THESIS

Comparison of fat globules.

Noel M. Morse. 1896.

Dairy husbandry

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COMPARISON OF FAT GLOBULES

By

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AUGUST 1890.

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COMPARISON OF FAT GLOBULES.

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The size of fat globules is commonly spoken of in agricultural text books and papers as an important breed characteristic,and the expressions,"breeds with large globules" and "breeds with small globules" are frequently met with. Considerable time has been spent in other experiment stations in comparing the fat globules of different breeds of cattle,and valuable and reliable results have been obtained. Heretofore at this station,very little has been done in comparing the size of the fat globules of the different cows in the college herds,and nothing has been done in comparing the milk of the different cows in regard to the number of globules in a given volume.

The object of this thesis is to compare the fat globules in the milk of the different cows in the college herd. The comparison is made,first,in regard to the number of globules in a given volume and the relative size of these globules; Second,in regard to the absolute size and uniformity of size. The methods used in making these comparisons and the results obtained are taken up in detail and in the order mentioned.

I. The comparison of the number of globules in a given volume was done by actual count. This at first would seem almost impossible,but when one knows how to do the work it is quite easy. The method adopted for this work was that of

Dr.Babcock,as described in the Fourth Annual Report of New York (Geneva) experiment station(1885),pp 371-375. A small glass tube,one-fourth inch in diameter,was heated and drawn out till the internal diameter was about one-tenth millimeter. Care was taken to draw it straight and that no flat surfaces were made. Small pieces of this capillary tube (2-3 centimeters in length) were dipped in the sample of milk and allowed to fill by capilary attraction. The ends of the tubes were then sealed with vaseline and put upon a microscope slide. A drop of glycerine was then added and a cover glass put over all. The sample of milk used was diluted to one part in fifty. The slides thus prepared were laid aside for a few minutes then they were put under a microscope magnifying 280 times. The fat globules floated on top and were easily counted.

By the use of the eye-piece micrometer the exact inside measurement of the tube was found. The tube,as was said before,was ~~about~~ one-tenth millimeter in diameter,and the length of the section in which the fat globules were counted was exactly one-tenth millimeter. Two tubes were filled from each cows milk and four counts were made from each tube, thus making eight counts from each sample. The average of these counts is the one that is used in stating the result.

Counts were made from the milk of sixteen cows of various breeds, six being Holsteins, five Jerseys, one Guernsey, one Red Polled, one Brown Swiss and two Natives.

Table I shows the data from which the comparisons in Table II were made. It shows the diameter of the tube used in each instance and the volume of the section. It also shows the average number of globules in that section. The length of the section was in each case one-tenth millimeter and the milk was diluted one to fifty. By the use of the Babcock test the % of butter fat in each smaple was found, and the results are found in the table.

TABLE I

Name of Cow	Breed	Diameter in millimeters of fat cell	Volume in cubic millimeters of section	No. of globules in section	% butter fat in milk examined *
Howtje D.	Hol.	.138	.00I387	67	3.
College Howtje	"	.146	.00I72I	55	3.
Belle Sarcastic	"	.138	.00I387	63	3.
College Pauline America	"	.165	.002I30	40	2.3
Oatka 3d.Wayne	"	.138	.00I486	42	2.4
College Pauline Wayne	"	.I3I	.00II5	40	2.7
College Dame Le Brocq	Jer.	.I3I	.00II5	30	6.3
College Dame Le Brocq 2d.	"	.090	.00077	37	3.9
College Pogis	"	.11	.00095	33	3.7
College Pogis 3d.	"	.099	.00077	34	4.2
Jersey	"	.II	.00095	32	4.4
Becky	Brown Swiss	.I3I	.00II5	43	2.8
Aida 3d.	Chocm. Red	.I24	.00I4I	63	5.2
Cara	Polled	.II4	.00I02I	37	3.5
Milla	Native	.II4	.00I02I	28	3.9
Materna	"	.I38	.00I387	38	3.3

* See table IV for average % butter fat for the week the count was made.

Table I is of but little value as a means for comparing results. it merely shows the various sizes of the tubes used and the per cent of butter fat on the day the count was made. In nearly all cases however, the per cent of butter fat on that day was considerable below the average for that week. Attention is called to table IV. which gives the average per cent fat for that week.

Table II is an outgrowth of table I. The figures given in this table were found by mathematical computations, using those in table I as a basis to work from. The first colums shows the number of globules in a tenth-millimeter section of a tube one-tenth millimeter in diameter, or a volum of .0007854 cubic millimeter.

So far the milk has been diluted to one part to fifty. Now by further computation the results found in the next two columns have been obtained.

The last column should be quite interesting. It does not show the exact size of any of the globules, but it does show the relative sizes of average globules from each sample of milk. These figures were obtained by multiplying the per cent butter fat in each instance by 10,000, to avoid fractions, and dividing the product by the number of fat globules in .0001 cubic millimeter of undiluted milk.

TABLE II.

Name of Cow	Breed	Globules in 1 cubic mm. long and 1/1000 mm. diam.	Globules in 1 cubic millimeter undiluted milk	Globules in 1 cc. undiluted milk	Relative size of globules
Howtje D	Hol.	41	301	3,010,000,000	115
College Howtje	"	35	159	1,590,000,000	189
Belle Sarcastic	"	38	242	2,420,000,000	134
College Pauline America	"	18	114	1,140,000,000	303
Oatka Sd. Wayne	"	22	140	1,400,000,000	173
College Pauline Wayne	"	27	173	1,730,000,000	157
College Dame Le Brocq	Jer.	35	159	1,590,000,000	300
College Dame Le Brocq Sd.	"	28	178	1,780,000,000	219
College Regis	"	24	153	1,530,000,000	111
College Regis Sd.	"	24	153	1,530,000,000	274
Jersey	"	26	165	1,650,000,000	267
Becky	Brown Swiss	29	185	1,850,000,000	151
Alda Sd.	Guern.	35	223	2,230,000,000	233
Cara	Red Polled	28	178	1,780,000,000	195
Willa	Native	22	140	1,400,000,000	278
Victoria	"	29	185	1,850,000,000	173

Conclusions.

It is perhaps unfair to make any definite statements in regard to the different breeds represented, because they have not been equally represented. A comparison, however, between the averages of the Holsteins and Jerseys shows that the Holsteins have about 11 3/4 per cent more fat globules in a given space than the Jerseys, but in regard to relative size the Jerseys are in the lead, their globules being 61 1/2 per cent larger than the Holsteins.

In comparing the different individuals, it will be found that Howtje D.(Holstein) leads in number of globules in a given volume, while College Pauline America (Holstein) has the least number. College Dame Le Brocq (Jersey) has the largest globules and College Pogis (Jersey) has the smallest. Aida 3d.(Guernsey) is ahead of the Jerseys in number of globules and is close to them in relative size.

Mention ought to be made before taking up the comparison of the real size of fat globules of an apparent contradiction of table II that will be found on comparing the drawings used in showing the size and uniformity of size of the fat globules of different cows. This may be explained by saying that the drawings were made several days before the counts were made, and that the "Relative size" in table II expresses a relation

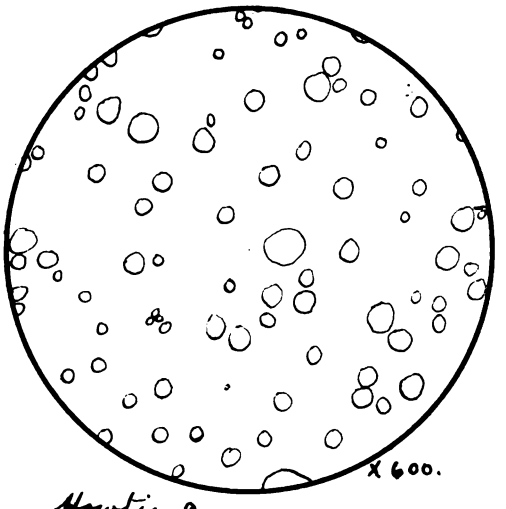
between the average sizes of globules while in the drawings, the large globules,as well as the small ones,are shown.

II. The second part of this thesis has to do with the size and uniformity of size of the fat globules in milk from the cows in the college herd.

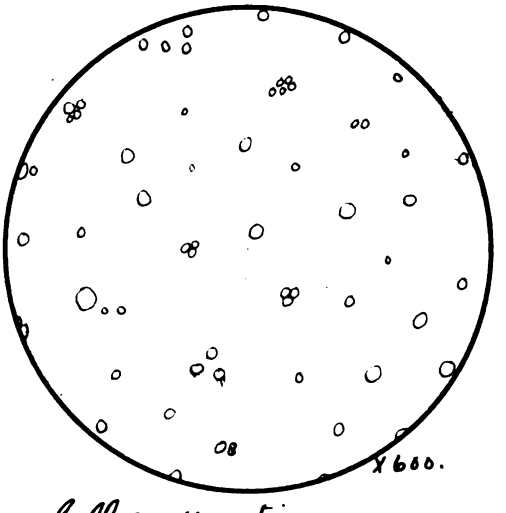
A sample of each cow's milk was examined microscopically, and,with the aid of a camera lucida,drawings were made. In preparing the slides for the microscope an attempt was made to have as little milk under the coverglass as possible,and although considerable care was taken in this respect,some slides had more milk on than others. The more milk present the thicker the globules in the drawing. Hence the drawings will be somewhat misleading if used in comparing the number of globules in a given space.

The microscope used in making these drawings magnifies 600 times.

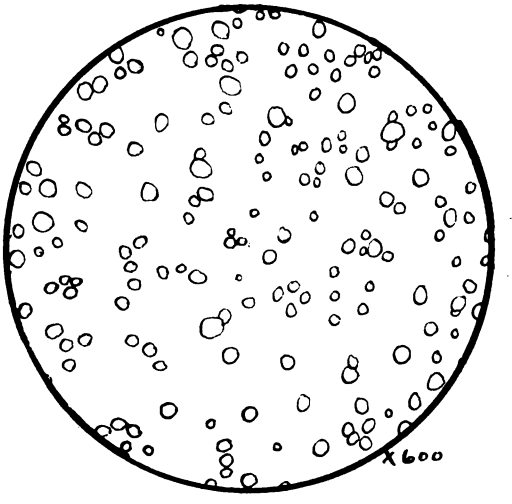
On each card will be found the name of the cow whose fat globules are represented and the name of the breed to which she belongs. Measurements were made of the largest and smallest globules and the results will be found under each drawing. These results will also be found in table III following the drawings.



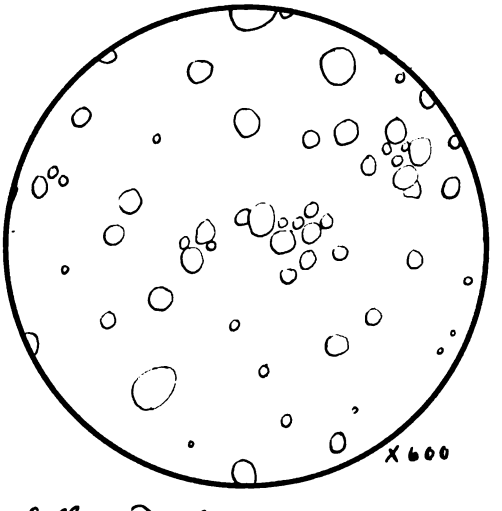
Howtje D. (Holstein)
Largest Diameter .0083 m m.
Smallest .. .0009 ..



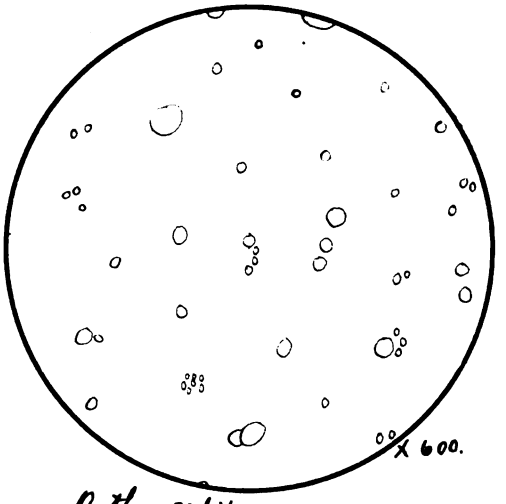
College Howtje (Holstein)
Largest Diameter .0041 m m.
Smallest .. .0007 ..



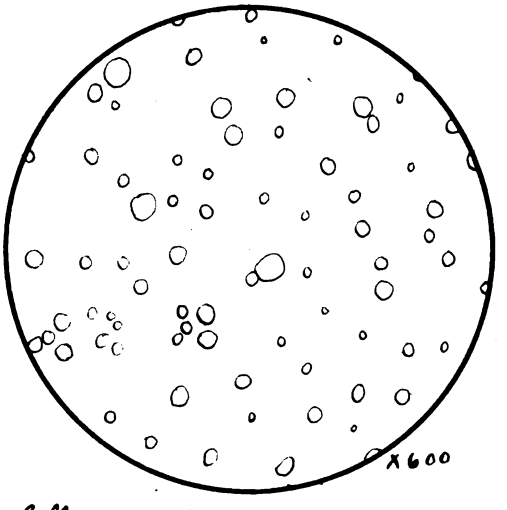
Belle Sarcastic (Holstein)
Largest Diameter .0041 mm.
Smallest .. .0013 ..



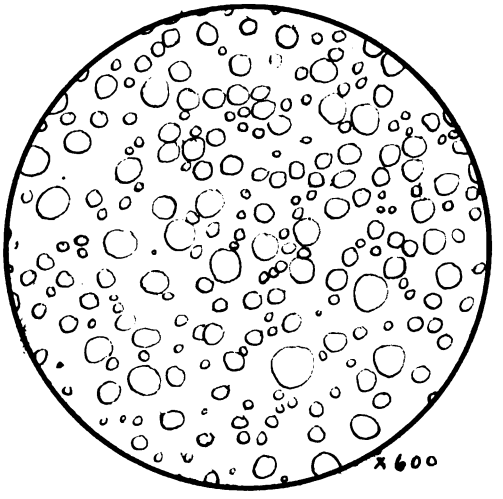
College Pauline Cimerica (Holstein)
Largest Diameter .0095 mm.
Smallest .. .0012 ..



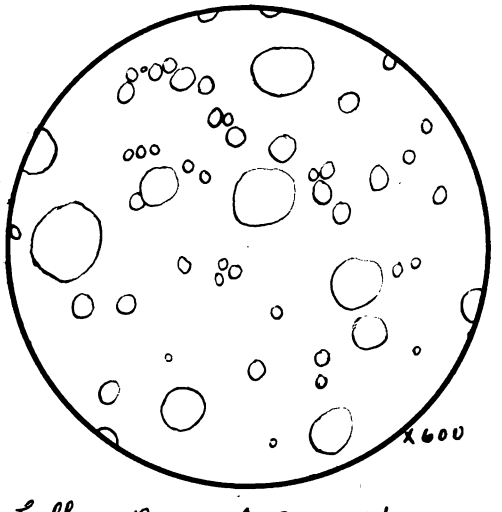
Oatka 3rd Wayne. (Holstein)
Largest Diameter .0066 mm.
Smallest " .0006 "



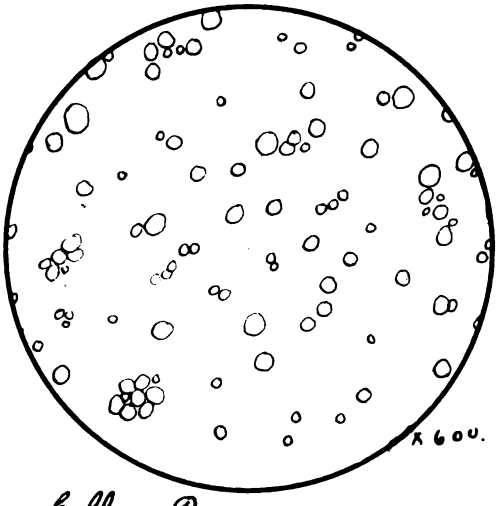
College Parkland Wayne. (Holstein)
Largest Diameter .0051 mm.
Smallest " .0008 "



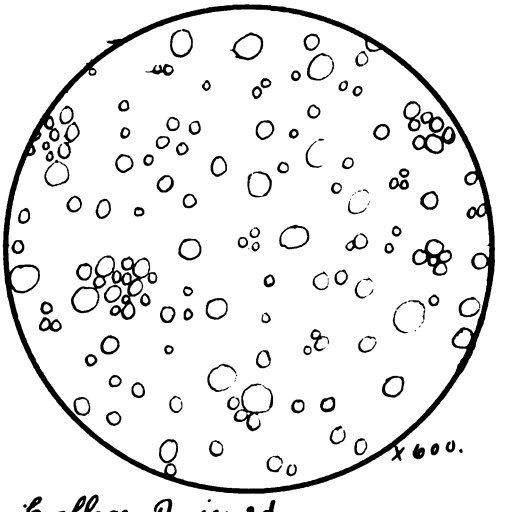
College Dame Le Brocq (Jersey)
Largest Diameter .0091 m.m.
Smallest " .0007 "



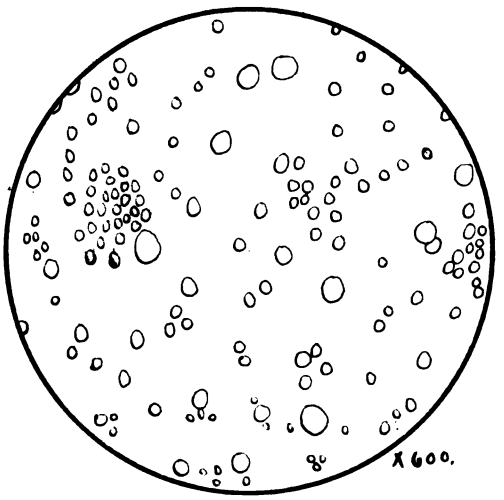
College Dame Le Brocq 2d (Jersey)
Largest Diameter .015 m.m.
Smallest " .0013 "



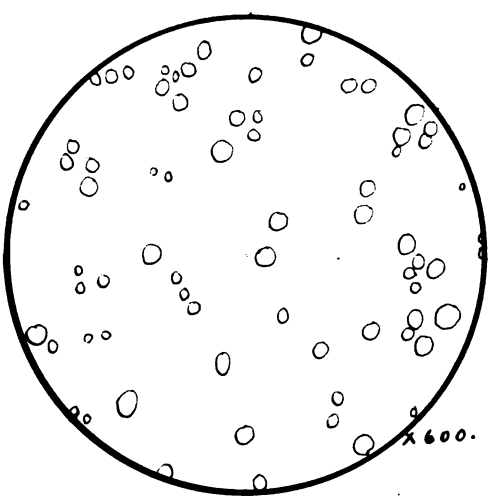
College Pogis. (Jersey)
Largest diameter .0054 mm.
Smallest " .0013 "



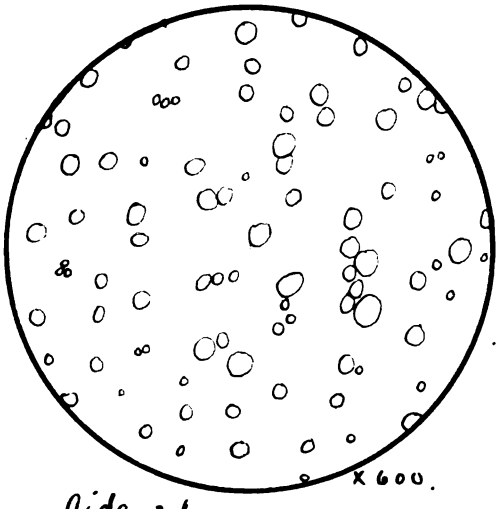
College Pogis 2d. (Jersey)
Largest diameter .0063 mm.
Smallest " .0013 "



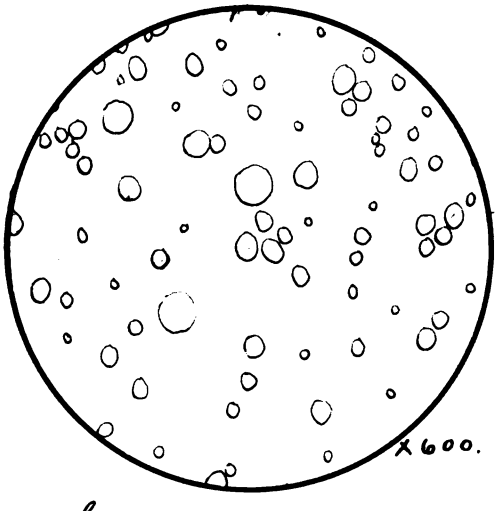
Jersey. (Jersey)
Largest Diameter .0061 m m.
Smallest .. .0013 ..



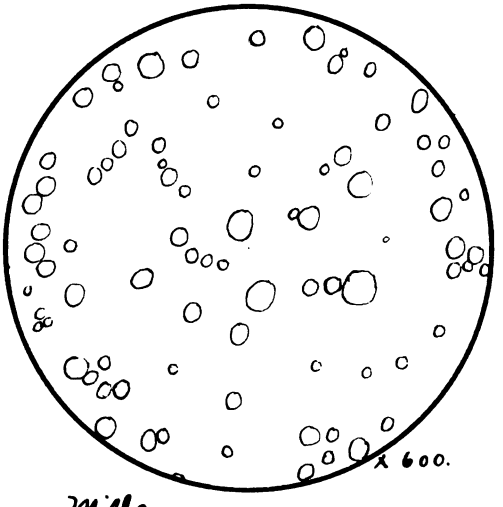
Becky. (Brown Swiss)
Largest Diameter .0071 m m.
Smallest .. .0009 ..



Aida 2d. (Guernsey)
Largest Diameter .0058 mm.
Smallest .. .0012 ..

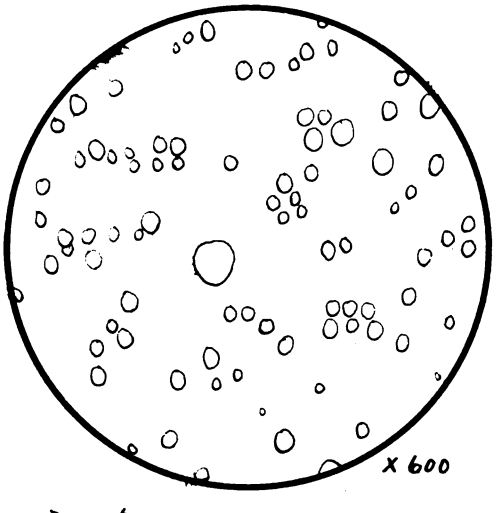


Cara. (Red Polled)
Largest Diameter .0085 mm.
Smallest .. .0016 ..



Milla.

	(Native)
Largest Diameter	.0075 mm.
Smallest "	.0014 "



Materna.

	(Native)
Largest Diameter	.0091 mm.
Smallest "	.0012 "

Table III

Names of Cows	Breed	Diameter in m m. of largest globule	Diameter in mm. of smallest globule.
Howtje D.	Hol.	.0083	.0009
College Howtje	"	.0041	.0007
Belle Sarcastic	"	.0041	.0013
College Pauline America	"	.0095	.0013
Oatka 3d. Wayne	"	.0066	.0006
College Pauline Wayne	"	.0051	.0006
College Dame Le Brocq	Jersey	.0091	.0007
College Dame Le Brocq 3d.	" "	.015	.0013
College Pogis	"	.0054	.0013
College Pogis 3d.	"	.0063	.0013
Jersey	"	.0061	.0013
Becky	Brown Swiss	.0071	.0009
Aida 3d	Guernsey	.0058	.0013
Cara	Red Polled	.0085	.0016
Milla	Native	.0075	.0014
Materna	"	.0091	.0013

Conclusions.

Here again conclusions cannot be arrived at in regard to all the breeds represented on account of the inequality in representations. The drawings,however,warrant the statement that the Jersey globules are larger than the Holstein globules. These two breeds are about the same in regard to uniformity of size. The fat globules from College Dame Le Brocq 3d. are among the largest ever seen. Those from Aida 3d.(Guernsey) are particularly noticable for their uniformity of size. Materna and Milla (Natives) make a good showing in regard to size and uniformity of size. Their milk in these respects resembles Jersey milk.

In regard to the size and uniformity of size of the globules from each individual cow,a clearer idea can be obtained by a study of the preceding drawings,to which the readers attention is respectfully called.

Remarks.

There is one condition that affected the results considerably,namely,the length of time that the different cows had been giving milk. It has been found that the number of globules increases and the size decreases as the period of

lactation lengthens. In table IV will be found the number of days each cow had been giving milk when the counts and the drawings were made.

In table I the per cent butter fat on the day the count was made is given. Inasmuch as the test was low that day, it seems no more than fair that the average test for that week should be given. Table IV shows the per cent butter fat on the day the count was made, also the average per cent for that week..

Table IV.

Name of Cow	Breed	Days in milk when count was made.	Days in milk when drawing was made.	% fat in day count was made.	Average % fat for the week count was made.
Howtje D.	Hol.	223	180	3.	3.2
College Howtje	"	73	30	3.	3.1
Belle Sarcastic	"	153	138	3.	3.
College Pauline America	"	40	4	2.3	2.7
Oatka Ct. Wayne	"	104	61	3.4	3.9
College Pauline Wayne	"	153	110	3.7	3.1
College Dame Le Brocq	Jersey	309	286	6.3	6.6
College Dame Brocq 3d.	"	70	33	3.9	4.3
College Pogis	"	370	333	3.7	4.5
College Pogis 3d.	"	345	308	4.2	5.3
Jersey	"	353	314	4.4	5.3
Becky	Brown Swiss	91	53	3.8	3.4
Aida 3d.	Gtown. Red	349	310	5.2	5.5
Sara	Polled	376	338	3.5	3.8
Milla	Native	225	156	3.9	3.6
Matonna	"	103	135	3.3	3.3

[redacted]

KW 2/5/14