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Milk Tests and Comparison Tables

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South Dakota Agricultural College

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DAIRY EXPERIMENT.

A. H. WHEATON, Professor of Dairy Science.

ESTABLISHMENT.

The establishment of a Dairy School in connection with the South Dakota Agricultural College and Experiment Station was authorized by the State Legislature of 1891. The sum of two thousand dollars was appropriated for the erection of suitable buildings and these were built and furnished with all necessary modern appliances and apparatus for instruction and experimental work.

The Department was not furnished with cows, however, until May 15th, 1892, when eight Durham cows were transferred to it from the Department of Agriculture. Three of these were found to be unsuitable for dairy purposes, being inferior milkers and were sold. In March following, there were purchased four Holstein Friesians, two Devons, two Ayrshires, five Guernseys, five Jerseys and one grade cow, making in all twenty-four cows.

All work before this time was conducted with much doubt and uncertainity because the Department had no control of the milk until received; but the results of which are given in this Bulletin with the hope that it may be of some benefit to the dairy farmers of the State as showing what may be done even under most unfavorable circumstances.

Dairying is, comparatively speaking, a new industry in this state, and the writer is alive to the fact that any information giving reliable results under any and all conditions that are applicable to, or at all practical within this State is eagerly sought after by the people. This fact alone has induced the publication of the first part of this Bulletin.

SEPARATOR TEST.

In the spring of 1892, desiring to make some use of the power separator, DeLaval pattern, with a view to ascertaining something in regard to its efficiency as a cream separator, arrangements were made with a farmer living at a distance of five miles from the dairy buildings, who, on April 1st, commenced delivering milk. It was thought that the distance the milk had to be hauled, the time it was usually received, the condition of the cows, stables, etc., would make it a fair average sample of milk such as is generally received at a separating station, or at a creamery managed by the separator process.

The following tables give the results of the work for April and a part of May.

The days when no milk is recorded were days when it stormed or from some other cause the milk was not delivered, but was separated on the farm by a De Laval hand separator, and the cream only was brought to the Station, the results of which are shown in Table No. III:

Table I shows results from milk received in April, 1892, and separated at the Station creamery.

The cream was allowed to ripen on an average of about twenty-six hours and was churned in a revolving barrel, or rectangular churn. The churn was stopped when the butter granules were the size of cracked wheat, the butter milk drawn off, and the butter washed with water at a temperature of 46° F.

It will be noticed that there is quite a difference in the per cent. of cream obtained, which can be accounted for in two ways. The separator was a new one and it was found that a very slight difference in the feed made a very marked change in the per cent of cream obtained. Moreover skimmed milk was used to clear the bowl of all cream at end of each separation, the amount of which was not carefully considered at the time. This also had a marked effect on the time required to churn the cream which was probably due to an excess of milk in the cream of the 1st and 10th inst.

The apparent excess of butter over fat and amount of milk on the 20th and 22nd was due in part to over-ripening of the the cream.

TABLE NO. I.

	Pounds of milk separated.	Rate per hour.	Time separated—A. M.	Pounds of cream obtained.	Pounds of cream to 100 pounds milk.	Per cent of butter fat in whole milk,	Per cent of butter fat in skimmed milk.	Per cent of butter fat in butter milk.	Temperature of milk when separated—deg. Fahr.	Temperature cream was ripened—deg. Fahr.	Time required to churn, in minutes.	Temperature churned.	Amount of butter recovered in pounds.
April 1	365	1,460	9.30	99	27.17	4.2	.2	.4	95	65	59	64	16.50
" 3	377	1,331	9.20	54½	14.00	4.	.1	.2	96	65	20	63	18.25
" 4	371	1,020	9.45	55	14.85	4.2	.1	2.	98	65	32	64	18.
" 5	414	1,129	9.45	66	16.07	4.6	.2	.8	95	70	20	62	21.
" 6	400	996	11.00	50	12.50	4.2	.0	1.4	95	70	20	64	18.75
" 7	408	951	10.30	55	13.58	3.6	tr	...	94	70	25	64	19.
" 8	412	882	10.15	53	12.89	4.2	.1	...	95	70	50	62	19.50
" 9	391	977	10.00	77	19.72	4.	.1	.8	92	60	30	62	18.50
" 10	408	1,020	9.00	93	22.84	3.5	tr	.2	95	60	80	65	16.50
" 11	388	1,164	9.30	64	16.60	3.4	tr	.4	90	60	45	64	15.04
" 12	403	885	9.45	58	14.40	3.5	.0	.8	90	60	38	63	17.50
" 18	393	1,043	11.00	63	16.05	3.6	.3	.7	92	60	45	62	16.75
" 20	405	900	10.30	55	13.60	3.6	.3	1	92	60	40	62	20.00
" 22	370	924	10.30	67	18.11	4.	tr	.2	96	60	20	62	20.00
" 25	415	922	10.40	57	13.73	3.6	.0	.3	94	60	45	62	18.66
" 27	407	922	10.10	52	13.79	3.9	tr	.6	97	60	45	63	18.00
" 30	416	1,021	10.30	81	19.49	3.6	.1	.1	98	60	45	64	17.83
Totals	6,744	.....	.....	1,199.50	.....	...	..	...	.....	.....	.....	.....	309.99
Averages	.....	1,020.4	10.09	.....	16.43	3.8	..	...	94.00	63.02	63.02	63.05	.....

RECAPITULATION.

Total amount of milk for whole time	6,744.00
" " " cream " " "	1,199.50
" " " butter " " "	309.99
Pounds of butter per 100 lbs milk	4.59
" " milk per 1 lb butter	21.75
" " cream to 1 lb butter	3.86
" " milk to 1 lb cream	5.62
Average rate of separation per hour	1,020.4
Total lbs of butter fat as per Babcock test	256.27
Average lbs butter fat to 100 lbs milk	3.08
Average lbs butter to one of butter fat	1.24

Table II shows results from milk received in May from same source as that received in April with conditions about the same, except that the milk was fed to the seperator with less variation owing to a better understanding of its capacity. The speed of the separator was maintained at 7,400 revolutions per minute in both trials.

TABLE NO. II.

	Pounds of milk separated.	Rate per hour.	Pounds of cream obtained.	Pounds of cream to 100 pounds of milk.	Per cent of butter fat in whole milk.	Per cent of butter fat in skim milk.	Per cent of butter fat in butter milk.	Temperature of milk when separated—deg. Fahr.	Temperature cream was ripened—deg. Fahr.	Time required to churn, in minutes.	Temperature churned—deg. Fahr.	Amount of butter, in pounds
May 3	442	982	59	13.35	3.9	tr	.2	95	60	45	62	15.50
" 5	439	936	50	11.40	3.7	....	.2	94	60	50	62	16 25
" 7	416	924	67	16.12	3.7	.3	.2	94	62	45	62	17.88
" 10	442	901	61	13.81	4.0	tr	.2	90	62	40	62	18.00
" 12	420	933	63	15.10	3.0	tr	.2	86	64	25	64	17.50
" 14	393	958	65	16.55	4.2	tr	.2	87	60	8	65	16.56
Totals	2,552	....	365	.....	....	....	.....	...	.....	.....	...	101.63
Averages	.....	939	....	14.39	3.75	.05	.20	91	61.33	35.50	63	16.94

RECAPITULATION.

Average No. of lbs of milk per lb of butter	25.20
" " " " " butter per 100 lbs of milk	3.96
" " " " " cream per 100 lbs of milk	15.10
" " " " " milk per 1 lb of cream	6.62
Whole No. lbs milk	2,552.00
" " " cream	385.00
" " " butter made	101.63
Average No. lbs cream to 1 lb of butter	3.79
Average rate of separation per hour	939.00
Total lbs of butter fat as per daily averages	95.70
Average per cent of butter fat per 100 lbs milk	3.75

The above table does not show as good results as the pre-

ceeding one probably owing to the fact that during the first trial the cows were fed hay, bran and shorts while during the second test they were fed on fresh grass in pasture and were fed some bran. This test was made during the most unfavorable time of the whole year for good yields of butter.

Table III shows the results obtained from cream separated by farm separator, the cream being delivered instead of the milk and during the same periods.

TABLE NO. III.

	Weight of cream.	Pounds of butter.	Temperature cream ripened—deg.	Temperature churned—deg.	Time required to churn.	Pounds of cream to pounds of butter.
April 11	62	17.50	60	62	45	.....
" 14	53	16.00	60	62	65	.....
" 15	57	16.75	60	62	45	.....
" 16	57	16.75	60	62	45	.....
" 17	57	16.75	60	62	45	.....
" 19	78	17.50	60	62	40	.....
" 23	64	18.66	60	62	45	.....
" 24	64	18.66	60	62	45	.....
" 28	58	17.88	60	62	40	.....
" 29	58	17.83	60	62	45	.....
Total	588	174.30	.....	.....	.....	.....
Average	.....	.....	60	62	46	3.31
May 1	58	15.50	60	62	45	.....
" 2	57	15.50	60	62	50	.....
" 4	68	16.30	60	62	45	.....
" 6	69	17.00	62	62	40	.....
" 8	61	17.00	62	62	40	.....
" 9	64	17.75	62	64	60	.....
" 11	60	17.50	64	64	60	.....
" 15	55	17.00	64	64	60	.....
" 16	55	16.90	64	64	45	.....
" 17	55	17.00	64	64	45	.....
" 18	56	17.10	64	62	30	.....
Total	668	184.55	.....	.....	.....	.....
Averages	.....	.....	62.3	62.9	47.2	3.62

RECAPITULATION.

Estimated No. lbs of milk per day	404.3
" " " " " from which the cream was separated by hand separator	8,490.3
Total No. lbs cream for 21 days	358.85
" " " butter for 21 days	125.6
" " " butter for 100 lbs milk	4.22
" " " milk for 1 lb butter	23.66
" " " cream for 1 lb butter	3.50
Average lbs milk to 1 lb cream	6.75

The following estimates show the variations between the two separators:

	Power Separator	Hand Separator	Diff.
Avg No. lbs butter per 100 lbs milk two periods.	4.27	4.22	0.05
" " " milk to 1 lb butter, two periods.	23.47	23.66	.19
" " " cream to 1 lb butter, two periods	3.82	3.50	.32
" " " milk to 1 lb cream, two periods.	6.12	6.75	.63

It is generally conceded that one pound of cream to six pounds of milk is about the right proportion for best work with separators. The flow of milk is regulated in the hand separator by a tube made by the manufacturers and cannot be changed, while the flow of milk in the power separator is regulated by a thumb screw and can be changed at will by the operator; but it was found that a very slight change made quite a difference in the flow, and that it required very nice adjustment to get the desired results. Although the power separator was new and had to be adjusted by careful computation of time it will be seen that the average variation between it and the hand separator in amount of butter to 100 lbs of milk was only .05 of one pound, while in the amount of milk to one pound of butter it was .19 of one pound. The difference in amount of milk to one pound of cream was .63 of one pound.

The following table shows comparative yield of milk from individual cows on the Station farm from May 15, 1892 to January 1st, 1893. The cows were all of same breed (Short-horn) and were fed the same—on grass in summer and when the pasturage began to get short a feed of grain and corn fodder was given them once per day and when the weather became cold enough to compel stabling, they had all the coarse fodder they would eat with about a peck of bran and shorts mixed in equal parts by bulk, night and morning. It is to be regretted that no more definite data of amount, and kinds of feed can be given

for the reason that the feeding and care of the cows were conducted by another department and no notes taken. Following is comparative yield of each cow:

	May.	June.	July.	August.	September.	October.	November.	December.	Total.	Estimated yield for full year.
Number 1	517	1,101	1,073	962	791	679	489	582	6,194	9,291
" 2	330	676	731	642	567	471	354	354	4,125	6,187
" 3	127	482	427	140	9	.....	582	827	2,944	4,416
" 4	388	868	830	701	549	476	375	472	4,658	6,987
" 5	436	785	871	872	705	579	456	498	5,142	7,713
" 6	399	791	817	672	503	442	285	358	4,266	6,399
" 7	379	752	782	670	531	454	346	363	4,279	6,418
" 8	221	441	434	322	254	124	.....	.....	1,796	2,694
Total	2,797	5,895	5,965	4,981	3,908	2,225	3,887	3,394	33,054	50,105

The right hand column of figures show approximately what the cows would yield in one full year with ordinary care or such as a farmer would naturally give them. The table gives the exact amount of milk given by each cow which was obtained by weighing each cow's milk in the stable at each milking. These cows were selected from twenty-one, all of same breed and closely allied by families, No. 1 produced 3.44 times as much as No. 8, and 1.32 times as much as No. 5 which is the next best cow in the list.

If No. 8 produced enough to pay for her keeping, No. 1 produced enough to keep 3.44 cows like No. 8, or figuring the milk of the two cows to contain 4.5 per cent. butter fat, which is nearly correct, we find No. 8 would make 151.56 lbs of butter in a full year which at 20 cents per lb would bring $30.31, while No 1 would make 518.45 lbs of butter which at 20 cents per lb would bring $103.69 or a difference of $73.38. This table and summary are intended to show the necessity of testing and weighing each cow's milk so that none but profitable cows may be kept. The cost of keeping these two cows was as nearly the same as could be determined without weighing the feed, which

the Department has no facilities for doing and which was not done.

SEPARATION OF CREAM—*Gravity vs. Centrifugal.*

In September 1893 an experiment was undertaken to determine, as near as possible, the relative value of three different methods of separating cream, viz: The hand separator, the Cooley Creamer and shallow pans with conditions as nearly as possible identical with those of the average farmer. For this purpose the De Laval Baby Separator, Alpha pattern No. 2, was used. The Cooley Creamer sat out doors without ice, and the pans sat in a room used for cold storage in warm weather but without ice during the trial. The trial lasted five days in which, morning and evening, the whole milk from the whole herd was thoroughly mixed by pouring from one vessel to another, then carefully weighed and divided into three equal parts for the experiment. The following table shows the results from the hand separator:

SEPARATOR WORK.

	Pounds of milk separated.	Temperature of milk.	Revolutions per minute of separator.	Pounds of milk separated per hour.	Pounds of cream obtained.	Per cent of butter fat in whole milk.	In skimmed milk.	Amount of acid when churned—cc.	Total amount of butter in pounds.	Temperature churned.
September 26	43.50	90	7,176	330.	7.00	4.9	.1	40	.....	....
September 27	38.00	84	7,176	285.	7.50	4.8	tr	40	.....	....
do	35.00	90	7,026	251.	7.25	4.7	tr	40	.....	....
September 28	32.00	81	7,000	270.	3.50	4.7	tr	40	.....	...
do	36.00	92	7,110	266.	7.50	4.0	.1	40	9.85	62
September 29	38.00	88	7,020	285.	8.25	4.5	tr	40	.....	....
do	39.33	92	7,020	226.	8.50	4 4	tr	40	.....	....
September 30	35.00	96	7.020	262.	7.50	4.5	.1	40	.....	....
do	35.00	92	6,820	268.	7.00	4.5	tr	40	9.50	62
Total	.....	88	7,041	275.22	7.11	4.55	.033	40	.....	....
Average	331.83	..	.....	.....	....	....	....	..	19.35	....

No. lbs of milk per lb of butter	17.14
" " " butter per 100 lbs of milk	5.83
Total No. lbs butter fat in whole milk	15.09
" " " " from one lb butter fat	1.28

Cooley Creamer.

	Pounds of milk set.	Temperature of milk when set.	Temperature of water when set.	Number of hours before skimming.	Per cent of butter fat in whole milk.	Cream ripened at deg. Fahr.	Per cent of fat in skim milk.	Amount of acid when churned—cc.	Pounds of butter obtained,	Temperature churned—deg.
September 26	43.50	90	54	23.	4.9	62	.2	..	.....	..
September 27	38.00	84	42	23.	4.8	50	.4	.	.....	..
do	35.00	90	54	23.50	4.7	62	.4	..	.....	..
September 28	32.00	81	40	22.50	4.7	44	.3	..	.....	..
do	36.00	92	50	24.	4.0	52	.4	40	6.00	..
September 29	38.00	88	53	23.	4.5	52	.4	..	.....	..
do.	39.33	92	54	23.50	4.4	56	.3	..	.....	..
September 30	35.00	96	52	23.	4.5	63	.5	..	.....	..
do	35.00	92	57	23.	4.5	64	.6	44	11.13	..
Total	331.83	..	.....	.....	....	....	....	..	17.13	..
Average	.....	88	50.66	23.16	4.55	56	.38	42	.....	62

Total lbs milk per lb butter	19.31
" " butter per 100 lbs milk	5.17
" " butter fat in whole milk	15.09
" " " recovered from 1 lb butter fat	35.11

Shallow Pans.

	Pound of milk.	Temperature of milk when set.	Number of hours before skimming.	Per cent of butter fat in whole milk.	Cream ripened at deg. Fahr.	Per cent of butter fat in skimmed milk.	Amount of acid when churned—cc	Pounds of butter obtained.	Temperature churned—deg	Temperature of room.
September 26	43.50	90	..	4.9	62	.7	..	....	....	62
September 27	38.00	84	..	4.8	50	.7	..	.....	....	50
do	35.00	90	..	4.7	62	.5	..	.....	....	62
September 28	32.00	81	..	4.7	54	.6	..	.....	....	54
do	36.00	92	..	4.0	52	.5	50	7.50	64	52
September 29	38.00	88	..	4.5	52	.6	..	.....	....	52
do	39.00	92	..	4.4	56	.6	..	.....	....	56
September 30	35.00	96	..	4.5	63	.2	..	.....	....	63
do	35.00	92	..	4.5	64	.4	46	11.15	61	64
Total	331.83	..	..	....	..	....	..	18.65	....	..
Average	.....	88	24	4.55	56	.55	..	.....	62.5	56

Total lbs milk per lb butter	17.79
" " butter per 100 lbs milk	5.55
" " " fat in whole milk	15.09
" " " recovered from 1 lb butter fat	1.23

From the three last tables it will be seen that in both the shallow pans and the Cooley process of raising cream by gravition there was considerable loss over the separator process which is shown in the following comparisons:

	Separator.	Cooley.	Pans
Amount of milk to 1 lb of butter	17.14	19.31	17.79
" " butter to 100 lbs milk	5.83	5.17	5.55
" " butter fat in whole milk	15.09	15.09	15.09
" " butter recovered from 1 lb butter fat	1.28	1.13	1.23

According to this test the loss from the milk of one cow in one year allowing that the cow would give 5,000 pounds of milk which is not a large average, may be found in the following table of comparisons. Amount of butter produced from 5,000 pounds of milk by each process as follows:

	Separator.	Cooley.	Pans
	291.13	258.93	281.05
Loss in pounds of butter		32.20	10.12
Loss at 20 cents per pound.....		$6.44	$2.02

With ten cows the loss in money in one year would be by Cooley process $64.40, and by pans $20.20; while with twenty cows it would amount to $128.80 by use of the Cooley process, and $40.40 with pans. It will be noticed that better results were obtained by milk set in pans than that submerged in water in the Cooley Creamer, which is contrary to popular belief under ordinary circumstances. The only way I can account for it is that the pans were set in the room used for a cold storage in warm weather, and which at this particular time maintained an even temperature of about 60° F. which is the most favorable temperature for cream raising by gravitation and in shallow pans. Moreover, the temperature was very constant on account of the room having been well built and very close, while in the Cooley cans the temperature was allowed to go down with the cool nights and up with the warming sun of mid-day, the only condition being that it was kept as cool as it could be by pumping cold well water into the tank morning noon and night. Just at this time when the question of hand separators is being so vigorously agitated an extended experiment might be profitable, showing the difference in yield under many varying conditions and circumstances and probably an experiment of this kind will be undertaken during the coming summer.

During the past winter many Farmer's Institutes were held in various parts of the State extending from the south line nearly to the north line in which samples of milk were brought in by the farmers and publicly tested with the Babcock milk tester. A few of these tests are given here to show the actual wide variation in the value of milk as it comes from the farm or city dairy.

Milk tested at Dell Rapids, January 5, 1894:

No.	Per Cent of Fat.	Per Cent of Butter.	Price per 100 lbs of Milk—Butter @ 20c.
1	3.00	3.75	.75
2	5.40	6.75	1.35
3	4.00	5.00	1.00

4	5.00	6.25	1.25
5	4.00	5.00	1.00
6	4.40	5.50	1.10
7	5.00	6.25	1.25
8	7.20	9.00	1.80
9	4.20	5.25	1.05
Average	4.69	5.86	1.17

Milk tests made at Lake Preston, January 4, 1894:

No.	Per Cent of Fat.	Per Cent of Butter.	Price per 100 lbs of Milk—Butter @ 20c.
1	3.00	3.75	.75
2	3.60	4.50	.90
3	6.60	8.25	1.65
4	5.40	6.72	1.35
5	3.60	4.50	.90
6	3.60	4.50	.90
7	3.60	4.50	.90
8	7.20	9.00	1.80
9	3.80	4.75	.95
10	3.40	4.25	.85
11	4.20	5.25	1.05
12	3.40	4.25	.85
13	8.00	10.00	2.00
14	8.20	10.25	2.05
15	4.60	5.75	1.15
16	4.40	5.50	1.10
17	4.40	5.50	1.10
18	5.60	7.00	1.40
19	6.60	8.25	1.65
20	5.60	7.00	1.40
21	6.40	8.00	1.60
22	5.40	6.75	1.35
23	7.00	8.75	1.50
24	7.00	8.75	1.50
25	3.00	3.75	.75
Average	5.11	6.38	1.26

In this table it will be seen that $1.26 is the average price for the milk tested, computing butter at 20 cents per pound, while 75 cents is the lowest and $1.80 the highest price. The difference between the maximum and the minimum price is $1.05. In other words if this milk was to be pooled in a co-operative factory and all patrons to be paid same price per 100 pounds of milk No. 25 would get the difference between 75 cents

and the average price $1.26 more than belonged to him, which would be 51 cents per 100 pounds, while No. 8 would get the difference between $1.80 and the average price $1.26 less than belonged to him, which would be 54 cents.

These tests were very carefully made and are given here to show the fallacy and injustice of the old practice of paying for milk or cream by volume or weight. A careful study of these tables will prove both suggestive and instructive to those who contemplate patronizing a co-operative cheese or butter factory.

Milk tests made at Bryant, January 23, 1894:

No.	Per Cent of Fat.	Per Cent of Butter.	Price per 100 lbs of Milk—Butter @ 20c.
1	6.00	7.50	1.50
2	6.40	8.00	1.60
3	5.00	6.25	1.25
4	4.60	5.75	1.15
5	5.80	7.25	1.45
6	8.20	10.25	2.05
7	6.80	8.50	1.70
8	5.20	6.50	1.30
Average	6.00	7.50	1.50

Milk tests made at St. Lawrence, January 31, 1894:

No.	Per Cent of Fat.	Per Cent of Butter.	Price per 100 lbs of Milk—Butter @ 20c.
1	4.20	5.25	1.05
2	6.80	8.50	1.70
3	5.60	7.00	1.40
4	6.20	5.25	1.05
5	4.80	6.00	1.20
6	5.20	6.50	1.30
7	6.60	8.25	1.65
8	4.80	6.00	1.20
9	5.60	7.00	1.40
10	4.20	5.25	1.05
11	5.20	6.50	1.30
12	9.00	11.25	2.25
13	5.60	7.00	1.40
14	4.00	5.00	1.00
15	3.60	4.50	.90
16	4.40	5.50	1.10
17	5.60	7.00	1.40
18	4.20	5.25	1.05
19	4.40	5.50	1.10

20	4.80	6.00	1.20
21	4.60	5.75	1.15
22	3.60	4.50	.90
23	7.80	9.75	1.95
24	6.80	8.50	1.70
25	4.60	5.75	1.15
26	9.20	11.50	2.30
Average	5.40	6.75	1.35

Milk tests made from skimmed milk:

No.	Per Cent of Fat.	Per Cent of Butter.	Price per 100 lbs of Milk--Butter @ 20c.
1	1.00	1.25	.35
2	.10	.02	.04
3	.60	.75	.15
4	1.60	2.00	.40
Average	.85	1.06	.21

Buttermilk:

No.	Per Cent of Fat.	Butter in 100 lbs.	Price per 100 lbs of Milk—Butter @ 20c.
1	.80	1.00	.20
2	1.20	1.50	.30
3	1.50	1.87	.37
Average	1.16	1.45	.29

But few samples of skimmed or butter milk were brought in, but enough to show that considerable waste is incurred in the common practice of setting milk for cream, and in the ripening and churning the same into butter. More attention will be given this part of the work in future with the hope of being able to check this waste, and save it to the farmer who keeps a few cows.

Following are the results obtained from the College herd of cows from January 1st, 1893 to January 1st, 1894. The milk was weighed from each cow at each milking and an accurate account kept of same for the entire period.

The Ayrshires, Devens, Guernseys and Jerseys were purchased in Wisconsin in March and could not be expected to do as well as cows that had become acclimated and used to Dakota grown feeds.

The whole herd have been kept on prairie grass for pasturage, but were fed some fodder corn when grass began to get short from drouth. While on grass they were not fed grain ex-

cept, perhaps, a pint each of bran and shorts night and morning as an inducement for them to take their places in the stable to be milked.

In winter they were fed on fodder corn and millet for hay, and when we had it, ten pounds of bran and shorts to each cow per day, and when the days were warm enough not to freeze, they were allowed to run in the yard and to ricks of fresh straw. But when the weather would not permit of outdoor exercise they were fed straw at noon in the stable, which seemed to be highly relished by them. The stables are in a basement where the temperature is easily kept above freezing. No hay was fed them during the winter. These cows have not been crowded in any way, the object being to keep them as nearly as possible as a good, prudent dairy farmer should keep cows in Dakota, and the figures given in the table below are not intended to show the best possible results obtainable, but to show the practical results of keeping a herd of good dairy cows as any ordinary farmer can keep them if he will. The writer believes that he is thoroughly acquainted with the conditions surrounding the average farmer in this state and believes it to be the duty of this department to try those experiments first, which may be of the most practical benefit to him, and most easily reached by him, with the means he may have at his command, with as little extra outlay as possible:

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total pounds milk.	Average per cent. butter fat.	Pounds of butter in year.	Value of butter @ 20 cts. per lb.
Proserpine,* Holstein Friesian, calved Feb. '92.	757.09	663.	738.13	645.03	669.04	733.02	550.01	234.04	6.09	.....	.....	881.06	5,899.11	3.35	246.58	49.32
Lakeman Lass, Holst. Fries., calved Dec. 20,'92..	929.04	960.	949.08	914.16	890.	929.18	877.08	701 01	492.	289.10	155.05	244.04	8,052 14	3.29	330.12	66.02
Lakeman Lassie, Holst. Fries.,calved Feb. 12,'93	243.02	269.	228.04	179.16	108.04	376.08	597.14	570.02	482.06	438.08	380.17	378.01	4,222.02	3.68	194.21	38.84
Elmside Lass, Holstein Fries., calved June 8,'93	.....	304.04	628.08	541.12	493.06	523.	496.11	404.02	293.04	265.18	297.	228.04	4,475.09	4.18	233.69	46.73
America 1, Short Horn, calved May 5, '93.....	539.11	273.11	45.11	.....	834.08	1266.18	1220.12	1020.16	773.12	718.05	713.14	659.09	8,066.09	4.00	403.30	80.66
America 2, Short Horn, calved April 8, '93.....	302.	189.05	45.08	531.09	791.12	765.14	676.04	584.08	463.13	400.01	350.	318.	5,325.14	4.00	266.25	53.25
Maggie Hughes, Short Horn, calved April 28, '93	354.	201.03	57.09	44.13	891.12	1013.08	965.10	754.19	520.	428.13	446.	392.05	5.840.	5.50	401.20	80.24
Mary Clay, Short Horn, calved June 8, '93.....	455.	386.	387.19	229.	79.11	.....	710.	959.09	655.09	640.09	644.02	624.07	5,774 06	4.52	325.23	65.05
Rose of Bloom, Short Horn, calved Nov., '92....	789.	624.09	741.04	582.12	563.06	743.06	727.16	447.03	149.08	.....	.....	.....	5,261.40	3.75	240.91	48.18
Lady Holbrook, grade, calved March 10, '93.....	.....	.....	336.17	541.18	564.03	585.15	572.03	420.17	330.	198.02	178.09	54.08	3,782.12	4.56	215.58	43.12
Hebron, Devonshire, calved March 5, '93	.....	.....	.....	518.07	710.12	754.07	713.05	504.07	619.07	312.01	266.05	170.04	4,570,15	5.65	322.65	64.53
Birdie, Devonshire, calved July 5, '93.....	.....	.....	.....	.....	.....	.....	734.	859. 11	659.05	619.09	608.03	559.07	4,040 15	4.60	232.20	66.46
Queen, Ayrshire, calved Sept. 4, '93.....	.....	.....	185.03	300.15	314.16	319.14	233.02	42.14	544.04	615.10	469.07	451.01	3,476.06	4.36	189.09	37.82
Lille, Ayrshire, calved May 12, '93.....	.....	.....	.....	.....	321.	1151.08	1060.14	829.06	533.18	442.16	374.11	521.09	5,868.	4.93	324.50	64.90
Daffodil, Guernsey, calved July 14, '93.....	.....	.....	220.11	356.05	335.08	264.08	236.14	.....	31.16	.....	.....	49.02	1 494.04	4.30	80.23	16.04
Lauretta, Guernsey, calved March 14, '93.....	.....	.....	443.06	775.07	787.15	866.02	863.16	682.18	351.06	416.08	463.11	478.04	6,129.00	5.00	383.06	76.61
Square's Beauty,† Guernsey.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Serrepta, Guernsey, calved Sept. 11, '93.....	.....	.....	.....	.....	.....	.....	.....	.....	145.14	807.10	738.16	689.08	2,382 08	4.60	137.02	27.40
Barca, Guernsey, calved March 11, '93.....	.....	.....	183.10	374.13	386.18	445.12	450.02	337.03	305.06	221.09	174.07	211.	3,090.	5.24	202.39	40.48
Mary Grant, Jersey, calved June 2, '93.....	.....	.....	266.10	284.04	328.13	431.17	416.06	379.08	256.05	365.01	264.03	251.08	3.243.15	5.78	230.91	46.18
Lady P. Pogis, Jersey, calved Nov., '92.....	.....	.....	340.01	449.07	626.	666.15	720.07	480.13	268.09	242.06	228.05	232.05	4,284.02	5.28	257.79	51.56
Lady Mahopac, Jersey, calved Aug. 10, '93.....	.....	.....	367.19	442.09	438.11	503.01	420.07	239.08	369.07	367.	387.04	288.08	3,623.14	6.16	293.47	58 69
Ella Europa, Jersey, calved Oct. 29, '93.....	.....	.....	295.02	514.10	542 19	579.	550.13	377.06	78.01	.....	340.01	460.08	3,738.	6.20	289.69	57.94
Enamel, Jersey, calved March 20, '93.....	.....	.....	68.13	700.09	663.05	669.10	647.	471.12	387.02	284.06	308.05	203.06	4,403.08	4.92	270.78	54.16

* Fresh Dec. 6, '93. † Farrow.

HOLSTEIN FRIESIANS.

Broserpine had been giving milk 13 months before this record was commenced.

Lakeman Lass is an imported cow, 10 years old April 3d.

Lakeman Lassie is the daughter of Lakeman Lass and was four years old March 29th.

Elmside Lass is a daughter of Lakeman Lass was three years old December 25th, 1893.

SHORT-HORNS.

America 1st is a roan cow, 6 years old July 5, 1893.
America 2nd is a red cow 5 years old December, 1893.
Maggie Hughes is red and five years old June 4, 1893.
Mary Clay is red and was 9 years old April 7, 1893.
Rose of Bloomfield is red and was four years old April, 1893.
Lady Holbrook is a grade Holstein 4 years old April, 1893.

DEVONS.

Hebron is dark red, 5 years old April 19, 1893.
Birdie is dark red, 5 years old April 30th, 1893.

AYRSHIRES.

Queen is red and white, spotted, 8 years old, September 4th, 1893.

Lilly is red and white, spotted, 7 years old, April 13, 1893.

GUERNSEYS.

Daffodil was 11 years old August 22d, 1893. She injured her udder and gave garget milk for a long time during which her milk was not recorded.

Lauretta is a very fine type of Guernsey six years old, March 19, 1893.

Square's Beauty did not come in; she was 3 years old February 26, 1893.

Serrepta was 3 years old February 12th, 1893.

Barco was two years old February 4, 1892; was due to calve May 1st but got hurt in shipping and lost her calf March

11th. She was brought to her milk, however and did very well.

JERSEYS.

Mary Grant is a fawn color and five years old Feb. 18, 1893.

Lady Pansey Pogis is fawn color and 6 years old August 2d, 1893.

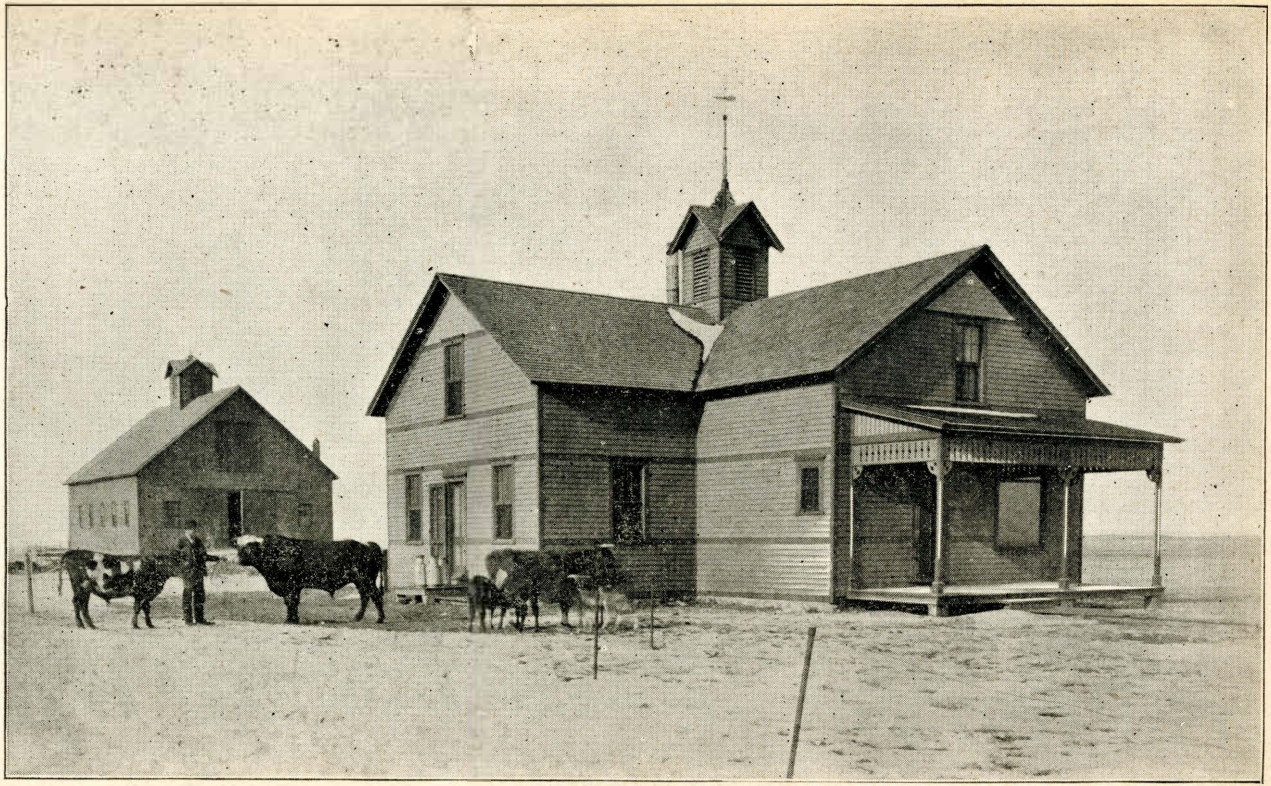
Ella Europa, 3d, is dark bronze and white and was 5 years old February 19th, 1893.

Lady Mahopac is fawn and white and 5 years old January 17, 1893.

Enamel is light fawn color 2 years old April 25th, 1893, and is a beauty, giving promise of a very fine cow.

These short sketches are given to enable those interested in the record table to judge better of the merits of the different breeds, age having something to do with the richness of milk. The older a cow is up to and including her prime, the richer her milk.

The limitation for space in this bulletin will not permit of more explicit data being given than is contained herein but all further information desired will be cheerfully furnished by the department.



View of Dairy Building and Barn.

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