95.	93.		
7/13 a. m.		52	99			93.5	93.
			100			94.5	93.
7/15 p. m.		53	101	93.	94.		
			102	94.5	94.		
7/15 p. m.		54	103			94.5	94.
			104			93.5	94.
7/16 a. m.	16	55	105	95.5	93.5		
			106	94.	93.5		
7/16 a. m.		56	107			92.	93.5
			108			89.	93.5
Average. . .				92.33	92.73	92.14	92.56

The 108 tubs were placed in storage and re-scored July 25 by G. L. McKay, John Crawford, John Mittelstadt, J. B. Newman and J. H. Credicott. Each judge worked independently and without any knowledge of the nature of the experiment.

TABLE 11. RESULT OF SCORING THE 108 TUBS OF BUTTER JULY 25, 1907

	Unpasteurized					Pasteurized				
	Judges					Judges				
Tub No.	Mc-Kay	Newman	Crawford	Mittelstadt	Credicott	Mc-Kay	Newman	Crawford	Mittelstadt	Credicott
1						92.50	94.00	93.00	92.00	92.00
2						93.50	91.00	90.00	92.00	91.00
3						92.00	93.00	93.00	94.50	88.00
4						92.75	94.00	92.00	93.50	89.00
5	93.25	94.50	92.00	93.50	92.00					
6	92.75	95.00	92.00	95.00	95.00					
7						94.00	93.00	93.00	95.00	88.00
8						93.75	93.00	93.00	94.00	93.00
9	92.50	94.50	94.00	94.50	89.00					
10	92.75	94.00	93.00	94.00	93.00					
11						93.50	93.00	93.00	91.00	91.00
12						93.25	94.50	90.00	94.00	92.50
13	94.50	93.00	94.00	93.00	92.00					
14	93.00	93.50	94.00	93.50	90.00					
15						93.00	95.00	93.00	94.00	91.00
16						93.25	94.00	93.00	94.00	91.00
17	93.25	95.00	93.00	93.00	89.00					
18	93.00	92.00	92.00	92.00	91.00					
19						93.50	94.00	92.00	93.50	92.50
20						93.00	95.00	93.00	94.00	92.50
21	93.25	95.00	94.00	93.50	90.00					
22	93.25	94.50	92.00	93.50	93.50					
23						93.00	91.50	91.00	93.00	89.00
24						92.00	94.00	92.00	93.50	92.00
25	93.00	95.00	93.00	92.50	90.00					
26	93.75	94.50	94.00	93.00	89.00					
27						94.00	93.50	91.00	94.00	90.00
28						94.00	93.00	93.00	93.00	93.00
29	93.25	94.00	95.00	95.00	93.00					
30	93.25	95.00	95.00	94.50	93.00					
31						92.75	93.00	94.00	92.50	93.50
32						93.00	92.50	94.00	93.00	92.00
33	93.00	94.00	94.00	94.00	93.00					
34	92.50	93.50	94.00	93.00	93.00					
35						92.75	93.00	94.00	92.50	93.50
36						92.50	93.50	94.00	93.00	92.00
37	92.75	95.00	95.00	94.50	91.50					
38	93.25	93.00	95.00	94.50	93.50					
39						93.50	94.00	94.00	93.50	93.00
40						93.00	94.50	95.00	92.00	93.00
41	93.50	95.00	94.00	94.50	93.00					
42	93.00	94.50	94.00	93.50	92.50					
43						93.00	95.00	94.00	94.00	89.00
44						93.00	94.50	94.00	94.00	94.00
45	91.50	93.00	95.00	93.50	88.00					
46	92.00	93.00	95.00	93.00	88.00					
47						.....	92.00	94.00	92.00	88.00
48						92.50	94.00	94.00	93.00	88.00

TABLE 11—*Continued*

Unpasteurized						Pasteurized				
	Judges					Judges				
Tub No.	Mc-Kay	New-man	Craw-ford	Mittel-stadt	Credi-cott	Mc-Kay	New-man	Craw-ford	Mittel-stadt	Credi-cott
49	92.50	89.00	93.00	91.50	87.00					
50	91.50	91.00	91.00	93.50	87.00					
51						92.50	90.00	93.00	92.50	87.00
52						92.75	92.00	93.00	94.00	89.00
53	92.50	93.00	94.00	93.00	86.00					
54	92.50	92.00	91.00	92.00	93.00					
55						92.75	94.00	93.00	92.00	87.00
56						93.00	94.50	92.00	94.50	92.50
57	92.50	94.00	93.00	93.00	93.00					
58	92.50	94.50	92.00	93.00	92.00					
59						93.00	94.00	91.00	94.00	93.00
60						94.50	94.50	92.00	94.00	92.50
61	92.50	94.75	92.00	94.00	91.00					
62	93.00	93.50	93.00	93.00	.....					
63						93.00	94.50	94.00	93.00	88.00
64						93.50	93.50	90.00	93.50	90.00
65	92.00	95.00	92.00	94.00	93.00					
66	92.75	94.00	92.00	93.00	93.00					
67						93.00	93.50	94.00	93.00	92.50
68						93.75	91.50	94.00	94.50	92.50
69	92.75	94.00	91.00	94.00	93.00					
70	93.00	94.50	93.00	93.50	91.00					
71						93.00	90.00	92.00	94.00	90.00
72						92.75	89.00	91.00	94.50	89.00
73	93.00	94.00	94.00	93.50	92.50					
74	92.50	93.50	93.00	93.50	90.00					
75						93.00	92.50	93.00	93.00	90.00
76						92.50	92.50	93.00	92.00	90.00
77	92.75	94.50	94.00	94.00	90.00					
78	92.50	93.50	93.00	94.00	92.00					
79						92.75	94.00	94.00	94.00	92.00
80						93.00	93.00	93.00	93.00	89.00
81	91.75	94.50	93.00	94.50	90.00					
82	93.75	94.50	93.00	94.50	92.00					
83						93.00	94.00	94.00	92.50	91.50
84						93.50	94.50	94.00	92.50	91.00
85	92.50	93.50	91.00	93.50	86.00					
86	93.00	94.00	92.00	94.00	89.00					
87						92.50	93.50	93.00	94.50	90.00
88						93.25	94.50	91.00	94.50	90.00
89	92.00	92.50	94.00	93.50	88.00					
90	92.75	93.00	91.00	93.00	89.00					
91						93.00	91.50	93.00	94.50	89.00
92						93.50	91.00	94.00	94.00	89.00

TABLE 11—*Continued*

Unpasteurized						Pasteurized				
	Judges					Judges				
Tub No.	Mc-Kay	New-man	Craw-ford	Mittel-stadt	Credi-cott	Mc-Kay	New-man	Craw-ford	Mittel-stadt	Credi-cott
93	92.75	94.00	93.00	93.50	89.00					
94	92.75	94.50	93.00	94.00	92.00					
95						92.75	95.00	94.00	93.00	93.00
96						93.25	93.00	92.00	93.00	93.00
97	92.75	95.00	93.00	94.00	89.00					
98	93.50	95.50	94.00	94.00	90.00					
99						93.00	95.50	94.00	95.00	92.00
100						92.75	95.00	94.00	94.50	90.00
101	92.50	94.50	94.00	94.00	88.00					
102	92.75	94.50	93.00	94.00	89.00					
103						92.75	93.00	93.00	94.50	93.00
104						92.75	93.50	92.00	94.00	92.00
105	93.00	94.50	94.00	94.00	87.00					
106	92.00	94.00	93.00	93.50	88.00					
107						92.75	94.00	92.00	93.00	93.50
108						93.50	94.00	91.00	94.50	91.00
Av.	92.78	93.91	93.17	93.60	90.61	93.08	93.35	92.90	93.50	91.02
Gain		0.56	0.27	0.10		0.30				0.41

TABLE 12. AVERAGE, HIGHEST AND LOWEST, OF THE EIGHT DIFFERENT SCORES ON THE SAME BUTTER JULY 25, 1907*

	Unpasteurized				Pasteurized			
	Tub No.	Av.	Highest	Lowest	Tub No.	Av.	Highest	Lowest
p.m.	5, 6	93.50	95. N.M.	92. C.	7, 8	93.59	95. M.	93. N.C.
a.m.	9, 10	93.66	94.5 N.M.	92.5 Mc.	11, 12	92.78	94.5 N.	90. C.
p.m.	13, 14	93.56	94.5 Mc.	93. McN.M	15, 16	93.66	95. N.	93. Mc.C.
a.m.	17, 18	92.91	95. N.	92. N.C.M.	19, 20	93.5	95. N.	92. C.
p.m.	21, 22	93.62	95. N.	92. C.	23, 24	92.5	94. N.	91. C.
a.m.	25, 26	93.59	95. N.	92.5 M.	27, 28	93.2	94. Mc.	91. C.
p.m.	29, 30	94.37	95. N.C.M.	93.25 Mc.	31, 32	93.09	94. C.	92.5 N.M.
a.m.	33, 34	93.5	94. N.C.M.	92.5 Mc.	35, 36	93.15	94. C.	92.5 Mc.M.
p.m.	37, 38	94.15	95. N.C.	92.75 Mc.	39, 40	93.69	95. C.	92. M.
a.m.	41, 42	94.	95. N.	93. Mc.	43, 44	93.93	95. N.	93. Mc.
p.m.	45, 46	93.25	95. C.	91.5 Mc.	47, 48	93.07	94. N.C.	92. N.M.
p.m.	49, 50	91.62	93.5 M.	89. N.	51, 52	92.47	94. M.	90. N.
a.m.	53, 54	92.5	94. C.	91. C.	55, 56	93.22	94.5 N.M.	92.5 C.M.
p.m.	57, 58	93.06	94.5 N.	92. C.	59, 60	93.37	94.5 Mc.N.	91. C.
a.m.	61, 62	93.22	94.75 N.	92. C.	63, 64	93.19	94.5 N.	90. C.
p.m.	65, 66	93.09	95. N.	92. Mc.C.	67, 68	93.41	94.5 M.	89. N.
p.m.	69, 70	93.22	94.5 N.	91. C.	71, 72	92.03	94.5 M.	91.5 N.
a.m.	73, 74	93.37	94. N.C.	92.5 Mc.	75, 76	92.69	93. McC.M.	92. M.
p.m.	77, 78	93.53	94.5 N.M.	92.5 Mc.	79, 80	93.34	94. N.C.M.	92.75 Mc.
a.m.	81, 82	93.69	94.5 N.M.	91.75 Mc.	83, 84	93.5	94.5 N.	92.5 M.
p.m.	85, 86	92.94	94. N.M.	91. C.	87, 88	93.34	94.5 N.M.	91. C.
a.m.	89, 90	92.72	94. C.	91. C.	91, 92	93.06	94.5 M.	91. N.
p.m.	93, 94	93.44	94.5 N.	92.75 Mc.	95, 96	93.25	95. N.	92. C.
a.m.	97, 98	93.87	95.5 N.	92.75 Mc.	99, 100	94.22	95.5 N.	92.75 Mc.
p.m.	101, 102	93.66	94.5 N.	92.5 Mc.	103, 104	93.19	94.5 M.	92. C.
a.m.	105, 106	93.5	94.5 N.	92. Mc.	107, 108	93.09	94.5 M.	91. C.
Average . . .		93.37	94.76	92.03		93.22	94.46	91.65

*Scores by Credicott omitted

From the foregoing table the average of the 208 scores on 52 tubs from 26 churnings of unpasteurized cream was 93.37, and 93.22 for the butter from the pasteurized cream. The average of all the highest individual scores for each day was 94.76 for the unpasteurized and 94.46 for the pasteurized, and the average of all the lowest scores for each day was 92.03 for the unpasteurized and 91.65 for the pasteurized.

The butter receiving the highest average score 94.37 was packed in tubs 29 and 30 (unpasteurized). The butter churned from the same cream fifteen hours later received an average score of 93.50. Butter made from the same cream pasteurized, received for the afternoon churning an average score of 93.09 and the butter made fifteen hours later a score of 93.15. The highest score, 95.50, was recorded on tubs 98 and 99. These tubs of butter were made the same day, one representing the unpasteurized and the other the pasteurized butter. The highest score on tub 97, which was from the same churning as tub 98, was 95. The average for all scores on tubs 97 and 98 was 93.87. Tub 100 was also scored 95, with an average for all scores on tubs 99 and 100 of 94.22. This gives 0.35 of a point in favor of the pasteurized butter. The butter in tubs 93 and 94 was churned from the same cream as the butter in tubs 97 and 98, the only difference the length of time the cream was held cold before churning. The same thing is true of the butter in tubs 95 and 96 as compared with butter in tubs 99 and 100. The average score for tubs 93 and 94 was 93.44 and for tubs 95 and 96, 93.25, or 0.19 of a point in favor of the unpasteurized butter.

The butter from fifteen out of the twenty-six churnings of unpasteurized cream received a higher average score than the butter made from the pasteurized cream.

SUMMARY OF EACH JUDGE'S SCORING, JULY 25, 1907

Result of McKay's Scoring.—An average of 92.78 for the butter made from the unpasteurized cream and 93.08 from the butter made from the pasteurized cream, or an average of 0.30 of one point higher for the pasteurized butter.

The butter made from both the unpasteurized and pasteurized cream for two days scored the same. The butter made from eighteen of the twenty-six churnings of pasteurized cream, scored from one-eighth to one point higher than that made from corresponding churnings of unpasteurized cream; while that from the other six churnings of unpasteurized cream scored from one-eighth to three-fourths of a point higher than the butter made from the six churnings of pasteurized cream.

The duplicate tubs of butter made from the unpasteurized cream scored the same from five different churnings; from five churnings the score on duplicate tubs varied one-fourth of a point; from eight churnings, one-half point; from four churnings, three-fourths of a point; from two churnings, one point; from one churning, one and one-half points; and from one churning, two points.

The duplicate tubs of butter made from the pasteurized cream scored the same from three churnings; one duplicate tub was overlooked by the judge. The variation in score on duplicate tubs from the other 22 churnings was as follows:

From 10 churnings one-fourth of a point; 7, one-half; 3, three-fourths; 1, one point, and 1 churning one and one-half points.

Result of Newman's Scoring.—An average of 93.91 for the butter

made from the unpasteurized cream and 93.35 for the butter made from the pasteurized cream, or an average of 0.56 of a point in favor of the unpasteurized. The butter made from both the unpasteurized and pasteurized cream scored the same for four day's churnings. The butter made from sixteen of the twenty-six churnings of unpasteurized cream scored from one-eighth to four and three-fourths points higher than the butter made from the pasteurized cream on corresponding days. While the butter made from the pasteurized cream for the other six days scored higher than the butter made from the unpasteurized by one-fourth to one and three-fourth points.

The duplicate tubs of butter made from the unpasteurized cream scored the same from three churnings. The variation in score on duplicate tubs packed from the other twenty-three churnings was as follows:

From 15 churnings one-half of a point; 4, one point; 1, one and one-fourth; 2, two points, and 1, three points.

The duplicate tubs of butter made from the pasteurized cream scored the same from three churnings. The variation in score on duplicate tubs packed from the other 23 churnings was as follows:

From 11 churnings one-half point; 6, one point; 1, one and one-half; 4, two points, and 1, two and one-half of one point.

Result of Crawford's Scoring.—An average of 93.17 for the butter made from the unpasteurized cream, and 92.90 for the butter made from the pasteurized cream, or an average of 0.27 of a point higher for the unpasteurized. The butter made from both the unpasteurized and pasteurized cream scored the same for six out of the twenty-six comparisons. The butter made from thirteen churnings of unpasteurized cream scored from one-half to two points higher than the butter made from the corresponding churnings of pasteurized cream.

From the seven remaining comparisons the butter made from the pasteurized cream scored higher than the butter made from the unpasteurized by one-half to two points.

The variation in score on tubs of butter packed from the same churn was as follows:

Unpasteurized butter:

From 10 churnings, no difference; 11, one point; 3, two points; and 2, three points.

Pasteurized butter:

From 11 churnings, no difference; 10, one point; 3, two points; 1, three points, and 1 four points.

Result of Mittelstadt's Scoring.—An average of 93.60 for the butter made from unpasteurized cream and 93.50 for the butter made from the pasteurized cream, or an average of one-tenth of a point higher for the unpasteurized.

The butter made from both the unpasteurized and pasteurized cream scored the same for two out of the 26 comparisons.

The butter made from eleven churnings of unpasteurized cream scored from one-fourth to two points higher than the butter made from corresponding churnings of pasteurized cream, while from the

other thirteen comparisons the butter made from the pasteurized cream scored higher than the butter from the unpasteurized by one to one and one-fourth points. The variation in score on duplicate tubs of butter from the same churning was as follows:

Unpasteurized butter:

From 8 churnings, no difference; 10, one-half point; 6, one point; 1, one and one-half; and 1, two points.

Pasteurized butter:

From 6 churnings, no difference; 9, one-half point; 5, one point; 4, one and one-half; 1, two and one-half; and 1, three points.

Result of Credicott's Scoring.—An average of 90.61 for the butter made from the unpasteurized cream and 91.02 for the butter made from the pasteurized cream, or an average of 0.41 of a point in favor of the pasteurized. The variation in score on duplicate tubs of butter from the same churning was as follows:

Unpasteurized butter:

From 5 churnings, no difference; 1, one-half point; 6, one point; 6, two points; 1, two and one-half; 3, three points; 1, three and one-half; 1, four points; 1, seven points. One tub overlooked.

Pasteurized butter:

From 9 churnings, no variation; 2, one-half point; 2, one point; 3, one and one-half points; 3, two points; 3, three points; 2, five points; and 1, a variation of five and one-half points.

TABLE 13. VARIATION IN SCORE ON DUPLICATE TUBS JULY 25, 1907

Extent of variation.....		0	¼	½	¾	1	1¼	1½	2	2½	3	3½	4	5	5½	7
McKay	Unpast.	5	5	8	4	2		1	1							
	Past.	3	10	7	3	1		1								
Newman	Unpast.	3		14		4	1		2		2					
	Past.	3		11		6		1	4	1						
Crawford	Unpast.	10				11			3		2	2				
	Past.	11				10			3			1	1			
Mittelstadt	Unpast.	8		10		6		1	1							
	Past.	6		9		5		4		1	1					
Credicott	Unpast.	5		1		6			6	1		3	1	1		1
	Past.	9		2		2		4	3		3			2	1	

After the scoring of July 25, the tubs of butter were again placed in storage at a temperature of 9° to 12° below zero.

December 27, 1907, the butter was re-scored by four of the same judges who scored July 25.

For this scoring the number on the top of the tubs was changed, while the original number remained on the bottom for identification, after scoring.

TABLE 14. RESULT OF SCORING THE 108 TUBS OF BUTTER DECEMBER 27, 1907

Unpasteurized						Pasteurized				
Tub No.	McKay	Newman	Crawford	Mittelstadt	Av. score	McKay	Newman	Crawford	Mittelstadt	Av. score
1	No unpasteurized for comparison					92.5	92.5	91.5	91.	1st 4 not
2						92.5	89.	90.5	89.	used in
3						92.5	90.	92.	93.	general
4						92.75	89.5	92.5	91.	average
5	91.	92.5	92.	92.						
6	92.5	92.	92.5	94.	92.31					
7						93.	92.	91.5	93.	
8						92.75	93.	91.	91.5	92.17
9	93.	92.5	92.5	94.						
10	93.25	92.	92.5	94.	92.87					
11						92.75	91.	91.5	90.5	
12						93.25	91.	91.5	93.5	91.87
13	93.5	91.5	91.5	92.5						
14	92.5	91.5	92.5	93.	92.31					
15						92.25	93.	92.	90.	
16						93.	92.5	92.5	92.	92.15
17	93.5	90.	92.	93.						
18	92.5	90.	91.5	92.	91.81					
19						92.50	92.	92.	93.	
20						93.25	92.	92.5	90.	92.15
21	91.00	91.00	91.50	93.00						
22	92.50	92.00	91.00	92.00	91.75					
23						92.75	91.00	91.50	89.50	
24						92.50	91.00	90.50	91.50	91.28
25	92.25	93.00	92.50	91.00						
26	92.75	93.00	91.50	92.50	92.31					
27						92.50	92.00	91.00	92.50	
28						92.25	92.00	92.50	91.50	92.03
29	92.00	91.00	91.50	93.50						
30	92.00	90.50	92.00	93.00	91.93					
31						92.25	92.00	92.00	91.00	
32						93.25	92.50	91.50	91.00	91.93
33	92.00	92.00	91.50	93.00						
34	91.00	93.00	91.50	91.50	91.93					
35						93.00	92.00	91.00	92.50	
36						92.00	92.00	91.50	93.00	92.12
37	93.50	91.00	92.50	94.00						
38	92.75	91.00	91.50	93.50	92.47					
39						92.00	92.00	91.00	93.00	
40						93.00	92.00	91.50	89.00	91.68
41	92.50	92.00	92.50	93.50						
42	93.00	90.00	92.50	93.50	92.44					
43						93.25	93.50	92.00	93.00	
44						93.00	93.00	91.00	93.50	92.78
45	92.00	90.00	92.00	89.00						
46	90.50	90.00	92.50	90.50	90.81					
47						92.00	90.00	91.50	89.00	
48						91.00	91.00	91.00	90.00	90.68

TABLE 14—*Continued*

Unpasteurized						Pasteurized				
Tub No.	McKay	Newman	Crawford	Mittelstadt	Av. score	McKay	Newman	Crawford	Mittelstadt	Av. score
49	91.00	90.00	91.00	90.00						
50	90.00	88.00	89.50	89.00	89.81					
51						92.25	90.00	91.50	91.00	
52						92.50	89.00	91.50	90.00	90.97
53	89.00	88.00	88.50	93.00						
54	89.00	89.00	91.00	91.00	89.81					
55						92.00	92.00	91.00	91.00	
56						93.50	93.00	90.50	92.50	91.93
57	92.25	93.00	92.00	91.00						
58	92.50	93.50	91.50	89.00	91.84					
59						92.75	89.00	91.00	90.00	
60						93.00	89.50	90.50	92.00	90.47
61	92.75	90.00	92.00	92.50						
62	92.50	91.00	91.50	93.00	91.90					
63						92.75	89.00	91.50	90.00	
64						92.00	90.00	88.50	93.00	90.84
65	92.00	92.00	92.00	93.50						
66	92.75	92.00	91.00	93.00	92.28					
67						93.00	89.00	91.50	92.50	
68						91.50	89.50	92.00	94.00	91.62
69	92.00	91.00	91.00	90.00						
70	92.25	90.00	91.00	92.00	91.15					
71						91.50	90.00	90.50	92.50	
72						92.50	90.00	91.00	93.50	91.44
73	92.50	91.00	91.50	92.50						
74	91.75	90.00	91.50	93.00	91.72					
75						93.00	89.00	90.50	89.00	
76						92.50	89.00	91.00	90.00	90.50
77	90.50	90.00	89.50	88.00						
78	92.00	91.00	90.50	91.00	90.31					
79						92.75	91.00	91.00	90.00	
80						92.00	91.00	90.50	90.00	91.03
81	92.50	90.00	91.50	92.00						
82	92.50	89.00	91.00	92.50	91.40					
83						93.00	89.00	91.00	92.50	
84						92.00	90.00	92.00	91.50	91.37
85	91.50	89.00	89.50	92.00						
86	92.50	88.00	89.50	92.50	90.56					
87						92.50	90.00	90.00	93.00	
88						92.00	89.50	91.50	91.50	91.25
89	91.50	91.00	89.50	90.00						
90	91.50	90.50	91.00	92.00	90.87					
91						92.50	89.00	89.50	93.00	
92						92.75	89.50	90.50	90.00	90.84
93	91.75	92.00	91.00	92.50						
94	92.00	92.00	89.50	91.00	91.47					
95						93.25	92.50	90.50	90.00	
96						93.00	92.00	91.50	90.50	91.65
97	93.50	90.00	91.50	93.00						
98	93.50	90.00	92.00	93.00	92.06					
99						92.00	90.50	90.00	92.50	
100						91.50	91.00	89.50	90.00	90.87

TABLE 14—*Continued*

Unpasteurized						Pasteurized				
Tub No.	McKay	Newman	Crawford	Mittelstadt	Av. score	McKay	Newman	Crawford	Mittelstadt	Av. score
101	92.00	90.00	91.00	92.00						
102	92.00	89.00	92.00	91.50	91.18					
103						91.00	92.00	91.50	93.00	
104						92.50	92.00	91.50	93.50	92.12
105	92.00	90.50	91.50	89.00						
106	92.75	91.00	91.50	91.00	91.15					
107						92.50	90.00	90.50	91.00	
108						92.50	92.00	91.00	93.50	91.62
Av...	92.07	90.82	91.34	91.98	.....	92.50	90.98	91.31	91.54	.....
Gain.	.....	.....	0.03	0.44	.....	0.43	0.16	.....	.....	.....

Result of McKay's Scoring.—An average of 92.07 for the unpasteurized butter and 92.5 for the pasteurized butter, or an average of 0.43 of a point higher for the pasteurized.

The butter from 11 out of the 26 churnings of unpasteurized cream scored higher than the butter from corresponding churnings of pasteurized cream by one-eighth to one and three-fourths points. While from the 15 corresponding churnings of pasteurized and unpasteurized cream the gain was from one-eighth to three and three-fourths points in favor of the pasteurized. The variation in score on two tubs packed from the same churning was as follows:

Unpasteurized butter:

From 6 churnings, same score; 5, a variation of one-fourth point; 2, one-half point; 4, three-fourths; 5, one point; and 4, one and one-half points.

Pasteurized butter:

From 1 churning, same score; 8, a variation of one-fourth point; 4, one-half point; 4, three-fourths; 6, one; and 3, one point.

Result of Newman's Scoring.—An average of 90.82 for the unpasteurized and 90.98 for the pasteurized, or an average of 0.16 points higher for the butter made from the pasteurized cream. The butter from corresponding churnings of pasteurized and unpasteurized cream for one day scored the same. The butter from 10 out of the 26 churnings of unpasteurized cream scored higher by one-half to four points. From the other 15 comparisons the butter made from the pasteurized cream scored higher by one-fourth to four points.

Variation in score on duplicate tubs packed from same churning of unpasteurized butter was as follows:

From 8 churnings, same score; 6, a variation of one-half point; 10, a variation of one point; and 2, a variation of two points.

The pasteurized butter from 10 churnings, the duplicate tubs, scored the same. From 9 churnings, a variation of one-half point; 6, a variation of one point; and 1, a variation of two points.

Crawford's scoring gave an average of 91.34 for the butter from the unpasteurized and 91.31 for the pasteurized, or an average of 0.03

of a point higher for the unpasteurized butter. The butter from both the pasteurized and unpasteurized cream scored the same on two comparisons. The unpasteurized butter from 15 out of the 26 comparisons, scored higher by one-fourth to two points than the butter from the pasteurized cream, while the butter from the pasteurized cream in the other 9 comparisons scored higher by one-fourth to one and one-fourth points.

Scores on duplicate tubs were as follows:

Unpasteurized butter:

From 7 churnings, no variation; 9, a variation of one-half point; 6, one point; 3, one and one-half; and 1, two and one-half points.

Pasteurized butter:

From 3 churnings, no variation between duplicate tubs; 15, a variation of one-half point; 5, one point; 2, one and one-half; 1, three points.

Result of Mittelstadt's Scoring.—An average of 91.98 for the unpasteurized and 91.54 for the pasteurized butter, or an average of 0.44 of a point higher for the unpasteurized. The butter from both the pasteurized and unpasteurized cream scored the same for two comparisons. The butter from 16 churnings out of the 26 of unpasteurized cream scored higher than the butter from the pasteurized cream by one-fourth to three and one-fourth points. While from the other 8 comparisons, the gain was in favor of the pasteurized by one-fourth to two and one-fourth points.

Variation in score on duplicate tubs as follow:

Unpasteurized butter:

From 3 churnings, no variation; 9, a variation of one-half point; 3, one point; 4, one and one-half points; 6, two points, and 1, three points.

Pasteurized butter:

From 2 churnings, no variation; 4, a variation of one-half point; 6, one point; 3, one and one-half; 3, two points; 3, two and one-half; 4, three points; and 1, four points.

TABLE 16. VARIATION IN SCORE ON DUPLICATE TUBS DECEMBER 27, 1907

Extent of variation		0	¼	½	¾	1	1½	2	2½	3	3½	4
McKay	Unpast.	6	5	2	4	5	4					
	Past.	1	8	4	4	6	3					
Newman	Unpast.	8		6		10		2				
	Past.	10		9		6		1				
Crawford	Unpast.	7		9		6	3		1			
	Past.	3		15		5	2			1		
Mittelstadt	Unpast.	3		9		3	4	6		1		
	Past.	2		4		6	3	4	2	4		1

TABLE 15. AVERAGE, HIGHEST AND LOWEST, OF THE EIGHT DIFFERENT SCORES ON THE SAME BUTTER DECEMBER 27, 1907

	Unpasteurized				Pasteurized			
	Tub No.	Av.	Highest	Lowest	Tub No.	Av.	Highest	Lowest
p.m.	5, 6	92.31	94. M.	91. Mc.	7, 8	92.17	93. Mc.M.N.	91. C.
a.m.	9, 10	92.87	94. M.	92. N.	11, 12	91.87	93.5 M.	90.5 M.
p.m.	13, 14	92.31	93.5 Mc.	91.5 N. C.	15,16	92.15	93. Mc.N.	90. M.
a.m.	17, 18	91.81	93.5 Mc.	90. N.	19, 20	92.15	93.25 Mc.	90. M.
p.m.	21, 22	91.75	93. M.	91. McNC.	23, 24	91.28	92.75 Mc.	89.5 M.
a.m.	25, 26	92.31	93. N.	91. M.	27, 28	92.03	92.5McCM.	91. C.
p.m.	29, 30	91.93	93.5 M.	90.5 N.	31, 32	91.93	93.25 Mc.	91. M.
a.m.	33, 34	91.93	93. N. M.	91. Mc.	35, 36	92.12	93. McM.	91. C.
p.m.	37, 38	92.47	94. M.	91. N.	39, 40	91.68	93. McM.	89. M.
a.m.	41, 42	92.44	93.5 M.	90. N.	43, 44	92.78	93.5 N. M.	91. C.
p.m.	45, 46	90.81	92.5 C.	89. M.	47, 48	90.68	92. Mc.	89. M.
p.m.	49, 50	89.81	91. Mc.C.	88. N.	51, 52	90.97	92.5 Mc.	89. N.
a.m.	53, 54	89.81	93. M.	88. N.	55, 56	91.93	93.5 Mc.	90.5 C.
p.m.	57, 58	91.84	93.5 N.	89. M.	59, 60	90.97	93. Mc.	89. N.
a.m.	61, 62	91.90	93. M.	90. N.	63, 64	90.84	93. M.	88.5 C.
p.m.	65, 66	92.28	93.5 M.	91. C.	67, 68	91.62	94. M.	89. N.
p.m.	69, 70	91.15	92.25 Mc.	90. N. M.	71, 72	91.44	93.5 M.	90. N.
a.m.	73, 74	91.72	93. M.	90. N.	75, 76	90.5	93. Mc.	89. N. M.
p.m.	77, 78	90.31	92. Mc.	88. M.	79, 80	91.03	92.75 Mc.	90. M.
a.m.	81, 82	91.40	92.75 Mc.	89. N.	83, 84	91.37	93. Mc.	89. N.
p.m.	85, 86	90.56	92.5 Mc. M	88. N.	87, 88	91.25	93. M.	89.5 N.
a.m.	89, 90	90.87	92. M.	89.5 C.	91, 92	90.84	93. M.	89. N.
p.m.	93, 94	91.47	92.5 M.	89.5 C.	95, 96	91.65	93.25 Mc.	90. M.
a.m.	97, 98	92.06	93.5 Mc.	90. N.	99, 100	90.87	92.5 M.	89.5 C.
p.m.	101, 102	91.18	92. Mc.M.	89. N.	103, 104	92.12	93.5 M.	91. Mc.
a.m.	105, 106	91.15	92.75 Mc.	89. M.	107, 108	91.62	93.5 M.	90. N.
Average		91.55	92.95	89.84		91.53	93.06	89.84

TABLE 17. EFFECTS OF STORAGE UPON QUALITY AND EXTENT OF DECREASE

Extent of decrease		0	¼	½	¾	1	1¼	1½	1¾	2¼	3½					
McKay	Unpast.	5	2	9	7	7	4	4		3	2					
	Past.	9	10	3	4	6	2	7	2	1						
Extent of decrease		0	½	1	1½	2	2½	3	3½	4	4½	4¾	5	5½	6	
Newman	Unpast.		1	2	3	10	5	10	1	4	7	1	2	3	1	
	Past.	4	1	6	8	9	3	5	5	2	2		5	1		
Crawford	Unpast.	6	4	5	11	5	11	3	3		1			1		
	Past.	5	5	1	11	7	7	7	4	1	1					
Mittelstadt	Unpast.	7	8	10	11	3	4	2	1	2	2		1		1	
	Past.	3	9	5	8	8	3	7	1	7	1					

According to McKay, 9 tubs unpasteurized butter scored higher by one-fourth to one point, and 7 tubs pasteurized butter by one-fourth to one-half point. Newman scored one tub unpasteurized one point higher and one tub pasteurized one point higher. Crawford scored two tubs unpasteurized one-half and one point, and three tubs pasteurized one-half to one and one-half points higher for December scoring.

TABLE 18. COMPARING QUALITY ON BASIS OF AVERAGE OF ALL SCORES OF JULY 25 AND DECEMBER 27. ALSO INDICATING DECREASE BETWEEN FIRST AND SECOND SCORING

Unpasteurized				Pasteurized			
Tub No.	Scores		Decrease	Tub No.	Scores		Decrease
	July 25	Dec. 27			July 25	Dec. 27	
5, 6	93.5	92.31	1.19	7, 6	93.59	92.17	1.42
9, 10	93.66	92.87	0.79	11, 12	92.78	91.87	0.91
13, 14	93.56	92.31	1.25	15, 16	93.66	92.15	1.51
17, 18	92.91	91.81	1.10	19, 20	93.50	92.15	1.25
21, 22	93.62	91.75	1.87	23, 24	92.5	91.28	1.22
25, 26	93.59	92.31	1.28	27, 28	93.20	92.03	1.17
29, 30	94.37	91.93	2.44	31, 32	93.09	91.93	1.16
33, 34	93.5	91.93	1.57	35, 36	93.15	92.12	1.03
37, 38	94.15	92.47	1.68	39, 40	93.69	91.68	2.01
41, 42	94.00	92.44	1.56	43, 44	93.93	92.78	1.15
45, 46	93.25	90.81	2.44	47, 48	93.07	90.68	2.39
49, 50	91.62	89.81	1.81	51, 52	92.47	90.97	1.50
53, 54	92.5	89.91	2.69	55, 56	93.22	91.93	1.29
57, 58	93.06	91.84	1.22	59, 60	93.37	90.97	2.40
61, 62	93.22	91.90	1.32	63, 64	93.19	90.84	2.35
65, 66	93.09	92.28	0.81	67, 68	93.41	91.62	1.79
69, 70	93.22	91.15	2.07	71, 72	92.03	91.44	0.59
73, 74	93.37	91.72	1.65	75, 76	92.69	90.5	2.19
77, 78	93.53	90.31	3.22	79, 80	93.34	91.03	2.31
81, 82	93.69	91.40	2.29	83, 84	93.5	91.37	2.31
85, 86	92.94	90.56	2.38	87, 88	93.34	91.25	2.09
89, 90	92.72	90.87	1.85	91, 92	93.06	90.84	2.22
93, 94	93.44	91.47	1.97	95, 96	93.25	91.65	1.60
97, 98	93.87	92.06	1.81	99, 100	94.22	90.87	3.35
101, 102	93.66	91.18	2.48	103, 104	93.19	92.12	1.07
105, 106	93.50	91.15	2.35	107, 108	93.09	91.62	1.37
Average	93.37	91.55	1.80		93.22	91.53	1.67

TABLE 19. VARIATION IN SCORE ACCORDING TO EACH JUDGE ON 104 TUBS OF BUTTER BETWEEN JULY 25 AND DECEMBER 27

1907

Unpasteurized									Pasteurized								
	McKay		Newman		Crawford		Mittlestadt			McKay		Newman		Crawford		Mittelstadt	
Tub No.	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Tub No.	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase
5	2¼		2		No Change		1½		7	1		1		1½		2	
6	¼		3			½	1		8	1		No Change		2		2½	
9		½	2		1½		½		11	¾		2		1½		½	
10		½	2		½		No Change		12	No Change		3½			1½	½	
13	1		1½		2½		½		15	¾		2		1		4	
14	½		2		1½		½		16	¼		1½		½		2	
17		¼	5		1		No Change		19	1		2		No Change		½	
18	½		2		½		No Change		20		¼	3		½		4	
21	2¼		4		2½		½		23	¼		½			½	3½	
22	¾		2½		1		1½		24		½	3		1½		2	
25	¾		2		½		1½		27	1½		1½		No Change		1½	
26	1		1½		2½		½		28	1¾		1		½		1½	
29	1¼		3		3½		1½		31	½		1		2		1½	
30	1¼		4½		3		1½		32		¼	No Change		2½		2	
33	1		2		2½		1		35		¼	1		3		No Change	
34	1½		½		2½		1½		36	½		1½		2½		No Change	
37		¾	4		2½		½		39	1½		2		3		½	
38	½		2		3½		1		40	No Change		2½		3½		3	
41	1		3		1½		1		43		¼	1½		2		1	
42	No Change		4½		1½		No Change		44	No Change		1½		3		½	
45		½	3		3		4½		47			2		2½		3	
46	1½		3		2½		2½		48	1½		3		3		3	
49	1½			1	2		1½		51	¼		No Change		1½		1½	
50	1½		3		1½		4½		52	¼		3		1½		4	
53	3½		5		5½		No Change		55	¾		2		2		1	
54	3½		3		No Change		1		56		½	1½		1½		2	

TABLE 19—*Continued*

Unpasteurized									Pasteurized								
	McKay		Newman		Crawford		Mittlestadt			McKay		Newman		Crawford		Mittelstadt	
Tub No.	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Tub No.	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase
57	¼		1		1		2		59	¼		5		No Change		4	
58	No Change		1		½		4		60	1½		5		1½		2	
61		¼	4¾		No Change		1½		63	¼		5½		2½		3	
62	½		2½		1½		No Change		64	1½		3½		1½		½	
65	No Change		3		No Change		½		67	No Change		4½		2½		½	
66	No Change		2		1		No Change		68	2¼		2		2		½	
69	¾		3		No Change		4		71	1½		No Change		1½		1½	
70	¾		4½		2		1½		72	¼			1	No Change		1	
73	½		3		2½		1		75	No Change		3½		2½		4	
74	¾		3½		1½		½		76	No Change		3½		2		2	
77	2¼		4½		4½		6		79	No Change		3		3		4	
78	½		2½		2½		3		80	1		2		2½		3	
81		1	4½		1½		2½		83	No Change		5		3		No Change	
82	1¼		5½		2		2		84	1½		4½		2		1	
85	1		4½		1½		1½		87	No Change		3½		3		1½	
86	½		6		2½		1½		88	1¼		5			½	3	
89	½		1½		4½		3½		91	½		2½		3½		1½	
90	1¼		2½		No Change		1		92	¾		1½		3½		4	
93	1		2		2		1		95		½	2½		3½		3	
94	¾		2½		3½		3		96	¼		1		½		2½	
97		¾	5		1½		1		99	1		5		4		2½	
98	No Change		5½		2		1		100	1¼		4		4½		4½	
101	½		4½		3		2		103	1¾		1		1½		1½	
102	¾		5½		1		2½		104	¼		1½		½		½	
105	1		4		2½		5		107	¼		4		1½		2	
106		¾	3		1½		2½		108	1		2		No Change		1	

1908

This work was carried on at the University creamery, using all the butter fat delivered in both the milk and cream from May 2 until June 30. The milk contained a total of 3,614 pounds of butter fat. Deliveries were made daily by the patrons. The milk was skimmed and the cream was stored in the refrigerator until the churning days.

The remainder of the butter fat was delivered in cream. During May, 65 patrons made 435 deliveries and in June, 71 patrons, 571 deliveries. The cream patrons were asked to consider Tuesdays and Fridays the regular cream receiving days. A few of them did not comply with this request, but delivered when convenient. The cream delivered irregularly was stored with the cream from the milk.

For example, cream delivered on Saturday was not churned until the following Tuesday. Wednesday's and Thursday's deliveries were, as a rule, churned on Friday.

Since most of the cream was delivered twice a week, the acidity was comparatively high when received and the quality from day to day was very uniform. On the regular churning days, all of the cream in the refrigerator was placed in the receiving vat and mixed with that day's delivery. While the cream was being divided it was kept stirred, one-half flowing directly into the pasteurizer and heated to a temperature of 180° F. This was collected from the cooler in 20 gallon cans. While these cans were filling, cans of similar size were being filled with unpasteurized cream from the same vat. By this method it was possible to fill two cans at the same time with the same grade of cream, one of which was pasteurized.

The smallest lot of cream handled for a single day's comparison was 2096 pounds. The average number of pounds of cream for the 20 churning days was 2848. In most cases as soon as a portion of the cream was in the ripener, the cooling was begun. The first three and the last one of the 20 comparisons of pasteurized and unpasteurized cream were held at churning temperature from 12 to 15 hours. Starter, thoroly mixed, then divided equally was added to both the pasteurized and unpasteurized cream for the first six, the eighth and the last eight comparisons. With the other five no starter was used on account of limited vat capacity.

On each day after the cream had been divided both lots were again divided and churned in two different churns.

Four 30 pound tubs of butter were packed from each churning, making a total of eight tubs each of pasteurized and unpasteurized butter. Two tubs from each of the 80 churnings were shipped to New York and the other 160 tubs stored in Chicago. The total amount of butter made for this experiment was 21,523 pounds.

The following Table shows the days when the cream was divided, the percent of fat and acidity of the cream before it was divided, total pounds in the pasteurized and unpasteurized lots and pounds of starter added to each; number of hours cream was held at ripening temperature before cooled to churning temperature, also number of hours the cream was held cold before churning.

TABLE 20. RECORD OF HANDLING THE CREAM BEFORE IT WAS CHURNED IN MAKING THE 1908 EXPERIMENTAL BUTTER

Date	Total Lb.	Percent Fat	Acidity	Lb.			Hrs. at ripening temp.	Hrs. held cold
				Past. lot.	Unpast. lot	Starter		
5/6	2654	30.5	.36	1320	1334	169	2 hours	15–17
5/8	3045	31.	.40	1530	1515	240	2 "	15–17
5/12	3112	31.	.52	1555	1557	123	½ hour	15–17
5/15	2827	31.5	.52	1416	1411	245	At once	4–6
5/19	2881	33.	.50	1448	1433	250	" "	3–5
5/22	2990	33.	.50	1430	1460	236	" "	3–5
5/26	3363	31.5	.54	1689	1674	None	" "	6–4
5/29	2879	31.	.52	1458	1421	212	" "	6–4
6/2	3224	32.	.50	1615	1609	None	" "	5–3½
6/5	3322	32.	.52	1651	1671	None	" "	3–5
6/9	3525	32.5	.54	1759	1766	None	" "	3–5
6/12	3402	32.	.49	1721	1681	None	" "	3–5
6/16	2754	33.	.50	1386	1368	271	" "	3–5
6/18	2234	31.	.50	1121	1113	282	" "	3–5
6/19	3054	29.5	.50	1548	1506	168	" "	3–0
6/23	2904	31.	.48	1476	1428	240	" "	3–5
6/25	2096	32.	.57	1095	1001	283	" "	3–5
6/26	2505	29.5	.50	1255	1220	286	" "	3–4
6/30	2136	31.	.50	1068	1068	142	" "	3–5
7/1 a.m.	2158	24.5	.50	1085	1073	150	" "	12–14

THE 1908 BUTTER WHICH WAS SHIPPED TO CHICAGO

All of the butter shipped to Chicago was put in cold storage within twenty hours after it was taken out of the University Refrigerator. The temperature of the University refrigerator was about 32° F.

Table showing when each shipment reached the Monarch Refrigerators in Chicago, and the age of the butter at that time is given below.

Number of tubs	Date placed in storage	Date butter was made	Age in days
24	May 16, 1908	May 6, 9, 13, 1908	3 to 10
16	May 23, 1908	May 15, 19, 1908	4 to 8
16	May 28, 1908	May 22, 26, 1908	2 to 6
16	June 4, 1908	May 29, 6, 2, 1908	2 to 5
16	June 12, 1908	June 5, 9, 1908	3 to 7
16	June 19, 1908	June 12, 16, 1908	3 to 7
24	June 25, 1908	June 18, 19, 23, 1908	2 to 7
32	July 3, 1908	June 25, 26, 27 and July 1, 1908	2 to 8

CHICAGO LOT

The temperature of the Chicago storage room ranged from 8 to 12° below zero. July 13, all of the butter was taken out of the refrigerator and placed in a tempering room where it gradually warmed to scoring condition. July 14, the 160 tubs of butter were scored by five judges, each working independently with no knowledge of what tubs contained pasteurized or unpasteurized butter, or which tubs were duplicates.

TABLE 21. RESULT OF THE FIVE JUDGES WORK OF SCORING THE 160 TUBS OF BUTTER IN CHICAGO ON JULY 14, 1908

			Pasteurized					Unpasteurized				
Vat No.	Churn No.	Tub No.	Crawford	Newman	McKay	Woolverton	Lee	Crawford	Newman	McKay	Woolverton	Lee
1	1	201	93.0	94.0	92.75	93.5	92.5					
		203	93.0	92.0	91.50	93.0	93.0					
	2	202	93.0	93.0	92.25	93.5	93.0					
		204	93.0	92.5	92.5	93.5	93.0					
	3	205						93.0	94.0	93.0	94.0	93.0
		207						93.0	93.0	91.0	93.0	93.5
	4	206						93.0	93.0	92.25	92.0	93.
		208						92.5	91.5	92.75	93.0	92.5
			Av. 92.87					Av. 92.80				
2	5	209	93.0	94.0	92.0	93.5	93.0					
		211	93.0	93.0	91.75	93.5	92.0					
	6	210	93.0	93.0	91.5	93.0	93.0					
		212	93.0	93.0	92.75	93.0	93.0					
	7	213						93.0	90.0	91.0	93.0	92.0
		215						92.5	92.0	91.0	92.0	92.5
	8	214						93.0	91.0	91.0	93.5	92.0
		216						92.0	93.0	92.0	93.5	92.0
			Av. 92.85					Av. 92.10				
3	9	217	92.0	90.5	92.75	92.0	90.5					
		219	91.0	90.5	92.0	92.5	90.5					
	10	218	91.5	91.5	92.25	92.0	92.5					
		220	91.5	90.0	92.5	90.0	90.5					
	11	221						92.0	92.0	90.0	93.5	92.0
		223						92.0	92.5	92.0	92.0	91.0
	12	222						92.5	93.0	91.0	93.5	93.0
		224						92.5	91.5	93.0	93.0	92.0
			Av. 91.42					Av. 92.20				
4	13	225	92.5	91.5	91.5	92.0	91.5					
		227	91.5	91.0	92.0	92.5	92.0					
	14	226	93.0	92.0	92.75	92.5	92.0					
		228	92.5	90.5	92.0	93.0	92.0					
	15	229						93.0	93.0	91.5	93.0	92.0
		231						93.5	90.5	90.5	93.0	90.5
	16	230						93.0	92.0	91.5	93.0	92.0
		232						92.5	93.5	91.0	93.5	92.5
			Av. 92.01					Av. 92.25				

TABLE 21—*Continued*

Vat No.	Churn No.	Tub No.	Pasteurized: Crawford	Pasteurized: Newman	Pasteurized: McKay	Pasteurized: Woolverton	Pasteurized: Lee	Unpasteurized: Crawford	Unpasteurized: Newman	Unpasteurized: McKay	Unpasteurized: Woolverton	Unpasteurized: Lee
5	17	233	93.0	93.0	92.0	92.0	92.0					
		235	92.0	92.0	92.0	93.0	93.0					
	18	234	93.0	92.0	92.0	92.0	92.0					
		236	92.0	91.0	92.75	93.5	90.5					
	19	237						93.0	93.0	92.5	93.0	92.5
		239						93.0	92.0	91.5	92.0	92.0
	20	238						93.5	93.0	92.0	93.0	92.5
		240						93.0	92.0	92.5	93.5	92.5
			Av. 92.23					Av. 92.60				
6	21	241	93.0	93.5	92.5	93.5	92.0					
		243	93.0	93.0	92.0	93.5	92.5					
	22	242	93.0	91.0	92.0	93.0	92.5					
		244	93.0	93.5	92.0	93.5	92.5					
	23	245						93.0	93.5	92.5	93.0	93.5
		247						93.0	94.0	93.0	94.0	93.5
	24	246						92.5	90.0	92.0	90.0	92.5
		248						93.0	92.5	92.5	92.0	93.0
			Av. 92.72					Av. 92.65				
7	25	249	92.5	92.0	91.0	93.0	92.5					
		251	93.0	93.0	93.0	92.5	93.0					
	26	250	93.0	93.5	92.0	93.5	92.0					
		252	93.0	91.5	93.0	93.0	92.5					
	27	253						93.0	93.5	92.5	93.0	93.0
		255						93.0	93.0	92.5	92.0	93.0
	28	254						93.0	93.0	91.5	93.0	92.5
		256						93.0	92.5	92.5	93.5	92.0
			Av. 92.62					Av. 92.75				
8	29	257	93.0	92.5	92.5	93.0	92.0					
		259	93.0	93.0	92.5	92.0	91.5					
	30	258	93.5	90.5	92.5	93.0	90.5					
		260	93.0	93.0	92.0	93.0	92.0					
	31	261						93.0	93.0	92.5	90.0	92.0
		263						92.5	93.5	91.75	93.0	93.0
	32	262						93.0	93.0	91.5	93.0	92.0
		264						93.0	92.0	92.0	90.0	92.0
			Av. 92.40					Av. 92.28				

TABLE 21—*Continued*

			Pasteurized					Unpasteurized				
Vat No.	Churn No.	Tub No.	Crawford	Newman	McKay	Woolverton	Lee	Crawford	Newman	McKay	Woolverton	Lee
9	33	265	92.0	93.0	91.0	92.0	92.5					
		267	92.5	92.5	90.5	92.0	92.5					
	34	266	91.5	91.5	92.25	92.5	92.5					
		268	92.5	92.0	92.75	93.0	92.5					
	35	269						92.0	93.0	91.0	88.0	92.0
		271						92.0	93.0	92.25	93.0	92.5
	36	270						93.0	92.0	92.75	92.0	92.0
		272						93.0	93.0	91.75	93.0	92.5
			Av. 92.17					Av. 92.18				
10	37	273	93.0	92.5	91.75	93.0	92.5					
		275	92.5	90.0	91.75	93.0	92.0					
	38	274	93.0	93.0	92.5	93.5	92.5					
		276	93.0	92.0	92.5	92.0	92.5					
	39	277						92.5	91.5	92.0	93.5	92.5
		279						93.0	93.0	91.0	92.0	93.0
	40	278						93.0	93.5	92.75	93.0	93.0
		280						93.0	93.0	92.75	93.0	93.0
			Av. 92.42					Av. 92.70				
11	41	281	93.0	92.5	91.5	92.0	93.0					
		283	92.5	92.5	91.0	93.0	92.0					
	42	282	93.0	91.5	92.0	92.0	92.5					
		284	93.0	92.0	92.0	92.5	93.0					
	43	285						92.5	93.0	91.5	87.0	92.0
		287						92.5	92.0	92.0	92.0	92.5
	44	286						93.0	93.0	92.25	93.0	92.5
		288						93.0	92.5	91.75	93.0	92.5
			Av. 92.32					Av. 92.07				
12	45	289	93.0	91.0	91.0	90.0	92.5					
		291	93.0	90.5	92.5	93.0	92.5					
	46	290	93.0	90.5	92.0	93.0	92.0					
		292	93.0	91.5	92.0	93.0	92.5					
	47	293						93.0	93.5	93.0	93.5	93.0
		295						92.5	93.0	92.5	93.0	92.0
	48	294						92.0	93.0	92.5	93.0	91.5
		296						93.0	92.0	91.5	93.0	92.5
			Av. 92.07					Av. 92.65				

TABLE 21—*Continued*

Vat No.	Churn No.	Tub No.	Pasteurized: Crawford	Newman	McKay	Woolverton	Lee	Unpasteurized: Crawford	Newman	McKay	Woolverton	Lee
13	49	297	93.0	91.5	92.0	92.0	92.5					
		299	92.5	93.0	91.5	93.0	92.0					
	50	298	92.5	92.0	92.0	92.0	92.0					
		300	93.0	92.0	91.0	89.0	92.5					
	51	301						92.0	92.5	93.0	89.0	92.0
		303						92 5	93.0	91.75	87.0	92.5
	52	302						93.0	93.0	91.5	92.0	92.5
		304						93.0	92.0	91.5	93.0	92.5
			Av. 92.05					Av. 91.96				
14	53	305	93.5	90.5	93.0	86.0	93.0					
		307	93.0	90.5	93.0	90.0	93.0					
	54	306	93.0	91.5	92.5	92.0	93.0					
		308	93.0	92.5	92.5	90.0	92.5					
	55	309						93.0	92.0	92.5	93.0	93.0
		311						93.0	93.0	91.0	92.5	93.0
	56	310						93.0	92.5	92.5	92.0	92.5
		312						93.0	92.0	92.0	93.0	93.0
			Av. 91.90					Av. 92.57				
15	57	313	93.0	92.0	93.0	93.0	92.5					
		315	93.0	92.5	93.0	93.0	92.5					
	58	314	93.5	93.0	92.5	93.0	92.0					
		316	93.0	92.5	92.25	92.0	92.5					
	59	317						94.0	93.0	92.25	92.5	92.5
		319						94.0	93.0	92.5	90.0	92.5
	60	318						93.5	93.0	92.5	93.0	92.5
		320						93.5	92.5	92.0	92.0	93.0
			Av. 92.68					Av. 92.68				
16	61	321	93.0	93.0	91.75	92.0	92.5					
		323	92.5	92.0	92.0	92.0	92.0					
	62	322	93.0	91.5	92.5	93.0	92.5					
		324	93.0	93.0	91.0	87.0	92.5					
	63	325						93.0	93.0	92.0	92.0	92.5
		327						93.0	93.0	92.75	93.0	93.0
	64	326						93.5	93.0	91.75	92.0	92.5
		328						93.0	92.5	91.5	87.0	93.0
			Av. 92.08					Av. 92.35				

TABLE 21—*Continued*

Vat No.	Churn No.	Tub No.	Pasteurized Crawford	Newman	McKay	Woolverton	Lee	Unpasteurized Crawford	Newman	McKay	Woolverton	Lee
17	65	329	91.0	88.0	90.5	87.0	90.5					
		331	91.0	86.0	91.0	87.0	90.5					
	66	330	91.5	86.0	91.0	86.0	90.0					
		332	92.0	85.5	91.5	86.0	90.0					
	67	333						91.0	92.0	90.5	87.0	90.5
		335						90.5	91.5	90.5	86.0	90.0
	68	334						90.5	90.0	90.0	86.0	90.0
		336						92.0	91.5	91.0	89.0	90.5
			Av. 89.50					Av. 90.00				
18	69	337	93.0	93.0	92.75	92.0	92.5					
		339	93.5	92.5	92.5	93.0	92.0					
	70	338	93.0	93.0	92.75	93.0	92.5					
		340	92.5	93.0	91.75	93.0	92.5					
	71	341						93.5	93.0	91.5	93.0	92.5
		343						93.0	93.0	92.75	93.0	93.0
	72	342						92.0	92.0	91.5	92.5	92.5
		344						93.0	92.0	90.5	92.0	93.0
			Av. 92.68					Av. 92.46				
19	73	345	93.0	93.0	92.0	93.0	93.0					
		347	93.0	93.0	92.5	93.0	92.0					
	74	346	93.0	91.5	92.25	92.0	93.0					
		348	93.0	91.0	92.5	93.0	92.0					
	75	349						93.0	93.5	92.5	92.0	93.0
		351						93.0	93.0	92.0	93.0	92.5
	76	350						93.0	93.0	90.5	93.0	92.0
		352						93.0	93.0	92.5	93.5	92.5
			Av. 92.53					Av. 92.67				
20	77	353	93.0	91.5	92.0	92.5	92.5					
		355	93.0	89.5	92.0	92.5	92.0					
	78	354	91.0	92.5	93.0	93.0	93.0					
		356	91.0	92.5	92.0	92.5	92.0					
	79	357						92.5	92.5	92.5	92.5	92.5
		359						93.5	93.0	92.5	87.0	92.5
	80	358						93.0	93.0	93.0	92.0	92.0
		360						93.0	93.0	92.5	92.0	92.0
			Av. 92.15					Av. 92.37				
Av.			92.7	91.8	92.1	92.1	92.2	92.8	92.6	91.9	92.	92.4
Gain			....	....	0.2	0.1	....	0.1	0.8	....	....	0.2

The butter had all been scored by Lee the day after each lot of 8 tubs were made.

The score placed upon the butter at that time was the same as the scores recorded in Table No. 31, New York lot of butter. Tubs Nos. 201 and 203 for Chicago were packed from the same churning as 401 and 403 for New York, 202 and 204 Chicago and 402 and 404 New York from same churning, the two churnings taken from the same vat of pasteurized cream May 6, 1908.

Table 22 is compiled from Table 21. Each of the twenty comparisons was represented by four tubs. The average of the four scores on the pasteurized butter from Vat 1, according to Crawford was 93; Newman, 92.87; McKay, 92.25; Woolverton, 93.37; and Lee, 92.87. The butter made from the same cream unpasteurized received the following average scores. Crawford and Newman 92.87; McKay, 92.25; Woolverton and Lee, 93.00. On this day two of the judges

TABLE 22. COMPARISON OF PASTEURIZED AND UNPASTEURIZED BUTTER BASED UPON SCORES OF JULY 14, 1908, CHICAGO

Vat No.	Pasteurized					Unpasteurized				
	Crawford	Newman	McKay	Woolverton	Lee	Crawford	Newman	McKay	Woolverton	Lee
1	93.	92.87	92.25	93.37	92.87	92.87**	92.87*	92.25*	93. **	93. *
2	93.	93.25	92.	93.25	92.75	92.62**	91.5 **	91.25**	93. **	92.12**
3	91.5	90.62	92.37	91.62	91.	92.25*	92.25*	91.5 **	93. *	92. *
4	92.37	91.25	92.06	92.5	91.87	93. *	92.25*	91.12**	93.12**	91.75**
5	92.5	92.	92.18	92.62	91.87	93.12*	92.5 *	92.12**	92.87*	92.37**
6	93.	92.75	92.12	93.37	92.37	92.87	92.5 **	92.5 *	92.25**	93.12*
7	92.87	92.5	92.25	93.	92.5	93. *	93. *	92.25*	92.87**	92.62*
8	93.12	92.25	92.37	92.75	91.5	92.87**	92.87*	91.93**	91.5 **	92.25*
9	92.12	92.25	91.62	92.37	92.5	92.5 *	92.75*	91.93*	91.5 **	92.25**
10	92.87	91.87	92.12	92.37	91.37	92.87*	92.75*	92.12*	92.87*	92.87*
11	92.87	92.12	91.62	92.37	92.62	92.75**	92.62*	91.87*	91.25**	92.37**
12	93.	90.87	91.87	92.25	92.37	92.62**	92.87*	92.37*	93.12*	92.25**
13	92.75	92.12	91.62	91.5	92.25	92.62**	92.62*	91.93*	90.25**	92.37*
14	93.12	91.25	92.75	89.5	92.87	93. **	92.37*	92. **	92.62 *	92.87*
15	93.12	92.5	92.68	92.75	92.37	93.75*	92.87*	92.31**	91.87 **	92.62*
16	92.87	92.37	91.81	91.	92.37	93.12 †	92.87†	92. †	91. †	92.75†
17	91.37	86.37	91.00	86.5	90.25	91. **	91.25*	90.5 **	87. *	90.25*
18	93.	92.87	92.43	92.75	92.37	92.87**	92.5 **	91.56**	92.62**	92.75*
19	93.	92.12	92.31	92.75	92.5	93. *	93.12*	91.87**	92.87*	92.4 *
20	92.	91.5	92.25	92.62	92.37	93. *	92.87*	92.62*	90.87**	92.25**

*Butter made from both the pasteurized and unpasteurized cream received the same average score.
**Higher score for the pasteurized butter.
†Higher for unpasteurized.

favored the pasteurized, one the unpasteurized butter, while there was no difference according to the other two judges.

This shows that the average of the 400 scores on pasteurized compared with the 400 on unpasteurized butter gave 0.15 of a point in favor of the unpasteurized. The average score for each day's make of the pasteurized butter for eight out of the twenty days is the same or higher than the average score of the unpasteurized butter.

There were only two days that the butter made from the pasteurized cream, and one day butter from unpasteurized cream did not receive one or more scores of 93 or 94. A comparison somewhat similar can be made of the lowest score for each day. The judge who was responsible for the lowest score sometimes gave the highest score on a duplicate tub of the same day's make.

Tables 24 and 25 are self explanatory, giving the result of scoring.

TABLE 23. AVERAGE, HIGHEST AND LOWEST, OF THE TWENTY DIFFERENT SCORES ON THE SAME BUTTER JULY 14, 1908

Pasteurized				Unpasteurized			
Tub No.	Average	Highest	Lowest	Tub No.	Average	Highest	Lowest
201–202	92.87	94. N.	91.5 Mc.	205–208	92.80	94. N. W.	91. Mc.
209–212	92.85	94. N.	91.5 Mc.	213–216	92.10	93.50 W.	90. N.
217–220	91.42	92.75 Mc.	90. N. W.	221–224	92.20	93.50 W.	90. Mc.
225–228	92.01	93. C. W.	90.5 N.	229–232	92.25	93.5 N.C.W.	90.5 N.Mc.L
233–236	92.23	93.5 W.	90.5 L.	237–240	92.6	93.5 C. W.	91.5 Mc.
241–244	92.72	93.5 N. W.	91. N.	245–248	92.65	94. N. W.	90. N. W.
249–252	92.62	93. N. W.	91. Mc.	253–256	92.75	93.5 N. W.	91.5 Mc.
257–260	92.40	93.5 C.	90.5 L. N.	261–264	92.28	93.5 N.	90. W.
265–268	92.17	93. N. W.	90.5 Mc.	269–272	92.18	93. C. N. W.	88. W.
273–276	92.42	93.5 W.	90. N.	277–280	92.70	93.5 N. W.	91. Mc.
281–284	92.32	93. C. W. L.	91. Mc.	285–288	92.07	93. C. N. W.	87. W.
289–292	92.07	93. C. W.	90. W.	293–296	92.65	93.5 N. W.	91.5 Mc. L.
297–300	92.05	93. C. N. W.	89. W.	301–304	91.96	93. C. N. W.	87. W.
305–308	91.90	93.5 C.	86. W.	309–312	92.57	93. W.L.C.N.	91. Mc.
313–316	92.68	93.5 C.	92. N.W.L.	317–320	92.68	94. C.	90. W.
321–324	92.08	93. C. N. W.	87. W.	325–328	92.35	93.5 C.	87. W.
329–332	89.50	92.0 C.	85.5 N.	333–336	90.00	92. C. N.	86. W.
337–340	92.68	93.5 C.	91.75 Mc.	341–344	92.46	93.5 C.	90.5 M.
345–348	92.53	93. W. L. C.N.	91. N.	349–352	92.67	93.5 W. N.	90.5 Mc.
353–356	92.15	93. W.L.C.Mc.	89.5 N.	357–360	92.37	93.5 C.	87. W.
Av. . . .	92.16	93.21	90.18		92.31	93.40	89.55

TABLE 24. VARIATION IN SCORE ON DUPLICATE TUBS, JULY 14, 1908

	Extent of variation		0	¼	½	¾	1	1¼	1½	2	2½	3	4	5	5½	6
		Churn No.														
McKay	Past.	1	6	3	7	1	0	1	1	1						
		2	5	4	3	2	4	1	1	0						
	Unpast.	1	4	1	4	2	3	3	1	2						
		2	2	1	9	0	6	0	0	2						
Lee	Past.	1	6		10		4									
		2	9		6		2		2	1						
	Unpast.	1	5		11		3		1							
		2	7		11		2									
Crawford	Past.	1	9		8		3									
		2	12		6		2									
	Unpast.	1	11		8		1		1							
		2	11		5		3									
Newman	Past.	1	4		7		4		1	3	1					
		2	4		6		4		3	1	2					
	Unpast.	1	4		9		4		1	1	1					
		2	3		6		5		4	1	1					
Woolverton	Past.	1	9		4		5					1	1			
		2	6		6		2		2	2		1				1
	Unpast.	1	2		2		8		2	1	1	1		2	1	
		2	5		6		5			1		2		1		

TABLE 25. RESULT OF FIVE JUDGES, SCORING 160 TUBS OF BUTTER MAKING A TOTAL OF 800 INDIVIDUAL SCORES TABULATED ON THE BASIS OF LIKE SCORE

Judges	Score	94	93½	93	92¾	92½	92¼	92	91¾	91½	91	90½	90	89½	89	88	87	86	85½
McKay	Past.			7	8	16	5	23	5	6	8	2							
	Unpast.			6	6	19	4	11	5	12	10	5	2						
Lee	Past.			16		31		22		2		7	2						
	Unpast.		3	20		30		20		1	1	3	2						
Crawford	Past.		4	50		11		5			5	5							
	Unpast.	2	7	46		13		9			1	2							
Newman	Past.	2	3	20		12		12		11	5	8	2	1		1		2	1
	Unpast.	2	7	37		9		15		5	1	1	3						
Woolverton	Past.		11	30		9		19					4		1		3	3	
	Unpast.	2	10	32		4		18					4		2	1	5	2	
	Totals	8	45	264	14	154	9	154	10	37	31	33	19	1	3	2	8	7	1

Only one tub of butter received the same score from all five judges.

Reading horizontally Table 25 indicates number of tubs for any given score. Ex. 8–94 scores and 45–93½ and so on.

SUMMARY OF JUDGES' WORK, JULY 14, 1908

McKay, Pasteurized. 7 tubs scored 93; 8 tubs, 92¾; 16 tubs, 92½; 5 tubs, 92¼; 23 tubs, 92; 5 tubs, 91¾; 6 tubs, 91½; 8 tubs, 91; and 2 tubs, 90½. Average 92.1. Difference between highest and lowest score 2½ points. Greatest variation between duplicate tubs 2 points.

Unpasteurized. 6 tubs scored 93; 6 tubs, 92¾; 19 tubs, 92½; 4 tubs, 92¼; 11 tubs, 92; 5 tubs, 91¾; 12 tubs, 91½; 10 tubs, 91; 5 tubs, 90½; 2 tubs, 90. Average 91.9. Difference between highest and lowest 3 points. Greatest variation between duplicate tubs 2 points.

Lee, Pasteurized. 16 tubs scored 93; 31 tubs, 92.5; 22 tubs, 92; 2 tubs, 91.5; 7 tubs, 90.5; 2 tubs, 90. Average 92.2. Difference between highest and lowest score 3 points. Greatest variation between duplicate tubs 2 points.

Unpasteurized. 3 tubs scored 93.5; 20 tubs, 93; 30 tubs, 92.5; 20 tubs, 92; 1 tub, 91.5; 1 tub, 91; 3 tubs, 90.5; 2 tubs, 90. Average 92.4. Difference between highest and lowest score 3½. Greatest difference between duplicate tubs 1½ points.

Crawford, Pasteurized. 4 tubs scored 93.5; 50 tubs, 93; 11 tubs, 92.5; 5 tubs, 92; 5 tubs, 91.5; 5 tubs, 91. Average 92.7. Difference between highest and lowest score 2½ points. Greatest difference between duplicate tubs 1 point.

Unpasteurized. 2 tubs scored 94; 7 tubs, 93½; 46 tubs, 93; 13 tubs, 92½; 9 tubs, 92; 1 tub, 91; 2 tubs, 90½. Average 92.8. Difference between highest and lowest score 3½ points. Greatest variation between duplicate tubs 1½ points.

Newman, Pasteurized. 2 tubs scored 94; 3 tubs, 93½; 20 tubs, 93; 12 tubs, 92½; 12 tubs, 92; 11 tubs, 91.5; 8 tubs, 90.5; 5 tubs, 91; 2 tubs, 90; 1 tub, 89.5; 1 tub, 88; 2 tubs, 86; 1 tub, 85.5. Average score 91.8. Difference between highest and lowest score 9½ points. Greatest variation between duplicate tubs 2½ points.

Unpasteurized. 2 tubs scored 94; 7 tubs, 93½; 37 tubs, 93; 9 tubs, 92.5; 15 tubs, 92; 5 tubs, 91.5; 1 tub, 91; 1 tub, 90.5; 3 tubs, 90. Average 92.6. Difference between highest and lowest scores 3½ points. Greatest variation between duplicate tubs, 2½ points.

Woolverton, Pasteurized. 11 tubs scored 93.5, 30 tubs, 93; 9 tubs, 92.5; 19 tubs, 92; 4 tubs, 90; 1 tub, 89; 3 tubs, 87; 3 tubs, 86. Average 92.1. Difference between highest and lowest score 7½ points. Greatest variation between duplicate tubs 6 points.

Unpasteurized. 2 tubs scored 94; 10 tubs, 93.5; 32 tubs, 93; 4 tubs, 92.5; 18 tubs, 92; 4 tubs, 90; 2 tubs, 89; 1 tub, 88; 5 tubs, 87; 2 tubs, 86. Average 92. Difference between highest and lowest score 8 points. Greatest difference between duplicate tubs 5½ points.

January 13, 1909, this lot of butter was again scored by four of the same men who scored the butter July 14, 1908. Mr. D. C. Wool-

verton was absent on account of illness. The original number on each tub cover was removed and the tubs re-numbered by Messrs. Jorgensen and Hepburn, as indicated by the number in the first column. Each judge worked independently, except that the man who acted as his secretary might at times examine the same trier of butter.

TABLE 26. RESULT OF THE FOUR JUDGES WORK OF SCORING THE 160 TUBS OF BUTTER, HELD IN CHICAGO, JANUARY 13, 1909

Pasteurized						Unpasteurized			
Judging No.	Original No.	Mc-Kay	Craw-ford	New-man	Lee	Mc-Kay	Craw-ford	New-man	Lee
100	201	91.5	91.5	92.5	92.0				
116	203	91.5	91.5	93.5	91.5				
17	202	91.5	91.5	93.5	92.5				
123	204	91.5	92.5	93.0	92.5				
44	205					90.0	90.5	91.0	92.0
106	207					91.0	92.0	89.5	92.0
68	206					91.0	92.0	91.5	92.0
26	208					90.5	92.0	92.5	92.5
		Av. 92.06				Av. 91.37			
86	209	91.5	91.5	92.5	92.5				
127	211	91.5	92.5	92.5	92.0				
168	210	91.5	92.0	93.5	91.5				
16	212	91.0	92.0	90.0	92.0				
159	213					90.0	92.0	90.5	91.0
37	215					90.5	91.0	92.0	91.0
158	214					90.0	91.5	88.0	91.5
96	216					91.0	90.5	90.0	91.5
		Av. 91.87				Av. 90.75			
3	217	90.0	90.5	89.0	90.5				
160	219	90.0	90.5	89.0	90.5				
22	218	91.0	90.5	92.0	91.5				
29	220	91.0	90.5	91.0	92.0				
67	221					90.5	92.0	92.5	92.5
126	223					91.5	88.0	87.0	90.5
75	222					90.0	91.5	91.0	91.5
112	224					90.5	91.5	89.0	90.5
		Av. 90.59				Av. 90.62			
65	225	91.5	91.5	91.5	91.5				
121	227	90.0	91.5	92.0	91.5				
146	226	90.5	91.5	89.5	91.0				
84	228	91.5	91.5	90.5	92.0				
102	229					90.5	91.5	91.5	92.0
18	231					90.5	91.0	91.0	91.0
1	230					91.5	92.0	89.0	91.5
24	232					90.5	92.0	92.0	91.5
		Av. 91.18				Av. 91.18			

TABLE 26—*Continued*

Pasteurized						Unpasteurized			
Judging No.	Original No.	Mc-Kay	Craw-ford	New-man	Lee	Mc-Kay	Craw-ford	New-man	Lee
83	233	91.5	91.5	93.0	91.5				
98	235	91.0	91.0	92.0	92.5				
88	234	90.0	92.0	91.5	92.0				
28	236	89.5	91.5	92.0	92.5				
99	237					90.5	91.0	91.5	92.0
90	239					90.0	91.5	92.5	92.0
59	238					90.5	92.0	91.0	91.5
119	240					90.0	91.5	89.0	91.0
		Av. 91.56				Av. 91.09			
70	241	90.0	91.5	92.0	92.0				
71	234	90.5	91.0	92.5	91.5				
51	242	91.5	91.5	91.5	92.0				
56	244	91.0	92.0	92.0	92.5				
130	245					91.0	92.0	90.0	91.5
151	247					90.5	92.0	91.5	91.5
63	246					91.5	91.5	89.5	88.0
74	248					92.0	92.5	91.5	91.5
		Av. 91.56				Av. 91.12			
69	248	91.0	91.5	91.0	91.5				
33	251	91.0	92.0	89.0	91.5				
165	250	91.25	92.0	91.0	91.5				
161	252	91.0	92.0	90.5	92.0				
150	253					91.5	91.5	89.5	91.5
14	255					92.0	92.0	92.5	90.5
188	254					90.5	91.0	87.0	91.0
2	256					86.0	90.0	85.0	90.0
		Av. 91.23				Av. 90.09			
53	257	91.5	91.5	91.5	92.0				
9	259	91.75	92.0	90.5	92.5				
143	258	90.0	92.0	88.0	92.0				
60	260	91.5	92.0	90.0	92.0				
101	261					91.0	92.0	87.0	91.5
50	263					90.5	91.5	90.5	91.0
148	262					91.0	92.0	88.0	91.0
91	264					90.5	91.5	89.0	91.0
		Av. 91.29				Av. 90.56			

TABLE 26—*Continued*

Pasteurized						Unpasteurized			
Judging No.	Original No.	Mc-Kay	Craw-ford	New-man	Lee	Mc-Kay	Craw-ford	New-man	Lee
139	265	90.0	91.5	90.5	91.0				
118	267	91.75	92.0	91.5	92.0				
34	266	91.0	91.5	92.5	92.0				
32	268	90.5	92.0	91.5	92.0				
134	269					90.5	91.0	91.5	89.0
92	271					90.5	92.0	92.0	92.0
149	270					90.0	91.5	89.0	91.5
10	272					91.0	92.0	87.0	92.0
		Av. 91.45				Av. 90.78			
55	273	92.5	91.5	91.5	92.5				
31	275	90.5	92.0	91.5	92.5				
19	274	92.0	92.0	89.0	92.0				
12	276	91.5	92.0	91.5	92.0				
57	277					89.0	91.5	90.0	91.0
8	279					91.5	92.0	89.0	91.5
137	278					90.5	92.0	91.5	92.0
93	280					90.5	92.0	91.5	92.0
		Av. 91.65				Av. 91.09			
162	281	91.5	91.5	92.0	92.0				
40	283	89.5	91.5	90.0	92.0				
52	282	90.5	91.5	90.5	91.5				
38	284	91.5	90.5	90.0	92.0				
154	285					90.0	92.0	89.0	92.0
142	287					90.5	92.0	88.0	90.5
97	286					90.0	92.0	87.0	91.0
39	288					91.5	92.0	88.0	91.0
		Av. 91.12				Av. 90.40			
82	289	91.0	92.0	89.0	92.0				
45	291	89.5	91.5	90.0	92.0				
167	290	90.5	91.0	91.0	92.0				
80	292	91.0	91.5	92.0	92.0				
132	293					90.0	91.5	90.0	92.0
114	295					89.5	91.5	89.0	92.0
49	294					90.0	90.5	89.0	92.0
170	296					90.0	92.0	89.0	91.0
		Av. 91.06				Av. 90.56			

TABLE 26—*Continued*

Pasteurized						Unpasteurized			
Judging No.	Original No.	Mc-Kay	Craw-ford	New-man	Lee	Mc-Kay	Craw-ford	New-man	Lee
42	297	92.0	91.5	92.5	92.0				
124	299	91.0	92.5	90.0	91.5				
46	298	90.0	91.0	91.5	91.5				
81	300	91.0	92.0	91.5	92.0				
47	301					91.0	91.0	90.0	92.0
72	303					90.0	91.0	91.5	92.0
169	302					90.5	92.0	88.0	91.5
211	304					91.5	92.0	91.5	91.5
			Av. 91.47				Av. 91.06		
76	305	90.5	91.0	91.5	91.5				
107	307	90.0	92.5	91.5	92.5				
7	306	92.0	92.0	92.0	92.5				
6	308	90.5	92.0	92.0	92.0				
155	309					90.0	92.0	91.5	91.0
105	311					92.0	92.0	91.5	92.0
35	310					91.5	92.0	91.5	92.0
103	312					90.5	92.0	92.0	91.0
			Av. 91.62				Av. 91.55		
166	313	91.5	91.5	92.0	92.0				
13	315	91.5	92.0	90.0	91.5				
79	314	91.0	91.5	90.5	92.0				
128	316	91.5	92.0	89.0	91.5				
125	317					89.0	91.5	88.0	91.0
78	319					89.0	91.5	89.0	92.0
4	318					90.5	92.0	91.0	92.0
23	320					92.0	92.0	90.5	92.5
			Av. 91.31				Av. 90.84		
144	321	90.0	91.5	91.0	91.5				
113	323	89.5	91.5	90.0	92.0				
21	322	91.5	91.5	91.0	92.5				
141	324	91.0	90.0	91.5	92.0				
145	325					91.0	92.0	91.5	91.5
129	327					89.5	90.0	89.5	92.0
140	326					91.0	92.0	89.0	91.5
136	328					90.5	91.5	92.0	89.5
			Av. 91.12				Av. 90.87		

TABLE 26—*Continued*

Pasteurized						Unpasteurized			
Judging No.	Original No.	Mc-Kay	Craw-ford	New-man	Lee	Mc-Kay	Craw-ford	New-man	Lee
64	329	90.5	90.5	87.0	91.0				
66	331	90.5	91.5	87.0	89.0				
62	330	87.0	89.0	88.0	89.0				
152	332	89.5	89.5	87.0	89.0				
133	333					90.0	90.0	87.0	91.5
135	335					91.5	90.5	87.0	89.0
36	334					87.0	89.0	86.0	89.0
164	336					89.0	89.0	87.0	89.0
		Av. 89.06				Av. 88.97			
94	337	91.5	92.0	92.5	92.5				
54	339	92.0	91.5	92.0	92.0				
25	338	91.0	92.0	92.5	92.0				
156	340	91.0	92.0	90.5	92.0				
109	341					91.5	92.0	91.5	91.0
147	343					90.5	92.0	90.0	92.0
111	342					92.5	92.5	91.5	92.0
117	344					91.0	91.5	88.0	89.0
		Av. 91.81				Av. 91.15			
122	345	90.5	92.0	91.0	92.0				
87	347	90.5	92.0	92.0	91.5				
131	346	91.0	92.0	88.0	91.5				
30	348	91.5	92.0	92.0	92.5				
104	349					91.5	92.0	89.0	92.0
11	351					92.0	92.0	91.0	92.0
153	350					91.0	92.5	90.0	92.0
115	352					91.0	91.0	89.0	91.0
		Av. 91.37				Av. 91.18			
157	353	91.0	91.5	89.0	90.5				
163	355	91.0	91.0	91.5	91.5				
20	354	92.0	89.0	86.0	89.0				
110	356	91.0	89.0	88.0	91.5				
95	357					89.5	91.0	86.0	92.0
73	359					88.0	90.0	85.0	91.0
58	358					87.0	88.0	84.0	86.0
89	360					89.5	88.0	86.0	87.0
		Av. 90.15				Av. 88.0			
Average .	.....	90.89	91.47	90.84	91.71	90.44	91.41	89.62	91.18
Gain. . .	.....	0.45	0.06	1.22	0.53	.....	.....	.....	.....

TABLE 27. COMPARISON OF PASTEURIZED AND UNPASTEURIZED BUTTER AFTER STORAGE, BASED UPON SCORES OF JANUARY 13, 1908, CHICAGO

	Pasteurized				Unpasteurized			
Vat No.	McKay	Crawford	Newman	Lee	McKay	Crawford	Newman	Lee
1	91.50	91.75	90.37	92.12	90.62‡	91.67‡	91.12†	92.12*
2	91.37	92.00	92.12	92.00	90.37*	91.25†	90.12‡	91.25‡
3	90.50	90.50	90.25	91.12	90.62†	90.75†	89.87‡	91.25†
4	90.87	91.50	90.87	91.50	90.75‡	92.62†	90.87*	91.50*
5	90.50	91.50	92.12	92.12	90.25‡	91.50*	91.00‡	91.62‡
6	91.75	91.50	92.12	92.00	91.25‡	92.00†	90.62‡	90.62‡
7	91.06	91.87	90.37	91.62	90.00‡	91.12‡	88.50‡	90.75‡
8	91.18	91.87	90.00	92.12	90.75‡	91.75‡	88.62‡	91.12‡
9	90.81	91.75	91.50	91.75	90.50‡	91.62‡	89.87‡	91.12‡
10	91.62	91.87	90.87	92.25	90.37‡	91.87*	90.50‡	91.62‡
11	90.75	91.25	90.62	91.87	90.50‡	92.00†	88.00‡	91.12‡
12	90.50	91.37	90.37	92.00	89.87‡	91.37*	89.25‡	91.75‡
13	91.00	91.75	91.37	91.75	90.75‡	91.50‡	90.25‡	91.75*
14	90.75	91.87	91.75	92.12	91.00†	92.00†	91.62‡	91.50‡
15	91.37	91.75	90.37	91.75	90.12‡	91.75*	89.62‡	91.87†
16	90.50	91.12	90.87	92.00	90.50*	91.37†	90.50‡	91.12‡
17	89.37	90.12	87.50	89.50	89.37*	90.00‡	86.75‡	89.75†
18	91.37	91.87	91.87	92.12	91.37*	92.00†	90.25‡	91.00‡
19	90.87	92.00	90.75	91.87	91.37†	91.87‡	89.75‡	91.75‡
20	91.25	90.12	88.62	90.62	88.50‡	89.25‡	85.25‡	89.00‡

*Butter made from both the pasteurized and unpasteurized cream after storage, received the same average score.
‡Higher score for the pasteurized butter,
†Higher for unpasteurized butter.

The above table is compiled from Table 26. The average of the scores on the four tubs of butter made from the pasteurized cream, Vat 1, by McKay, was 91.50; Crawford, 91.75; Newman, 90.37; and by Lee, 92.12. The butter made from the same cream unpasteurized, received the following average scores: McKay, 90.62; Crawford, 91.67; Newman, 91.12 and Lee, 92.12. Two of the judges placed a higher average score on the pasteurized, one on the unpasteurized butter, and the fourth judge placed the same score on both lots.

TABLE 28. AVERAGE, HIGHEST AND LOWEST, OF THE SIXTEEN DIFFERENT SCORES ON THE SAME BUTTER, AFTER STORAGE, JANUARY 13, 1909

Pasteurized				Unpasteurized			
Tub No.	Aver-age	Highest	Lowest	Tub No.	Aver-age	Highest	Lowest
201–204	92.06	93.5 N.	91.5 Mc.C.L.	205–208	91.37*	92.5 L. C.	89.5 N.
209–212	91.87	93.5 N.	90.0 N.	213–216	90.75*	92.0 C. N.	88. N.
217–220	90.59	92.0 N. L.	89.0 N.	221–229	90.62†	92.5 N. L.	87. N.
225–228	91.18	92.0 N. L.	89.5 N.	229–232	91.18	92. N. C. L	90.5 Mc.
233–236	91.56	93.0 N.	89.5 Mc.	237–240	91.09*	92.5 N.	89. N.
241–244	91.56	92.5 N. L.	90. Mc.	245–248	91.12*	92.5 C.	88. L.
249–252	91.23	92.0 C. L.	89. N.	253–256	90.09*	92.5 N.	85. N.
257–260	91.29	92.5 L.	88. N.	261–264	90.56*	92. C.	87. N.
265–268	91.45	92.5 N.	90. Mc.	269–272	90.78*	92. C. N. L.	87. N.
273–276	91.65	92.5 L.	89. N.	277–280	91.09*	92. C. L.	89. Mc. N
281–284	91.12	92. L.	89.5 Mc.	285–288	90.40*	92. C. L.	87. N.
289–292	91.06	92. C. L.	89.5 Mc.	293–296	90.56*	92. C. L.	89. N.
297–300	91.47	92.5 C. N.	90. Mc. N.	301–304	91.06*	92. C. L.	88. N.
305–308	91.62	92.5 C. L.	90. Mc.	309–312	91.55*	92. C.N.L.Mc.	90. Mc.
313–316	91.31	92. C.N.L.	89. N.	317–320	90.84*	92.5 L.	89. Mc.N.
321–324	91.12	92.5 L.	89.5 Mc.	325–328	90.87*	92. C. N. L.	89. N.
329–332	89.06	91.5 C.	87. Mc. N.	333–336	88.97*	91.5 Mc. L.	86. N.
337–340	91.81	92.5 N. L.	90.5	341–344	91.15*	92.5 Mc. C.	88. N.
345–348	91.37	92.5 L.	88. N.	349–352	91.18*	92.5 C.	89. N.
353–356	90.15	92. Mc.	86. N.	357–360	88. *	92.5 L.	84. N.
Av. . . .	91.22	92.4	89.22		90.71	92.17	87.95

*Higher score for pasteurized butter.
†Higher for unpasteurized butter.

Reading across the page tubs 201 to 204 pasteurized and 205 to 208 unpasteurized, represent one comparison with all butter from the same cream.

January 13, the average of the 320 scores placed upon the butter made from the pasteurized cream was 91.22, while the average of the same number of scores placed upon the unpasteurized butter was 90.71.

The average of all the scores placed on the same butter July 14, was 92.16 for the pasteurized and 92.31 for the unpasteurized.

The butter made from the pasteurized cream scored 0.15 of a point lower July 14 as compared with the butter made from the cream which was not pasteurized and six months later the butter made from

the pasteurized cream scored 0.51 of a point higher than the butter from the unpasteurized cream. This indicates that pasteurizing the cream increased its keeping quality by two-thirds of a point. In comparing the average of each day's make it is evident that on only one day did the butter made from pasteurized and unpasteurized cream receive the same average score. On two days it was higher for the unpasteurized. On seventeen days the score was in favor of the pasteurized cream.

Comparing McKay's average for each day, gives three days the same, four in favor of unpasteurized and thirteen in favor of the pasteurized.

Crawford's average gave four days the same, seven in favor of unpasteurized and nine days in favor of pasteurized.

Newman's average gave one day the same, one in favor of unpasteurized and the other eighteen days in favor of pasteurized.

Lee's average gave three days alike, three in favor of unpasteurized and the other fourteen in favor of pasteurized.

TABLE 29 VARIATION IN SCORE ON DUPLICATE TUBS JANUARY 13, 1909

Extent of variation		0	¼	½	1	1½	1¾	2	2¼	2½	3	3½	4	4½	5½
McKay	Past.	11	2	14	5	4	1	2		1					
	Unpast.	6		14	9	6		2	2						1
Crawford	Past.	17		15	6	2									
	Unpast.	18		10	7	3		1					1		
Newman	Past.	8		9	11	1		6		3		1	1		
	Unpast.	4		4	11	5		9			3	3			1
Lee	Past.	13		19	6			1		1					
	Unpast.	14		7	12	1		2		1	2	1			

TABLE 30 VARIATION IN SCORE ACCORDING TO EACH JUDGE ON 160 TUBS OF BUTTER, BETWEEN JULY 14 AND JANUARY 13, 1909

	Pasteurized								Unpasteurized							
	McKay		Crawford		Newman		Lee			McKay		Crawford		Newman		Lee	
T'b No	De-crease	In-crease	De-crease	In-crease	De-crease	In-crease	De-crease	In-crease	T'b No	De-crease	In-crease	De-crease	In-crease	De-crease	In-crease	De-crease	In-crea'e
201	1¼		1½		1½		½		205	3		2½		3		1	
203	No change		1½			½	1½		207	No change		1		3½		1½	
202	¾		1½			½	½		206	1¼		1		1½		1	
204	1		½			½	½		208	2¼		½			1	No change	
209	½		1½		1½		½		213	1		1			½	1	
211	¼		½		½		No change		215	½		1½		No change		1½	
210	No change		1			½	1½		214	1		1½		3		½	
212	1¾		1		3		1		216	1		1½		3		½	
217	2¾		1½		1½		No change		221		½	No change			½		½
219	2		½		1½		No change		223	½		4		5½		½	
218	1¼		1			½	1		222	1		1		2		1½	
220	1½		1			1		1½	224	2½		1		2½		1½	
225	No change		1		No change		No change		229	1		1½		1½		No change	
227	2		No change			1	½		231	No change		2½			½		½
226	2¼		1½		2½		1		230	No change		1		3		½	
228	½		1		No change		No change		232	½		½		1½		1	
233	½		1½		No change		½		237	2		2		1½		½	
235	1		1		No change		½		239	1½		1½			½	No change	
234	2		1		½		No change		238	1½		1½		2		1	
236	3¼		½			1		2	240	2½		1½		3		1½	
241	2½		1½		1½		No change		245	1½		1		3½		2	
243	1½		2		½		1		247	2½		1		2½		2	
242	½		1½			½	½		246	½		1		½		4½	
244	1		1		1½		No change		248	½		½		1		1½	

TABLE 30—*Continued*

	Pasteurized								Unpasteurized							
	McKay		Crawford		Newman		Lee			McKay		Crawford		Newman		Lee	
T'b No	De-crease	In-crease	De-crease	In-crease	De-crease	In-crease	De-crease	In-crease	T'b No	De-crease	In-crease	De-crease	In-crease	De-crease	In-crease	De-crease	In-crea'e
249	No change		1		1		1		253	1		1½		4		1½	
251	2		1		4		1½		255	½		1		½		2½	
250	¾		1		2½		½		254	1		2		6		1½	
252	2		1		1		½		256	6½		3		7½		2	
257	1		1½		1		No change		261	1½		1		6		½	
259	¾		1		2½		1		263	1¼		1		3		2	
258	2½		1½		2½		1½		262	½		1		5		1	
260	½		1		3		No change		264	1½		1½		3		1	
265	1		½		2½		1½		269	½		1		1½		3	
267		1¼	½		1		½		271	1¾		No change		1		½	
266	1¼			1		1	½		270	2¾		1½		3		½	
268	2¼		½		½		½		272	¾		1		6		½	
273		¾	1½		1		No change		277	3		1		1½		1½	
275	1¼		½			1½		½	279		½	1		4		1½	
274	½		1		4		½		278	2¼		1		2		1	
276	1		1		½		½		280	2¼		1		1½		1	
281	No change		1½		½		1		285	1½		½		4		No change	
283	1½		1		2½		No change		287	1½		½		4		2	
282	1½		1½		1		1		286	2¼		1		6		1½	
284	½		2½		2		1		288	¼		1		4..5		1½	
289	No change		1		2		½		293	3		1½		3½		1	
291	3		1½		½		½		295	3		1		4		No change	
290	1½		2			½	No change		294	2½		1½		4		½	
292	1		1½			½	½		296	1½		1		3		1½	
297	No change		1½			1	½		301	2		1		2½		No change	
299	½		No change		3		½		303	1¾		1½		1½		½	
298	2		1½		½		½		302	1		1		5		1	
300	No change		1		½		½		304	No change		1		½		1	

TABLE 30—*Continued*

Pasteurized									Unpasteurized								
	McKay		Crawford		Newman		Lee			McKay		Crawford		Newman		Lee	
T'b No	De-crease	In-crease	De-crease	In-crease	De-crease	In-crease	De-crease	In-crease	T'b No	De-crease	In-crease	De-crease	In-crease	De-crease	In-crease	De-crease	In-crea'e
305	2½		2½			1	1½		309	2½		1		½		2	
307	3		½			1	½		311	1		1		1½		1	
306	½		1			½	½		310	1		1		1		½	
308	2		1		½		½		312	1½		1		No change		2	
313	1½		1½		No change		½		317	3¼		2½		5		1½	
315	1½		1		2½		1		319	3½		2½		4		½	
314	1½		2		2½		No change		318	2		1½		2		½	
316	¾		1		3½		1		320	No change		1½		2		½	
321	1¾		1½		2		1		325	1		1		1½		1	
323	2½		1		2		No change		327	3¼		3		3½		1	
322	1		1½		½		No change		326	¾		1½		4		1	
324	No change		3		1½		½		328	1		1½		½		1½	
329	No change		½		1			½	333	½		1		5			1
331	½			½		1	1½		335	1		No change		4½		1	
330	4		2½			2	1		334	3		1½		4		1	
332	2		2½			1½	1		336	2		3		4½		1½	
337	1¼		1		½		No change		341	No change		1½		1½		1½	
339	½		2		½		No change		343	2¼		1		3		1	
338	1¾		1		½		½		342		1		½	½		½	
340	¾		½		2½		½		344		½	1½		4		4	
345	1½		1		2		1		349	1		1		4½		1	
347	2		1		1		½		351	No change		1		2		½	
346	1¼		1		3½		1½		350		½	½		3		No change	
348	1		1			1		½	352	1½		2		4		1½	
353	1		1½		2½		2		357	3		1½		6½		½	
355	1		2		2		½		359	4½		3½		8		1½	
354	1		2		6½		4		358	6		5		9		6	
356	1		2		4½		½		360	3		5		7		5	

RESULT OF SCORING NEW YORK LOT OF BUTTER, DECEMBER 31, 1908.

As soon as the butter had been tempered after coming out of storage it was scored by four judges working independently. According to Kieffer, the butter made from the cream which was pasteurized received an average score of 90.52, while the butter made from corresponding lots of cream not pasteurized, received an average score of 89.77; an average of 0.75 of a point in favor of the pasteurized butter.

According to the scores placed upon the same butter by Smarzo, the butter made from the pasteurized lots of cream received an average score of 91.12 and the butter from unpasteurized cream, an average score of 89.68, or a difference of 1.44 of a point in favor of the pasteurized.

Crawford's average score of the butter made from the pasteurized cream was 91.27 and the unpasteurized 90.69, an average of 0.58 of a point in favor of the butter made from pasteurized cream.

Lee's average on the same butter was 91.15 for the pasteurized and 90.67 for the unpasteurized or 0.48 of a point in favor of the butter made from pasteurized cream.

The average of the scores placed upon the four tubs of pasteurized butter for each day compared with the average of the four tubs of corresponding butter from unpasteurized cream gives the following daily data.

KIEFFER'S DAILY COMPARISON

There was no difference in quality between pasteurized and unpasteurized butter for two days; thirteen days from 0.5 to 3 points in favor of the butter made from the pasteurized cream, and on the other five out of the twenty days the average score was higher by one-fourth to one and one-fourth points for butter made from the cream that was not pasteurized. Comparing Kieffer's score on the eighty individual tubs of pasteurized butter with the corresponding tubs of butter from the unpasteurized cream the following results were obtained:

13 tubs compared, same score; 18, one point in favor of pasteurized; 14, two; 6 three; 6, four; 1, five; and 1, seven points. In 9 tubs compared, the butter made from the unpasteurized cream scored higher by one point; 8 tubs higher by two points; 1, three points; 2, four, and 1, five points.

The variation in score on duplicate tubs was as follows: There was no difference in the score on duplicate tubs of butter packed from 11 churnings of pasteurized and 5 churnings of unpasteurized cream; 15 pasteurized and 10 unpasteurized, one point variation in score; 4 pasteurized and 15 unpasteurized, two points; 6 pasteurized and 7 unpasteurized, three points; 1 pasteurized and 2 unpasteurized, four; 2 pasteurized and 1 unpasteurized, five points.

SMARZO'S DAILY COMPARISON

There was no difference in quality between pasteurized and unpasteurized butter for one day. On only two days out of the other 19

did the average score on the four tubs of unpasteurized butter range higher than the butter made from the pasteurized cream. Comparing individual tubs of pasteurized with unpasteurized butter, we find that 7 out of the 80 comparisons show no difference in quality. In 66 of the comparisons the butter made from the cream which was pasteurized scored higher by one-half to 6½ points while the other 7 scored higher in favor of unpasteurized butter by one-half to three points.

Smarzo's variation on duplicate tubs as follows:

No difference in score on duplicate tubs of butter packed from 15 churnings of pasteurized and 8 of unpasteurized cream.

14 pasteurized and 7 unpasteurized, one-half point variation; 6, pasteurized and 14 unpasteurized, one point; 2, pasteurized and 1 unpasteurized one and one-half; 2 pasteurized and 7 unpasteurized, two; 1 pasteurized and 1 unpasteurized two and one-half; 1 unpasteurized, three points; and 1 unpasteurized, four points.

CRAWFORD'S DAILY COMPARISON

Both the pasteurized and unpasteurized butter scored the same on two of the 20 days. The butter made from the pasteurized cream on 14 of 20 comparisons scored higher by 0.12 to 2.37 of a point, while on the other four days the butter made from the unpasteurized cream scored higher by 0.12 to 0.38 of one point.

Comparing the individual tubs of each lot, it will be noticed that 17 comparisons showed no difference. Forty-seven out of the 80, scored higher for the pasteurized by one-half to four points, while in the other 16 the pasteurized scored higher by one-half to two and one-half points.

The variation in score on duplicate tubs was as follows:

The tubs packed from 14 churnings of pasteurized and 14 of unpasteurized cream, no variation. 12 pasteurized and 13 unpasteurized, one-half points; 5 pasteurized and 7 unpasteurized, one point; 9 pasteurized and 1 unpasteurized, one and one-half; 2 unpasteurized, two and one-half; 2 unpasteurized, two; and 1 unpasteurized, three points.

LEE'S DAILY COMPARISON

On two out of the 20 days there was no difference in the average scores placed upon the 4 tubs of pasteurized butter as compared with the average of the 4 tubs of unpasteurized butter. The butter made from the pasteurized cream received on the other 18 days an average score of 0.12 to 1.87 points higher score than the butter made from the unpasteurized cream. Comparing the individual tubs, there was no difference in 24 out of the 80 comparisons. Forty-seven pasteurized tubs scored higher than corresponding unpasteurized tubs. The other 9 comparisons scored higher for the unpasteurized butter by one-half point.

Variation on duplicate tubs as follows:

15 pasteurized and 15 unpasteurized, no variation. 18 pasteurized and 12 unpasteurized, one-half point variation; 7 pasteurized and 8

unpasteurized, one point; 1 unpasteurized, one and one-half; 3 unpasteurized, two; and 1, two and one-half points.

As previously stated the first eight tubs of butter were made May 6, and the last eight July 1. The first 40 tubs shipped to New York were not placed in the regular storage rooms as soon as intended on account of Mr. Kieffer's absence from the city.

The following table shows when each shipment reached New York City, also when the tubs of butter were scored by Kieffer and then placed in storage.

Date Recd. by Gude Bros.	No. of tubs	When scored	When stored 1908	Date Recd. by Gude Bros.	No. of tubs	When scored	When stored, 1908
May 20	32	June 5	June 5,	June 24	32	June 25	June 25,
June 1	24	" 5	" 5,	July 1	24	July 3	July 3,
" 8	16	" 12	" 12,	" 7	16	" 9	" 9,
" 15	16	" 25	" 25,				

TABLE 31 SCORES BY C. E. LEE ONE DAY AFTER MAKING, AND BY P. H. KIEFFER BEFORE EACH SHIPMENT WAS PLACED IN STORAGE

Lee			Kieffer		Lee			Kieffer	
Tub No.	Pasteurized	Unpasteurized	Pasteurized	Unpasteurized	Tub No.	Pasteurized	Unpasteurized	Pasteurized	Unpasteurized
401	94.5		91.		421		92.5		90.
403	94.5		90.		423		92.5		89.
402	94.5		91.		422		92.5		89.
404	94.5		89.		424		92.0		91.
	Av. 94.5		Av. 90.25				Av. 92.37		Av. 89.75
405		94.5		91.	425	93.0		88.	
407		94.5		91.	427	93.0		89.	
406		94.5		90.	426	93.0		90.	
408		95.0		91.	428	93.0		91.	
		Av. 94.62		Av. 90.75		Av. 93.0		Av. 89.5	
409	94.5		89.		429		93.0		89.
411	94.0		89.		431		93.0		91.
410	94.5		90.		430		93.0		91.
412	94.0		91.		432		93.0		91.
	Av. 94.25		Av. 89.75				Av. 93.0		Av. 90.5
413		94.0		88.	433	93.0		90.	
415		94.0		90.	435	93.0		90.	
414		94.5		91.	434	93.0		92.0	
416		94.0		90.	436	93.0		90.	
		Av. 94.12		Av. 89.75		Av. 93.0		Av. 90.5	
417	92.0		90.		437		93.0		90.0
419	92.0		90.		439		93.0		92.
418	91.0		90.		438		93.0		90.
420	91.0		90.		440		92.5		92.
	Av. 91.5		Av. 90.				Av. 92.87		Av. 91.0

TABLE 31—*Continued*

Lee			Kieffer		Lee			Kieffer	
Tub No.	Pasteurized	Unpasteurized	Pasteurized	Unpasteurized	Tub No.	Pasteurized	Unpasteurized	Pasteurized	Unpasteurized
441	93.0		90.		461		92.		89.
443	93.0		91.		463		92.		89.
442	93.0		91.		462		92.		89.
444	92.5		91.		464		92.		89.
	Av. 92.87		Av. 90.75				Av. 92.0		Av. 89.0
445		93.5		92.	465	93.		89.	
447		93.0		92.	467	93.		89.	
446		93.0		92.	466	93.		89.	
448		93.0		92.	468	93.		89.	
		Av. 93.12		Av. 92.0		Av. 93.0		Av. 89.0	
449	93.5		89.		469		93.		89.
451	93.0		91.		471		93.		89.
450	93.0		91.		470		93.		89.
452	93.0		91.		472		93.		89.
	Av. 93.12		Av. 90.5				Av. 93.0		Av. 89.0
453		93.0		89.	473	93.0		92.	
455		92.5		90.	475	93.0		92.	
454		93.0		88.	474	93.0		92.	
456		92.5		91.	476	93.0		92.	
		Av. 92.75		Av. 89.5		Av. 93.0		Av. 92.0	
457	92.0		89.		477		93.		92.
459	92.5		89.		479		93.		92.
458	93.0		89.		478		93.		92.
460	93.0		89.		480		93.5		92.
	Av. 92.62		Av. 89.0				Av. 93.12		Av. 92.0

TABLE 31—*Continued*

Lee			Kieffer	
Tub No.	Pasteurized	Unpasteurized	Pasteurized	Unpasteurized
481	92.0		91.	
483	92.0		91.	
482	92.0		91.	
484	92.0		92.	
	Av. 92.0		Av. 91.25	
485		92.		92.
487		92.		92.
486		92.		92.
488		92.		92.
		Av. 92.0		Av. 92.0
489	92.5		92.	
491	92.5		92.	
490	92.5		92.	
492	92.5		92.	
	Av. 92.5		Av. 92.0	
493		92.5		92.
495		92.5		92.
494		92.5		92.
496		92.5		92.
		Av. 92.5		Av. 92.0
497	93.0		92.	
499	93.0		92.	
498	93.0		90.	
500	93.0		92.	
	Av. 93.0		Av. 91.5	

Lee			Kieffer	
Tub No.	Pasteurized	Unpasteurized	Pasteurized	Unpas. teurized
501		93.		92.
503		93.		92.
502		93.5		92.
504		93.5		92.
		Av. 93.25		Av. 92.0
505	93.5		90.	
507	93.5		90.	
506	93.5		90.	
508	93.5		90.	
	Av. 93.5		Av. 90.0	
509		93.5		90.
511		93.5		90.
510		93.5		90.
512		93.5		90.
		Av. 93.5		Av. 90.0
513	93.0		90.	
515	93.0		90.	
514	93.0		90.	
516	93.0		90.	
	Av. 93.0		Av. 90.0	
517		93.		90.
519		93.		90.
518		93.		90.
520		93.		90.
		Av. 93.0		Av. 90.0

TABLE 31—*Continued*

Lee			Kieffer	
Tub No.	Pasteurized	Unpasteurized	Pasteurized	Unpasteurized
521	92.0		92.	
523	92.0		92.	
522	92.0		92.	
524	92.0		92.	
	Av. 92.0		Av. 92.0	
525		92.		92.
527		92.		92.
526		92.		92.
528		92.		92.
		Av. 92.0		Av. 92.0
529	90.0		90.	
531	90.0		92.	
530	90.0		90.	
532	90.0		92.	
	Av. 90.0		Av. 91.0	
533		90.		92.
535		90.		92.
534		90.		92.
536		90.		92.
		Av. 90.0		Av. 92.0
537	93.5		92.	
539	93.5		92.	
538	93.5		92.	
540	93.5		92.	
	Av. 93.5		Av. 92.0	
541		93.5		92.
543		93.5		92.
542		93.5		92.
544		93.5		92.
		Av. 93.5		Av. 92.0
545	93.5		92.	
547	93.5		92.	
546	93.5		92.	
548	93.5		92.	
	Av. 93.5		Av. 92.0	
549		93.5		92.
551		93.5		92.
550		93.5		92.
552		93.5		92.
		Av. 93.5		Av. 92.0
553	93.5		91.	
555	93.5		91.	
554	93.5		91.	
556	93.5		91.	
	Av. 93.5		Av. 91.0	
557		93.5		91.
559		93.5		89.
558		93.5		89.
560		93.5		89.
		Av. 93.5		Av. 89.5
Total average	92.87	92.89	90.7	90.8

These 160 tubs of butter were taken out of the cold storage rooms December 26, and placed in a tempering room. December 30 the butter was judged by Lee and Crawford in the presence of one of the employees of the firm of Gude Bros. and on the following day scored by Messrs. Kieffer and Smarzo. Previous to the scoring, the helper removed the number which had been placed on each tub cover at the time it was made. The number which had been placed on the bottom of the tub was left for identification. Each tub was given a new number, running from 1 to 160. The tubs were not identified until all scores had been placed. In no case did a judge know what score had been given by another judge until his score had been recorded.

The result of this scoring is as follows:

TABLE 32 RESULT OF THE FOUR JUDGES WORK OF SCORING THE 160 TUBS OF BUTTER HELD IN NEW YORK, DECEMBER 30-31, 1908

Pasteurized						Unpasteurized				Pasteurized					Unpasteurized			
Score No.	Tub No.	Kieffer	Smarzo	Crawford	Lee	Kieffer	Smarzo	Crawford	Lee	Score No.	Tub No.	Kieffer	Smarzo	Crawford	Lee	Kieffer	Smarzo	Crawford	Lee
73	401	91.	92.	92.	91.					18	425	91.	90.5	90.5	90.5				
28	403	90.	91.5	91.5	91.5					71	427	90.	91.	89.	89.5				
76	402	89.	91.	92.	91.					30	426	91.	90.	91.5	91.5				
20	404	90.	91.	91.5	91.					29	428	90.	91.	90.	91.5				
36	405					91.	90.5	90.	91.5	35	429					89.	89.	90.	91.
13	407					92.	90.	91.	91.	15	431					92.	90.	91.5	90.
23	406					91.	89.	91.5	90.	52	430					90.	89.	90.	90.
26	408					89.	91.	91.	91.	25	432					91.	89.5	91.	91.5
		Av. 91.10				Av. 90.65						Av. 90.5				Av. 90.28			
38	409	90.	91.5	91.5	91.5					4	433	90.	91.5	90.	91.5				
37	411	90.	91.5	91.5	91.5					24	435	90.	89.5	91.	90.5				
19	410	91.	91.5	91.	91.					16	434	91.	90.5	91.5	90.5				
67	412	91.	91.5	91.	91.					45	436	91.	91.5	90.	91.5				
34	413					89.	89.	90.5	91.	22	437					89.	90.5	91.	90.5
68	415					88.	88.	90.	90.5	11	439					91.	91.	91.	90.5
74	414					87.	88.	91.	90.5	12	438					92.	92.	91.	91.
69	416					90.	89.5	90.5	90.5	44	440					90.	90.	91.	91.
		Av. 91.12				Av. 89.56						Av. 90.69				Av. 90.78			
53	417	90.	90.	90.	91.					14	441	91.	91.5	91.5	91.				
54	419	90.	89.5	91.	91.					10	443	92.	91.5	91.	91.				
27	418	89.	91.	90.	90.					21	442	89.	91.5	92.	91.				
55	420	90.	90.	91.	90.5					31	444	91.	91.5	92.	91.				
70	421					85.	89.5	87.	88.	2	445					87.	87.	90.	91.
3	423					88.	87.	87.	88.	43	447					91.	88.	90.	89.
7	422					88.	87.	89.	90.	9	446					91.	90.	91.	91.
39	424					89.	91.	90.	89.	17	448					89.	90.	91.	90.
		Av. 90.12				Av. 88.28						Av. 91.22				Av. 89.75			

TABLE 32—*Continued*

Pasteurized						Unpasteurized				Pasteurized						Unpasteurized			
Score No.	Tub No.	Kieffer	Smarzo	Crawford	Lee	Kieffer	Smarzo	Crawford	Lee	Score No.	Tub No.	Kieffer	Smarzo	Crawford	Lee	Kieffer	Smarzo	Crawford	Lee
33	449	92.	91.5	91.5	91.					116	473	91.	91.5	91.5	91.				
48	451	90.	91.5	90.	91.					104	475	91.	91.5	91.5	91.5				
32	450	92.	92.	91.5	90.5					120	474	91.	92.	91.5	91.				
1	452	90.	91.	90.	91.					97	476	92.	91.5	92.	91.5				
5	453					89.	86.	90.	90.5	103	477					91.	92.	91.	91.
6	455					87.	85.	90.	88.	106	479					92.	91.	91.5	91.
8	454					92.	91.	89.	91.	101	478					88.	91.5	91.5	91.
46	456					92.	91.	90.	91.5	107	480					92.	91.	91.5	91.
		Av. 91.04				Av. 89.56						Av. 91.43				Av. 91.12			
41	457	91.	90.5	90.5	91.					99	481	89.	90.	90.5	91.				
42	459	91.	89.	89.	91.5					113	483	91.	91.	92.	92.				
84	458	92.	89.	90.5	90.5					105	482	91.	92.	91.5	91.				
60	460	90.	91.	92.	91.5					115	484	92.	91.5	91.5	91.5				
85	461					88.	89.	91.	91.	140	485					88.	88.	91.5	91.5
57	463					91.	88.5	91.5	91.	114	487					91.	88.	91.5	90.5
79	462					90.	89.	89.	89.	139	486					87.	89.	91.	91.5
88	464					92.	89.	91.5	91.	100	488					85.	90.	88.	90.5
		Av. 90.62				Av. 90.09						Av. 91.22				Av. 89.41			
40	465	88.	91.	91.	91.					160	489	92.	91.5	92.	92.				
59	467	91.	91.5	91.5	91.					111	491	87.	91.5	91.5	91.5				
82	466	90.	90.	91.5	91.5					149	490	92.	91.5	92.	92.				
61	468	91.	91.5	91.5	91.					143	492	89.	91.5	92.	91.5				
77	469					91.	91.5	91.5	91.	126	493					90.	91.	91.5	91.
78	471					92.	90.5	92.	90.5	159	495					92.	91.	92.	91.5
87	470					91.	90.	91.	91.	156	494					90.	90.	91.5	91.5
47	472					90.	91.	90.	91.	148	496					92.	88.	92.	91.5
		Av. 90.87				Av. 91.00						Av. 91.28				Av. 91.04			

TABLE 32—*Continued*

Pasteurized						Unpasteurized				Pasteurized						Unpasteurized			
Score No.	Tub No.	Kieffer	Smarzo	Crawford	Lee	Kieffer	Smarzo	Crawford	Lee	Score No.	Tub No.	Kieffer	Smarzo	Crawford	Lee	Kieffer	Smarzo	Crawford	Lee
138	497	87.	92.	92.	91.					50	521	91.	91.5	91.	91.5				
153	499	92.	91.	92.	91.5					96	523	91.	91.5	91.	91.5				
150	498	91.	91.	92.	91.5					72	522	91.	91.5	91.	90.				
132	500	89.	91.	91.5	91.5					91	524	91.	91.	91.5	91.				
98	501					89.	91.5	91.5	91.	83	525					91.	89.	91.	90.5
146	503					91.	91.	92.	91.	86	527					87.	91.	90.5	91.
152	502					92.	91.	92.	92.	81	526					89.	90.	91.5	90.5
147	504					91.	90.	92.	91.5	75	528					89.	88.	91.5	90.5
		Av. 91.06				Av. 91.22						Av. 91.12				Av. 90.06			
144	505	92.	92.	92.	91.5					58	529	90.	90.	91.	91.				
127	507	92.	91.5	91.5	91.5					90	531	89.	90.	91.	91.				
128	506	91.	92.	92.	91.5					92	530	88.	90.	91.5	90.5				
157	508	92.	91.5	91.5	92.					49	532	89.	90.	90.	90.				
141	509					90.	91.	92.	91.5	56	533					86.	89.	88.	90.5
145	511					90.	91.	92.	91.5	66	535					86.	88.	90.	90.5
129	510					89.	91.	92.	91.5	94	534					89.	87.	88.	88.
102	512					92.	91.	91.5	91.5	64	536					88.	89.	88.	89.
		Av. 91.72				Av. 91.21						Av. 90.12				Av. 88.37			
142	513	91.	91.5	92.	91.5					89	537	91.	91.5	91.5	90.5				
130	515	91.	92.	92.	91.5					80	539	90.	92.	91.	91.				
155	514	92.	91.5	91.5	92.					93	538	89.	92.	91.5	91.5				
158	516	91.	92.	91.5	92.					51	540	92.	91.5	92.	91.				
151	517					88.	88.	92.	91.	65	541					87.	88.	90.5	90.5
110	519					90.	91.	91.	91.5	62	543					90.	89.	91.5	90.5
125	518					91.	91.	91.5	91.	63	542					89.	89.	88.	89.
131	520					90.	90.	92.	91.5	95	544					91.	91.	90.5	91.
		Av. 91.62				Av. 90.65						Av. 91.18				Av. 89.72			

TABLE 32—*Continued*

Pasteurized						Unpasteurized			
Score No.	Tub No.	Kieffer	Smarzo	Crawford	Lee	Kieffer	Smarzo	Crawford	Lee
134	545	91.	92.	92.	91.				
137	547	92.	92.	92.	91.5				
122	546	89.	92.	91.	91.5				
135	548	92.	91.5	92.	91.5				
133	549					91.	91.	91.5	91.
136	551					92.	91.	92.	91.5
118	550					88.	87.	91.5	91.
117	552					90.	88.	91.5	91.5
		Av. 91.5				Av. 90.59			
123	553	90.	91.	91.5	92.				
108	555	92.	91.	91.5	91.				
121	554	92.	90.5	90.5	90.5				
109	556	88.	88.	91.5	91.				
124	557					90.	91.	90.	91.
119	559					91.	90.	88.	90.5
112	558					90.	92.	91.	90.5
154	560					92.	91.5	91.	91.5
		Av. 90.75				Av. 90.68			
Average....		90.52	91.12	91.27	91.15	89.77	89.68	90.69	90.67
Gain.....		0.75	1.44	0.58	0.48				

TABLE 33 COMPARISON OF PASTEURIZED AND UNPASTEURIZED BUTTER AFTER STORAGE, BASED UPON SCORES OF DECEMBER 30, 31, 1908, NEW YORK

Pasteurized					Unpasteurized			
Vat No.	Kieffer	Smarzo	Crawford	Lee	Kieffer	Smarzo	Crawford	Lee
1	90.	91.37	91.75	91.12	90.75†	90.12‡	90.87‡	90.87‡
2	90.5	91.5	91.25	91.25	88.50‡	88.62‡	90.5 ‡	90.62‡
3	89.25	90.12	90.5	90.62	87.5 ‡	88.62‡	88.25‡	88.75‡
4	90.5	90.62	90.25	90.62	90.5 *	89.37‡	90.62†	90.62*
5	90.5	90.75	90.62	91.	90.5 *	90.87†	91. †	90.75‡
6	90.75	91.5	91.62	91.	89.5 ‡	88.75‡	90.5 ‡	90.25‡
7	91.	91.5	90.75	90.87	90. ‡	88.25‡	89.75‡	90.25‡
8	91.	89.87	90.5	91.12	90.25‡	88.87‡	90.75†	90.5 ‡
9	90.	91.	91.37	91.12	91.25†	90.75‡	91.12‡	90.87‡
10	91.25	91.37	91.62	91.25	90.75‡	91.37*	91.37‡	91. ‡
11	90.75	91.12	91.37	91.37	87.75‡	88.75‡	90.5 ‡	91. ‡
12	90.	91.5	91.87	91.75	91. †	90. ‡	91.75‡	91.37‡
13	89.75	91.25	91.87	91.37	90.75†	90.87‡	91.87‡	91.37*
14	91.75	91.75	91.75	91.62	90.25‡	91. ‡	91.87†	91.5 ‡
15	91.25	91.75	91.75	91.75	89.75‡	90. ‡	91.62‡	91.5 ‡
16	91.	91.37	91.12	91.	89. ‡	89.5 ‡	91.12*	90.62‡
17	89.	90.	90.87	90.62	87.25‡	88.25‡	88.5 ‡	89.5 ‡
18	90.5	91.75	91.5	91.	89.25‡	89.25‡	90.12‡	90.25‡
19	91.	91.87	91.75	91.37	90.25‡	89.25‡	91.62‡	91.25‡
20	90.5	90.12	91.25	91.12	90.75†	91.12†	90.00‡	90.87‡

*Butter made from both the pasteurized and unpasteurized cream after storage, received the same average score. ‡Higher score for the pasteurized butter, †Higher for unpasteurized butter.

Table 33 is compiled from Table 32. The average of the scores on the four tubs of butter made from the pasteurized cream, Vat 1, by Kieffer, was 90.00; Smarzo, 91.37; Crawford, 91.75, and by Lee, 91.12. The butter made from the same grade of cream unpasteurized, received the following average scores, Kieffer, 90 75; Smarzo, 90.12; Crawford, 90.87 and Lee, 90.87. One of the judges placed a higher average score on the unpasteurized butter while, the other three judges favored the pasteurized butter.

TABLE 34 AVERAGE, HIGHEST AND LOWEST, OF THE 16 DIFFERENT SCORES ON THE SAME BUTTER, AFTER STORAGE, DECEMBER 30-31, 1908

Pasteurized				Unpasteurized			
Tub No	Av.	Highest	Lowest	Tub No.	Av.	Highest	Lowest
401–404	91.10	92. S. C.	89. K.	405–408	90.65	92. K.	89. K.
409–412	91.12	91.5 S. C. L.	90. K.	413–416	89.56	91. C. L.	87. K.
417–420	90.12	91. S. C. L.	87. K.	421–424	88.28	90. C. L.	85. K.
425–428	90.5	91.5 C. L.	89. C.	429–432	90.28	92. K.	89. K. S.
433–436	90.69	91.5 S. C. L.	89.5 S.	437–440	90.78	92. K. S.	89. K.
441–444	91.22	92. K. C.	89. K. C.	445–448	89.75	91. K.C.L.	87. K. S.
449–452	91.04	92. K. S.	90. K. C.	453–456	89.56	92. K.	85. S.
457–460	90.62	92. K. C.	89. S. C.	461–464	90.09	92. K. C.	88. K.
465–468	90.87	91.5 S. C. L.	88. K. L.	469–472	91.	92. K. C.	90. K.S.C.
473–476	91.43	92. K. S. C.	91. K. L.	477–480	91.12	92. K. S.	88. K.
481–484	91.22	92. K.S.C.L.	89. K.	485–488	89.41	91.5 C. L.	85. K.
489–492	91.28	92. K. C. L.	87. K.	493–496	91.04	92. K. C.	88. S.
497–500	91.06	92. K. S. C.	87. K.	501–504	91.22	92. K.C.L.	89. K.
505–508	91.72	92. K.S.C.L.	91. K.	509–512	91.21	92. K. C.	89. K.
513–516	91.62	92. K.S.C.L.	91. K.	517–520	90.65	92. C.	88. K. S.
521–524	91.12	91.5 S. C. L.	90. L.	525–528	90.06	91.5 C.	87. K.
529–532	90.12	91.5 C.	88. K.	533–536	88.37	90.5 L.	86. K.
537–540	91.18	92. K. S. C.	89. K.	540–544	89.72	91.5 C.	87. K.
545–548	91.5	92. K. S. C.	89. K.	549–552	90.59	92. K. C.	87. S.
553–556	90.75	92. L. K.	88. K. S.	557–560	90.68	92. K. S.	88. C.
	1820.53	1836.5	1781.5		1803.96	1833.0	1750.0
Av. . . .	91.03	91.8	89.0		90.31	91.65	88.0

TABLE 35 DIFFERENCE IN QUALITY OF BUTTER MADE FROM PASTEURIZED AND UNPASTEURIZED CREAM, ACCORDING TO EACH JUDGE

Vat No.	Kieffer		Smarzo		Crawford		Lee	
	Past.	Unpast.	Past.	Unpast.	Past.	Unpast.	Past.	Unpast.
1		0.75	1.25		0.88		0.25	
2	2.0		2.88		0.75		0.73	
3	1.75		1.50		2.25		1.87	
4	Same		1.35			0.37	Same	
5	Same			0.12		0.38	0.25	
6	1.25		2.75		1.12		0.75	
7	1.00		3.25		1.00		0.62	
8	0.75		1.00			0.25	0.62	
9		1.25	0.25		0.25		0.25	
10	0.50		Same		0.25		0.25	
11	3.00		2.37		0.87		0.37	
12		1.00	1.50		0.12		0.38	
13		1.00	0.38		Same		Same	
14	1.50		0.75			0.12	0.12	
15	1.50		1.75		0.13		0.50	
16	2.00		1.87		Same		0.38	
17	1.75		1.75		2.37		1.12	
18	1.25		2.50		1.38		0.75	
19	0.75		2.62		0.13		0.12	
20		0.25		1.00	1.25		0.25	

This Table differs from Table 33 in that the extent of difference is shown in place of average score. According to Kieffer, for two comparisons the average score of the four tubs of pasteurized was the same as the average score of the four tubs of unpasteurized butter. Average for thirteen comparisons was in favor of the butter made from the pasteurized cream and the other five were in favor of the butter made from the unpasteurized cream.

According to Smarzo, for two comparisons the average score for the butter made from both the pasteurized and unpasteurized cream was the same; 17 days in favor of pasteurized and two in favor of

TABLE 36 VARIATION IN SCORE ON DUPLICATE TUBS DECEMBER 30-31, 1908

Extent of variation		0	½	1	1½	2	2½	3	3½	4	4½	5
Kieffer	Past.	11		15		7		4		1		2
	Unpast.	5		10		15		7		2		1
Smarzo	Past.	15	14	6	2	2	1					
	Unpast.	8	7	14	1	7	1	1		1		
Crawford	Past.	14	12	5	9							
	Unpast.	14	13	7	1	2	2	1				
Lee	Past.	15	18	7								
	Unpast.	15	12	8	1	3	1					

unpasteurized butter. According to Crawford, two days the same, 14 in favor of pasteurized and four in favor of the unpasteurized butter. According to Lee, two days the same, and all the other eighteen comparisons received a higher average for the butter made from the pasteurized cream.

According to Lee, two tubs of the pasteurized butter scored the same at both scorings. One tub of the pasteurized butter and two of the unpasteurized, scored one-half of a point higher after storage.

Two tubs of butter Nos. 533–535 packed from the same churning June 16, scored 90 June 17, and 90.5 December 30. Tubs Nos. 534–536 packed from churning No. 2 from same vat of unpasteurized cream, scored 90, June 17, and January 30, 88–89 respectively. The remaining 153 tubs (Nos. 534–536 included) scored lower December 30, to the following extent: 6 tubs pasteurized and 2 unpasteurized, one-half point; 12 tubs pasteurized and 9 unpasteurized, one point; 15 pasteurized and 11 unpasteurized, one and one-half; 20 pasteurized and 23 unpasteurized, two points; 12 pasteurized and 11 unpasteurized, two and one-half; 5 pasteurized and 11 unpasteurized, three; 5 pasteurized and 3 unpasteurized, four and one-half points; 3 unpasteurized, four points, and 5 unpasteurized, four and one-half points.

The following results were obtained by comparing Kieffer's score on this butter before and after storage:

20 tubs pasteurized and 15 tubs unpasteurized, did not change; 15 tubs pasteurized and 16 unpasteurized, decreased one point; 5 tubs pasteurized and 10 unpasteurized decreased two points; 8 tubs pasteurized and 7 unpasteurized, decreased three points; 5 tubs unpasteurized, decreased four points; 2 tubs pasteurized and 5 unpasteurized, decreased five; 6 tubs unpasteurized decreased 6 points; 7 tubs unpasteurized, decreased 7 points, while 19 tubs pasteurized and 9 unpasteurized, increased one point; 8 tubs pasteurized and 5 unpasteurized, increased two points; 3 tubs pasteurized and 4 unpasteurized increased three points and 1 tub unpasteurized, increased four points.

There was a greater variation between Lee's and Kieffer's score on the butter before storage than after. This in a measure accounts for the number of tubs of butter, that according to Kieffer did not change or else received a higher score after storage.

September 14 and 15, 1908, the creamery located at Morrison, Illinois, was visited for the purpose of making a comparison of the butter made from pasteurized and unpasteurized cream.

September 14, a total of 1858 pounds of cream were received. All of the cream when mixed in the receiving vat, contained 0.43 percent acidity and 23 percent of fat. The flavor of the cream was decidedly bad, indicating age and poor care. Much of it was lumpy when delivered, a natural condition for cream from three to five days old which had not been thoroly stirred and containing such a low percent of fat. One-half of this cream was pasteurized to a temperature of 180° F. and the remainder was cooled at once to 50° F. and one and one-half hours later it was churned. The pasteurized cream was also

cooled to 50° F. and held at that temperature for 12 hours. The cream curdled when pasteurized. Loss in buttermilk from the pasteurized cream was 0.55 and for the unpasteurized 0.20. A few small particles of curd were noticeable in the butter made from the pasteurized cream, but there was no noticeable difference in the flavor of the two lots of butter.

The 2893 pounds of cream delivered September 15 contained nearly the same degree of acidity and percent of butter fat as that delivered the previous day. The flavor and condition of this cream was poorer than that of September 14. The two lots were treated the same as on the previous day except that the pasteurized cream was held only four hours at churning temperature. Loss in buttermilk from the pasteurized cream was 1.0 percent and unpasteurized, one-tenth of one percent. The butter made on this day from the pasteurized lot seemed to have a cleaner flavor than that made from the unpasteurized cream.

One 30 pound tub of butter was packed from each churning, marked—A unpasteurized, B pasteurized, for September 14, and C unpasteurized, D pasteurized, for September 15.

These four tubs were shipped by express, September 16 to Monarch Refrigerating Co., Chicago.

Federal Inspector Credicott examined this butter before it was placed in storage and gave each tub the following score:

A unpasteurized 91, B pasteurized 92, C unpasteurized 89, D pasteurized 87. One 5 pound box of butter was also packed from each of the two churnings of August 15 and submitted to three other butter experts. In each case the unpasteurized butter was given from one to three points higher score.

January 13, when the regular 160 tubs of experimental butter were scored, these four tubs were distributed promiscuously and given the numbers as indicated in the following Table:

	New number	Original number	Scores by			
			McKay	Crawford	Newman	Lee
Unpasteurized.....	85.	A	88.	88.	86.	89.
Pasteurized.....	77.	B	90.5	88.	86.	87.
Unpasteurized.....	5.	C	86.	87.	85.	86.
Pasteurized.....	120.	C	86.	90.	87.	87.

These tubs could not by appearance be distinguished from the 160 storage tubs.

January 4, 6, and 8, 1909, six tubs of butter were made at the University creamery representing pasteurized and unpasteurized butter from the same grade of cream. This cream was handled the same as in previous experiment. The butter made January 4, was packed in tubs marked E, pastuerized and F, unpasteurized. January 6, G pasteurized and H unpasteurized. January 8, I pasteurized and J unpasteurized.

These tubs reached Chicago January 12, and the butter was scored with the regular lot January 13. The tubs were of the same appearance as the other 164 tubs. The day previous to shipping this butter it was decided by the men who made it that tub E should score 94, and the other five 93, since no difference in flavor could be detected.

The tubs received the following score January 13.

New number	Original number	McKay	Crawford	Newman	Lee
27	E, pasteurized.....	91.5	93.	94.5	94.
61	F, unpasteurized.....	87.5	93.5	88.	93.
138	G, pasteurized.....	91.5	93.	88.	93.5
48	H, unpasteurized.....	89.	91.	87.	93.
43	I, pasteurized.....	91.	90.5	94.5	93.
15	J, unpasteurized.....	91.5	91.	91.	93.

The work recorded for 1905 and 1906 may be considered as a preliminary study, since it was not only an indication of what we might look for in studying butter, but also a means of working out a system for carrying on such investigation. The average for these two years makes it apppear that some conclusions had been reached. However, when individual scores are compared it is apparent that the averages are the result of one judge scoring high and another scoring low on the same tub or one judge scoring a comparison high on one day or correspondingly low on the following day. This led to the system followed during the years 1907 and 1908, when each churning was represented by duplicate tubs and the scoring done by several judges working independently.

During the whole period the work was done on a large enough scale to eliminate outside influences. In looking over the records of judging for 1907 and 1908, single instances might be selected which would lead one to believe that judging is very inaccurate. Such instances should not be used to condemn the whole system of judging. Judging butter by this or similar methods is an accurate means of estimating quality. Speaking collectively the work of the judges in this experiment is notably uniform and consistent.

In any comparison dealing with quality, the following facts must be observed: 1. The experiment must be conducted on a large enough scale to eliminate outside influences affecting flavor. 2. Any comparison of unlike conditions must be secured by using cream of identically the same grade. This means that a lot of cream must be first thoroly mixed and then divided to suit the comparison. 3. Uniformity must be followed in manipulation of churns. 4. Butter must be represented by two or more packages for each churn. 5. Quality should be determined by three or more judges, working independently, with no knowledge of the identity of the tubs or the nature of the experiment. This should be applied not only to experimental work, but to any contest where contestants are competing for a prize.

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