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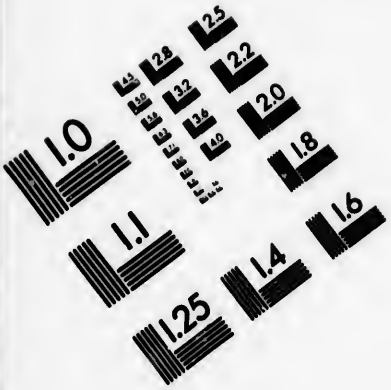

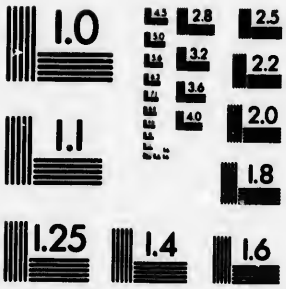

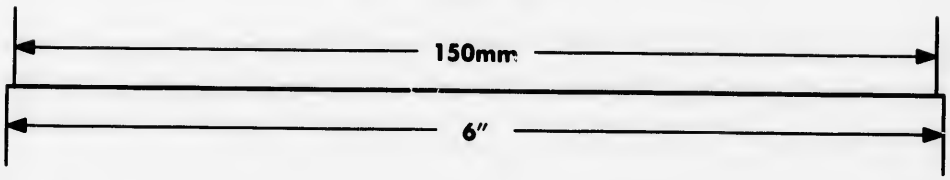

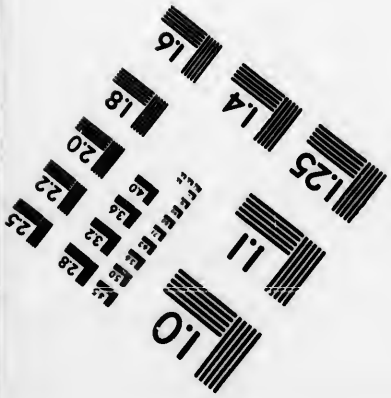

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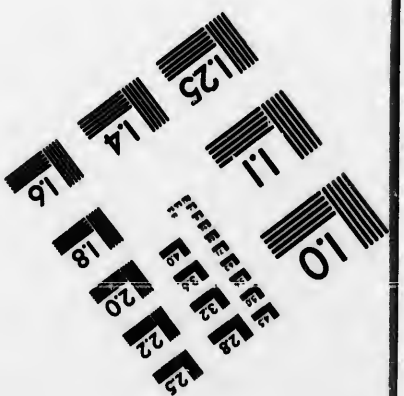

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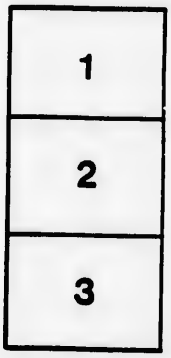
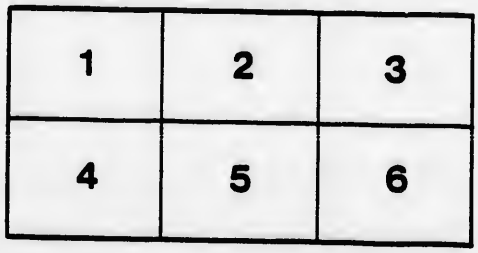




ONTARIO AGRICULTURAL COLLEGE

EXPERIMENT STATION

BULLETIN LXXX.

EFFECT OF FOOD ON MILK AND BUTTER.

BY H. H. DEAN, B.S.A., PROFESSOR OF DAIRY HUSBANDRY.

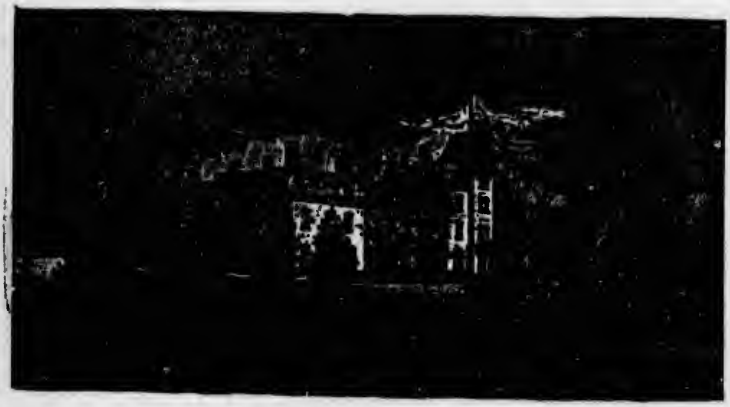
PUBLISHED BY THE DEPARTMENT OF AGRICULTURE
October 24, 1893

TORONTO
PRINTED BY WARWICK & SONS

MINISTER OF AGRICULTURE

Hon. John Dryden, Toronto.

Ontario Agricultural College and Experimental Farm, Guelph, under control of the Minister of Agriculture.



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BULLETIN LXXX.

EFFECT OF FOOD ON MILK AND BUTTER.

During 1891 we conducted an experiment similar to the one here reported.

The cows used in the experiment were six in number, divided into three lots—two cows in each lot. The general plan was to feed each lot for four weeks on one ration, note the quantity and quality of the milk and butter, then change to another ration and feed for four weeks until each lot had been fed each ration for the same length of time. The rations were:

No. 1. Ensilage, 30 lb.; oat s raw, 20 lb.; hay (cut), 10 lb.

No. 2. Hay (cut), 20 lb.; linseed oil meal, 4 lb.; cottonseed meal, 5 lb.

No. 3. Hay (cut), 20 lb.; pea meal, 4 lb.; oatmeal, 5 lb.; corn meal, 8 lb.

The effect on the fat and solids not fat was as follows:

The average per cent. of fat given in the milk by the three lots when fed ration No. 1 was 3 67; on No 2, 3.49; and on No. 3, 3.25.

The average per cent. of solids not fat from all the lots when fed on No. 1 was 7.79; on No. 2 8 62; and on No. 3 it was 8.37.

In every case there was a slight decrease in per cent. of solids not fat when the cows were fed the poor ration.

Some conclusions from the experiment of 1891:

1. When there is a deficiency of fat or albuminoids in the ration, the animal draws from her own body to make up this lack, maintaining about the same *quality* of milk, though the quantity may be greatly reduced.

2. When an excess of nutrients is fed these are doubtless wasted to a considerable extent, and if fed for a length of time might do injury to the animals, though these cows ate their full ration for a period of 21 days without apparent injury.

3. Judging from the returns from the winter ration we may expect to receive profit from a much wider ratio and on less nutrients than the German standard calls for.

4. In answer to the question, Was the fat fed in the food recovered in the milk? these experiments show that on ration No. 1 more fat was recovered in the milk than was fed in the food, and on Nos. 2 and 3 the returns of fat in milk were about the same as the fat fed, but whether it all came from the fat of the food or not was undecided.

5. The general conclusion would seem to be, that *the food does not affect the quality of milk to any appreciable extent so long as the animals are in good condition.* This applies more particularly to rations fed for short periods—from 21 to 28 days—but in the case of Lot III it may be said to be true for 49 days.

6. It is a waste of food to give more than the animal can assimilate. Find the capacity of the cow for economic production and feed to that capacity.

7. A poor ration may give profitable returns for a while, but will end in depletion of the cow's vitality and injure milk secretion.

8. The cost of food fed is an important item in the profitable returns from a dairy, and an extra amount of some cheap food in the ration, such as ensilage or bran may prove a profitable investment. For instance in the case of Lot I, by putting 20 lb. straw in the place of 6 lb. hay and 5 lb. bran, and reducing the ensilage from 50 lb. to 30 lb. per day, we reduced the cost of the weekly food from $1.78 to $1.22, but we also decreased the value of their production in butter-fat (besides loss of skim-milk) from $3.98 to $2.31; in other words by reducing the cost of the food 32 per cent., the value of fat was reduced 42 per cent., besides causing the cows to lose in weight. (For details of this experiment see College Report for 1891.)

EXPERIMENT OF 1892. This experiment was conducted somewhat differently from that of last year. The number of cows was the same but they were divided into two groups instead of three, and two rations only were used. The experiment lasted from April 4th to June 12th, a period of ten weeks. The cows used were H. No. 2, A. No. 3, and No. 13 in Lot I. A. No. 2, No. 4 and No. 2 comprised Lot II. The rations were: No. 1, 50 lb. ensilage, 1 lb. bran, 5 lb. hay (uncut). No 2, 50 lb. ensilage, 5 lb. pea meal, 3 lb. oatmeal, 2 lb. barley meal, 5 lb. hay (uncut).

No. 1 ration cost 6.35 cents per day and No. 2 15.83 cents.

Lot I was fed for five weeks on ration No. 1, then changed to ration No. 2, which was fed to them for five weeks. Lot II commenced on ration No. 2 and were then changed to ration No. 1. They were fed on each ration for five weeks. The milk from each cow was weighed morning and evening. The per cent. of fat, water and solids not fat in the milk of each cow was determined on four days of each week. On two days of each week the milk from each lot was set in the Cooley creamer. The skim-milk was tested; the cream from each lot was churned separately; the butter-milk was tested; the quality of the butter was noted and a sample sent to the laboratory for analysis, determination of melting point and Iodine number. The cows were weighed at the beginning and close of each period of feeding.

Table showing effect on quality with lot I (3 cows.):

Week ending—	Average p. c. fat.	Average p. c. solids not fat.	Average p. c. total solids.	Weekly lb. fat.	lb. butter in two days.	lb. milk for one lb. butter.	Ration.
							No. 1.
April 17....	3.50	8.90	12.40	21.21	5.0	23.0	50 lb. ensilage; 5 lb. hay (uncut); 1 lb. bran.
" 24....	3.34	8.71	12.05	20.74	6.1	25.2	
May 1....	3.31	8.77	12.08	19.73	4.1	27.8	
" 8....	3.36	8.65	12.01	18.85	5.5	26.7	
Averages.	3.38	8.76	12.14	20.13	5.2	25.7	
							No. 2.
May 22....	3.10	8.85	11.95	20.00	.....	.....	50 lb. ensilage; 5 lb. pea meal; 3 lb. oat meal; 2 lb. barley meal; 5 lb. hay (uncut).
" 29....	3.31	8.90	12.21	20.65	5.5	28.9	
June 5.. .	3.37	8.86	12.23	20.06	4.9	25.1	
" 12....	3.43	8.81	12.24	20.03	6.9	21.9	
Averages.	3.30	8.86	12.16	20.19	5.8	25.8	

Table showing effect on quality with lot II (3 cows):

Week ending—	Average p. c. fat.	Average p. c. solids not fat.	Average p. c. total solids.	Weekly lb. fat.	lb. butter in two days.	lb. milk for one lb. butter.	Ration.
							No. 2.
April 17....	3.69	9.20	12.89	18.84	4.0	26.3	50 lb. ensilage; 5 lb. pea meal; 3 lb. oatmeal; 2 lb. barley meal; 5 lb. hay (uncut).
" 24....	3.63	9.20	12.83	18.36	5.6	23.9	
May 1....	3.65	9.29	12.94	17.54	5.3	24.8	
" 8....	3.65	9.12	12.77	17.42	5.4	25.7	
Averages.	3.66	9.20	12.86	18.04	5.1	25.1	
							No. 1.
May 22....	3.71	8.76	12.47	13.69	.....	.....	50 lb. ensilage; 1 lb. bran; 5 lb. hay.
" 29....	3.81	8.89	12.70	11.66	2.9	24.8	
June 5....	4.00	8.20	12.20	11.48	3.6	24.7	
" 12*...	....	.....	.....	.....	.....	.....	
Averages.	3.84	8.62	12.46	12.28	3.3	24.8	

* A. 2 was sick during the latter part of the third week of this period, and hence the results are not reported for the last week. The average per cent. of fat for this week from cow No. 2 was 4.30, and from No. 4 was 4.08. For the last week of period I. the average per cent. of fat from the same cows was respectively 3.67 and 3.77. The average per cent. of total solids from these two cows during the last week of period I, on the rich ration was 12.88, and during the second period on the poor ration, the average was 12.33.

Conclusions as to Quality.

1. The average of four weeks on a poor ration with Lot I was 3.38 per cent. of fat. With one week intervening, during which time they were changed to a rich ration containing the same amount

of coarse fodder but having 10 lb. meal in addition, the average per cent. of fat in the milk from the same cows for four weeks was 3.30 —practically the same as in the previous period. Lot II gave milk containing 3.66 per cent. of fat during the period on which they were fed the meal ration, and 3.84 per cent. of fat while receiving practically no meal for three weeks. Again we must conclude that for a short period of time with these cows meal did not affect the per cent. of fat or quality of the milk to any great extent.

2. Last year the poor ration gave results which showed a slight decrease in per cent. of solids not fat. The same is true for this year. The average of both Lots is 8.69 per cent. on the poor ration and 9.03 on the meal ration.

Table showing effect on quantity:

Date.	Total lb. of milk given.	Gain or loss + −	Weight of cows at beginning of period.	Weight of cows at close of period.	Gain or loss + −	Ration.
Lot I.						
April 11—May 8....	2,384	.....	3,265	3,068	—197	Ensilage and hay.
May 16 -June 12 ...	2,450	+66	3,068	3,114	+ 46	Ensilage, hay and meal.
Lot II.						
April 11—May 1....	1,486	.....	2,918	2,967	+ 49	Ensilage, meal and hay.
*May 16—June 5 ...	962	—524	†1,941	†1,770	†—171	Ensilage and hay.

* One cow sick for two days in this period. † Two cows only.

Conclusions as to Quantity.

1. With Lot I the extra amount of meal did not appear to have much effect on the quantity, as they gave but 66 lb. more milk in four weeks while getting meal than during the same length of time without meal. This may be accounted for in some degree by the fact that two of the cows in this lot had calved recently. Those in Lot II had been milking for a longer time when the experiment commenced.

2. Both Lots lost heavily in weight while getting ration No. 1, and gained considerably on the ensilage, meal and hay. One ration was not sufficient to sustain the live weight of the animals while giving milk, and the other caused them to lay on flesh without a corresponding increase of milk.

3. The cost per 100 lb. of milk from both Lots on ration No. 1 was 55.8 cents, while the cost when No. 2 was fed was $1.18 per 100. Such a large quantity of meal could not be profitably fed to these cows.

Losses of fat in skim-milk and buttermilk:

Number of trials.	Average p.c. fat in skim-milk.	Average p.c. fat in buttermilk.	Ration.
Lot I. .... { 4.....	0.26	0. 1	Ensilage and hay.
3.....	0.33	0. 1	Ensilage, hay and meal.
Lot II .... { 4.....	0.72	0.19	Ensilage, hay and meal.
3. ...	0.48	0.15	Ensilage and hay.

Both Lots appear to have given slightly better creaming results on the ration composed nearly altogether of ensilage. The average per cent. of fat in the skim-milk from both, in seven settings being 0.37 of one per cent., while the average of the same number of settings, under exactly the same conditions, was 0.53, when the meal ration was fed in addition to the ensilage.

Analysis of butter:

Lot.	Ration.	Water.	Fat.	Casein.	Ash.	Iodine number.	Melting point.
I	No. 1—1st period.....	*9.36	87.06	0.99	2.59	32.00	32.25
II	No. 2—1st period.....	*9.74	86.49	1.04	2.74	28.32	34.15
I	No. 2—2nd period.....	*11.36	85.20	1.06	2.38	30.52	32.61
II	No. 1—2nd period....	†11.90	84.78	1.01	2.31	33.32	33.33
	Average on Ration No. 1..	10.63	85.92	1.00	2.45	32.66	32.79
	Average on Ration No. 2..	10.69	85.85	1.05	2.56	29.42	33.38

* Average of four analyses and determinations.
† " three " "

It was observed in the practical handling of the samples, that the butter from Lot II was always firmer than that from Lot I, due doubtless to the influence of the animals composing this lot. It is rather remarkable what a difference one or two degrees in the melting point makes in the physical properties of butter. Both lots gave firmer butter or butter with a higher melting point when they were fed meals in addition to the ensilage and hay. Last year when the cows were fed ensilage chiefly it produced a butter with a low melting point (31.75°). "Taking the average melting point (32.4°) of the butter produced from the ensilage, hay, straw, and grass rations as a standard, we find that it was increased 2.3°C. when a mixture of oil meals and hay was fed; 1° when linseed

meal alone was fed; and 4.1° on the cottonseed meal ration." If it is possible to feed something which will produce firmer butter, a butter that will "stand up" better in hot weather, the question becomes of much practical importance.

There appears to be little difference in the average composition of the butter produced by the two rations. I repeat what was stated in the last College Report, p. 169: "That the varying per cent. of fat, water and other substances found in butter, is likely due more to the method of manufacture than to the influence of food."

Practical Points for Farmers.

1. For practical use I would not recommend either of the rations used in this experiment. No. 1 I consider deficient in milk producing substances, and No. 2 is too rich for our ordinary cows, as they did not appear to be able to digest and assimilate so much meal. I would also warn against feeding much more than 50 lb. ensilage per day to cows weighing under 1,000 lb. We have found the following ration to give good results: 50 lb. of corn ensilage, 6 lb. of hay, 4 lb. of bran, and 2 lb. of pea and oatmeal mixed in equal proportions. If these latter become too high priced, I would recommend the use of 2 lb. of cottonseed meal (in place of the bran or meals) per day to each cow, when it can be bought for about $30 per ton.

Feed *liberally*, though not wastefully, bearing in mind that although the *per cent.* of fat may not be increased by liberal feeding, the total amount of fat or butter may be largely increased by causing the cow to give a larger *quantity of milk.* Three things determine the value of a cow: *the quality of her milk, the quantity she gives,* and *the economical use she makes of her food.*

2. During the hot weather buttermakers are frequently troubled with soft butter. This is largely due, in most cases, to improper handling of the milk, cream and butter, but there is a tendency during hot spells for the butter to be soft no matter what the care taken. From the experiments here reported I am led to believe that the addition of a small quantity of meal, especially cottonseed meal, has a tendency to make the butter firmer, or as we say, raise the melting point from one to four degrees Centigrade. Last summer we fed about 1 lb. per day to each cow, while at pasture, and our buttermaker informs me that he did not have a churning of soft butter during the whole season. Whether this was due altogether to the cottonseed meal, I am not prepared to say, but I think it had something to do with it. In feeding cottonseed meal it should be mixed with bran, cut hay, or some grain meal.