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Feeding for milk and butter

E. R. Lloyd

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FEEDING FOR MILK AND BUTTER.

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AGRICULTURAL COLLEGE, MISS.

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FEEDING FOR MILK AND BUTTER.

On November 24th, 1889, sixty cows were put into the Station barn for the purpose of making a series of tests to determine the most economical food for the production of milk and butter. The herd was divided into six lots containing ten cows each, of which seven were common "natives" purchased in the immediate neighborhood, two were low-grade Jerseys and one a grade Devon belonging to the College.

Each cow was given all the hay she would eat, and as much grain as was thought safe. The barns containing the hay which had been stored for winter feeding were destroyed by fire in September and October, and the "mixed hay" referred to was cut during the latter part of October and November in uncultivated fields. It had been touched by frost and contained a considerable amount of asters, broom-sedge, iron-weed and other almost worthless materials, though about three-fourths of it was Japan clover *(Lespedeza striata)*, with a small amount of Chicken-corn *(Sorghum vulgare)*. In estimating the expenses of the work, this hay is valued at seven dollars per ton, Bermuda hay at ten dollars, cotton seed at nine dollars, cottonseed meal at twenty dollars, and corn meal at fifty cents per bushel (twenty dollars and eighty-five cents per ton).

The test was continued twelve weeks and the general results were as follows:

	FEED.	Cost of Feed.	No. Gal'ns Milk.	Cost per Gal. Av.	No. pounds Butter.	Cost per pound. Av.
		$		cts.		cts.
1st Lot	Bermuda Hay and Cotton Seed.....	62.32	795.01	7.8	359 46	15.70
2d. Lot	Mixed Hay and Cotton Seed.....	56.86	756.90	7.5	339.46	15.62
3d Lot	Bermuda Hay and Cotton Seed Meal.....	123 78	1058.04	11.7	418.50	26 83
4th Lot	Mixed Hay and Cotton Seed Meal	108.99	957.01	11.5	419.98	23.62
5th Lot	Bermuda Hay and Corn Meal.....	121 62	848.28	14.3	297.66	37.31
6th Lot	Mixed Hay and Corn Meal	103.91	802.51	12.9	280.20	33 65
		577.48	5217 75	11.1	2115.26	25 46

As will be seen in the table above, the best results were from Lot 2, which was fed with mixed hay and cotton seed: this lot

giving milk at a cost of 7.5 cents per gallon, and butter at a cost of 15.62 cents per pound. Lot 1, which was also fed with cotton seed, did very nearly as well. The most expensive milk and butter were from Lot 5, which was fed with Bermuda hay and corn meal, the milk costing 14.3 cents per gallon and the butter 37.31 cents per pound. The average cost of milk for the six lots was 11.1 cents per gallon, and of butter 25.46 cents per pound.

The results show very clearly that for the winter production of both milk and butter, Lespedeza is a cheaper hay than is Bermuda, and that cotton seed is much cheaper for the grain ration than either cottonseed meal or corn meal.

Details of the work were as follows: In selecting the cows it was the aim to make each lot of ten represent, in quality and breeding, the herd of the average farmer as nearly as was possible, and the test was continued through the ordinary feeding season. The average weight of each lot at the beginning was 6968 pounds, and none of the lots varied more than 475 pounds from that weight. Care was taken that the cows in the different lots should be, as nearly as was possible, the same length of time from calving. The food for each lot was weighed separately morning and evening, and all waste reweighed in the morning; and the cows charged with the amounts actually eaten. The milk from each cow was weighed separately at each milking, and samples of the milk were taken for testing on Wednesday morning and evening of each week. In taking these samples the milk of each lot was thoroughly mixed, and one litre (about a quart) taken for the test. These samples were kept at a temperature of 65° F. until ripened, when they were churned and the total butter yield estimated from the yields of the samples. While this method of testing the quality of the milk does not show accurately the amount of butter fat which the butter may contain, it corresponds more nearly with the actual results obtained with the churn than we have found to be the case with either the Short, Lactocrite, or other more chemically accurate methods. We used this test because we wished to ascertain the amount of butter which might be made under ordinary treatment, rather than the amount of fat in the milk, a variable per cent of which is unavailable for butter when separated by the usual dairy methods. The butter test made in the seventh week of the trial va-

ried so widely from the tests made during the other eleven weeks that it is thought there must have been some error in the work,

—TABLE NO. 2.—

		Feed No. pounds eaten per week.		Value of Feed...	Milk			Pounds of milk for 1 pound butter.		Butter.	
		Hay	Grain		Number pounds	Number gallons	Cost per gallon ...	Morning	Evening	Number pounds	Cost per pound
LOT ONE. BERMUDA HAY —AND— CORN MEAL.	2	705	581	$ 5.78	498 4	62.30	cts. 9 2	18 3	13.7	30 80	18.76
	3	604	635	5 58	66∾ 5	82 56	6 7	17.8	13 3	42 36	13.17
	4	670	642	5.90	654 0	81 75	7·2	17.4	13 0	41 65	14 16
	5	665	615	5 76	653.0	81.62	7.0	18.5	13.5	39.89	14.43
	6	683	613	5.83	615 5	76.95	7.5	19 7	13 9	35.94	16.22
	[illegible]	[illegible]	[illegible]	[illegible]	627 2	[illegible]	14.1	21.1	20 2	30 19	[illegible]
	6	800	667	10.55	638 0	79.75	13.2	26.7	22.1	26.16	40.32
	7	836	691	10 96	625.2	78.15	14 0				
	8	807	695	10.87	636.0	79.50	13.8	19.7	14 4	37.28	29.15
	9	850	700	11.11	628 5	78 56	14.1	22 7	18 5	29.95	37.09
	10	874	694	11.16	635 0	79.37	14 1	19.3	16.2	35.21	31 68
	11	865	698	11 16	632.0	79.00	14·0	23 9	18 1	29.46	37.88
	12	844	692	11.01	595.5	74.43	14.7	18.5	19.9	31.50	34 92
		9376	7626	121 62	6786.4	848 28	14 3	22 5	19.1	297.66	37.31
LOT SIX. MIXED HAY —AND— CORN MEAL.	2	713	640	$ 9.15	358 0	44 75	cts. 20.4	24.9	18.1	16.56	55 25
	3	767	601	8 94	500.5	62.56	14.2	33.6	25.1	16.78	53 27
	4	775	666	9 65	578.0	72.25	13.3	25.2	18.8	25.57	37.74
	5	605	683	9.23	620 4	77.55	11.9	24 5	17.8	28.76	32.09
	6	613	697	9 41	674.5	84 18	11 1	23·3	14.9	34.73	27.09
	7	602	680	9.20	606.5	75.81	12 1				
	8	599	686	9.24	575.5	71 93	12.8	19.7	15.9	40.97	22.55
	9	710	692	9.69	614 5	76.81	12 6	23 3	18 9	24 24	39.98
	10	741	695	9.83	630.5	78.81	12.4	22 3	16.5	32.11	30.61
	11	737	700	9.87	6 9 5	78.68	12.5	25.2	17.8	29.07	33 95
	12	688	700	9 70	633.5	79.18	12 2	20 2	19 3	31.41	30.88
		7550	7440	103.91	6421.4	802 51	12 9	24 2	18.3	280.20	33.65

—TABLE NO. 2.—

No.	Feed pounds eaten per week. Hay	Grain	Value of Feed	Milk Number pounds	Number gallons	Cost per gallon	Pounds of milk for 1 pound butter. Morning	Evening	Butter. Number pounds	Cost per pound
			$			cts				
LOT ONE. BERMUDA HAY —AND— COTTON SEED.										
2	705	581	5 78	498 4	62 30	9 2	18 3	13 7	30 80	18 76
3	604	635	5 58	665 5	82 56	6 7	17 8	13 3	42 36	13 17
4	670	642	5 90	654 0	81 75	7 2	17 4	13 0	41 65	14 16
5	665	615	5 76	653 0	81 62	7 0	18 5	13 5	39 89	14 43
6	683	613	5 83	615 5	76 93	7 5	19 7	13 9	35 94	16 22
7	696	608	5 87	595 0	71 37	7 8				
8	680	598	5 75	565 5	70 68	8 1	16 5	13 3	37 29	15 42
9	666	590	5 70	548 0	68 50	8 3	18 1	13 5	34 19	16 67
10	653	585	5 57	529 5	66 18	8 4	20 2	13 5	31 14	17 88
11	635	585	5 49	531 0	66 37	8 2	18 1	13 7	31 70	17 31
12	568	563	5 09	510 0	63 75	7 9	16 2	13 7	34 50	14 75
	7225	6624	62 32	6368 4	795 01	7 8	18 1	13 5	359 46	15 70
			$			cts				
LOT TWO. MIXED HAY —AND— COTTON SEED										
2	597	652	5 02	482 0	60 25	8 3	17 5	13 3	30 18	16 65
3	631	686	5 30	519 5	64 93	8 2	19 3	14 6	30 16	17 57
4	595	684	5 16	551 8	68 97	7 5	18 3	13 9	33 73	15 29
5	580	692	5 14	596 0	74 50	6 8	18 9	13 7	36 60	14 50
6	595	738	5 40	603 5	75 43	7 1	20 2	12 6	36 82	14 66
7	472	712	4 85	536 1	67 01	7 2				
8	483	700	4 84	518 7	64 83	7 4	16 8	13 7	33 58	14 41
9	624	674	5 21	591 0	73 87	7 0	19 3	14 4	34 62	15 04
10	694	670	5 44	569 0	71 12	7 6	17 8	14 2	35 61	15 83
11	660	694	5 43	545 0	68 12	7 9	16 8	13 7	35 26	15 81
12	594	664	5 07	543 0	67 87	7 4	17 4	14 4	33 50	15 13
	6525	7566	56 80	6055 6	756 90	7 5	18 2	13 8	339 46	15 62
			$			cts				
LOT THREE. BERMUDA HAY —AND— COTTON SEED MEAL										
2	1184	560	10 03	540 5	67 56	16 1	17 9	13 6	33 52	32 61
3	1124	560	10 08	639 0	79 87	13 3	20 2	15 1	35 52	30 01
4	970	680	11 16	672 9	84 11	13 2	18 3	13 8	41 11	27 12
5	859	700	10 91	324 4	103 05	10 5	20 6	15 6	44 04	24 48
6	912	700	11 10	862 5	107 81	10 3	25 9	16 8	40 04	27 72
7	992	700	11 46	862 1	107 78	10 6				
8	1015	700	11 57	810 6	101 32	11 4	18 9	13 9	48 53	23 84
9	989	700	11 41	823 0	102 87	11 1	21 6	17 1	41 96	27 19
10	1010	700	11 54	847 0	105 87	10 8	22 1	14 2	46 11	25 02
11	950	675	11 02	760 0	95 00	11 6	19 7	15 9	41 04	26 85
12	900	797	12 02	817 5	102 80	11.7	18 1	16.2	46 00	26 13
	10906	7472	123 78	8459 5	1058.04	11 7	20.3	15.2	418.50	26.85
			$			cts				
LOT FOUR. MIXED HAY —AND— COTTON SEED MEAL.										
2	920	560	8 82	648.5	81 95	10.7	18.8	14 1	39 36	22 40
3	898	560	8 74	624 0	78 00	11.2	17 2	12 1	45 95	19.02
4	836	680	9.75	731 5	91 13	10.6	17 3	13 0	47.31	20 56
5	833	698	9.90	743.5	92 93	10 7	18.1	14 6	44 86	22 06
6	708	700	9 79	752 0	94 00	10 4	21 1	16.8	29 11	25 02
7	769	700	9 69	709 5	88 68	10 9				
8	856	700	9 93	650 5	82 43	12.0	16 5	11 3	46 89	21 18
9	891	684	9 90	682 0	85 25	11.6	19 3	13 5	40 82	24.39
10	894	690	10.03	659.5	82 43	12 1	20 2	15 4	37 22	26 94
11	870	696	10 03	718 0	89 75	11 1	19 7	15 1	37 32	26.87
12	762	970	12 37	721 5	90.16	13 7	18 9	15 6	41.14	30 05
	9813	7638	108 90	7619 5	957.01	11.5	18 7	14 1	419.98	23 62
			$			cts				
LOT FIVE. BERMUDA HAY —AND— CORN MEAL										
2	955	700	11.59	510 1	63 75	18.2	21 9	18 7	24.92	46 91
3	880	696	11 18	624 0	78 00	14 3	27.5	23 1	24 27	46 07
4	830	698	11.00	635 0	79.37	13.8	23 4	20 0	28 72	38 30
5	825	698	11.05	657 5	82 18	13.4	24 1	20 2	30 15	36.57
6	800	697	10 55	638 0	79 77	13 2	26.7	22.1	26 16	40 32
7	836	691	10 96	625.2	78 15	14 0				
8	807	695	10 87	636.0	79 50	13 8	19.7	14 4	37 28	29.15
9	850	700	11 11	628 5	78 56	14.1	22 7	18.5	29 95	37 09
10	874	694	11.16	635 0	79 37	14 1	19 3	16 2	35.21	31 68
11	865	698	11 16	632.0	79.00	14 0	23 8	18 1	29 46	37 88
12	844	692	11.01	595.5	74.43	14 7	18.5	19.9	31 50	34 92
	9376	7626	121 62	6786 4	848 28	14 3	22 5	19.1	297.66	37.31
			$			cts				
LOT SIX. MIXED HAY —AND— CORN MEAL.										
2	713	640	9 15	358 0	44 75	20.4	24 9	18 1	16 56	55 25
3	767	601	8 94	500 5	62.56	14.2	33 6	25.1	16.78	53 27
4	775	666	9 65	578.0	72 25	13.3	25 2	18.8	25 56	37.74
5	605	685	9.23	620 4	77.55	11 9	24 5	17 8	28.76	32.09
6	613	697	9 41	674 5	84 18	11 1	23 3	14.9	34 73	27.09
7	602	680	9 20	606.5	75.81	12 1				
8	599	686	9.24	575.5	71 93	12 8	19 7	15 9	40 97	22.55
9	710	692	9.69	614 5	76.81	12 6	25 3	18 9	24 24	39.98
10	741	695	9.83	630.5	78 81	12 4	22 3	16.5	32 11	30 61
11	737	700	9.87	6 9 5	78 68	12.5	25.2	17.8	29.07	35 95
12	688	700	9 70	633.5	79 18	12 2	20 2	19 3	31.41	30.88
	7550	7440	103 91	6421.4	802 51	12 9	24 2	18.3	280 20	33 65

ried so widely from the tests made during the other eleven weeks that it is thought there must have been some error in the work, and in making the estimates in this bulletin the butter tests and yields for that week are omitted.

For some time previous to beginning the tests, the cows had been kept in an ordinary pasture, and each had been fed five pounds of cotton seed meal daily. The total yield of the herd for the first week of the test was 318.17 gallons of milk, containing 150.01 pounds of butter; or one pound of butter for 16.96 pounds of milk. The average yield of milk during the ten weeks of tabulated tests was 474.34 gallons per week, containing 211.53 pounds of butter; or one pound of butter for 19.73 pounds of milk. The cost of the butter made in the preliminary week was 35.4 cents per pound, while the average cost during the ten tabulated weeks was 25.46 cents per pound; a difference of 30 per cent in favor of the more liberal ration.

The first week of the test was regarded as preliminary only, and the record for that week is not included in any of the tables.

At the commencement of the test, each cow was given all the hay she would eat, which was about ten pounds daily. The cows fed on cotton seed were allowed twelve pounds daily, but it was found that few of them would eat so much, and although some of the seed were salted, and others heated, it was difficult to induce all of these cows to eat as many of the seed as was desired. Ten pounds of corn meal were allowed to each cow in lots 5 and 6, and seven pounds of cotton seed meal to each cow in lots 3 and 4. The amount of cotton seed meal was gradually increased until ten pounds were given to each cow, but without producing a corresponding increase of either milk or butter. The weekly results with each lot were as shown in Table No. 2.

An examination of this record will show a marked and unaccountable variation in the pounds of milk required to produce a pound of butter. The cows were milked by the same persons, in regular order, at the same hours daily, and all possible care was taken that the work of each day should be like that of every other day. At no time during the tests did the mercury fall as low as 32 F. Every one who has had experience in the testing

of milk for dairies has noted these daily differences, and a number of Experiment Stations have done a considerable amount of work to ascertain their causes, but with very contradictory results.

A very constant difference was observed in the butter content of the milk from the morning and the evening milkings, which was probably due to the effects of light and exercise. The milking was done between 5.30 and 7 o'clock in the morning, and between 3.30 and 5 o'clock in the evening, thus making the intervals between the milkings fifteen and nine hours. At nine o'clock each morning the cows were turned from the barn into an open lot where they had an abundant supply of water and room for exercise, and where they were allowed to remain until 2 o'clock in the afternoon, when they were placed in their stalls. Of the morning milk 18.1 pounds were required to produce a pound of butter, while of the evening milk, only 13.5 pounds were needed. In a further study of this matter two cows were used during August and September, 1890, in making a series of special tests of the effect of time of day of milkings and number of hours between milkings. During the first week they were milked at 7 A. M. and 6 P. M., during the second week at 6 A. M. and 7 P. M., and the third week at 6 A. M. and 6 P. M. All of the milking was done by the same man, and the two days following each change in hours were not included in the record.

The amounts of milk required to produce a pound of butter from the different milkings were as follows:

TIME.		POUNDS.
7 A. M.	13 hours since last milking,	23.60
6 P. M.	11 " " " "	16.71
6 A. M.	11 " " " "	24.95
7 P. M.	13 " " " "	19.52
6 A. M.	12 " " " "	24.75
6 P. M.	12 " " " "	22.05

Average for morning, ...24.46
" " evening, ...18.59
" " 13 hours, ...21.56
" " 11 " 21.14
" " 12 " 23.77
" all tests, ...22.17

Although these results show considerable irregularity, they

seem to indicate that day and night influence the amount of butter fat much more than does the number of hours between milkings.

The effects of each ingredient of the ration, tabulated without regard to the effects of the other parts of the ration, are shown in the following table:

	FEED.	Pounds Eaten.	Gallons Milk.	Cost Per Gallon.	Pounds Butter.	Cost Per Pound
Lots 2, 4, 6.	Mixed Hay	23388	2516.42	10 7	1039.64	23.6
Lots 1, 3, 5.	Bermuda Hay	27506	2701.29	11 4	1075.62	26.0
Lots 5, 6	Corn Meal	15066	1650.79	13 6	577.86	35.5
Lots 3, 4	Cotton Seed Meal	15110	2015.05	11.5	838 48	25.2
Lots 1, 2	Cotton Seed	14190	1552.01	7.7	698.92	15 5

From this it is seen that milk and butter from cows which had the mixed hay cost less than that from the cows fed on Bermuda, and that for the grain part of the ration cotton seed was much cheaper than was either corn or cotton seed meal. The use of raw cotton seed for feeding milch cows is often objected to on account of the flavor which such feed is supposed to impart to the butter. In this case one third of the cows were fed with raw seed, and the milk from the whole herd was put together before being taken to the College dairy. For several seasons the uniform price of the butter from this dairy has been thirty cents per pound during the winter months. The price has been the same during the present season, the dairy was overrun with orders, and not a single complaint was received in regard to flavor or quality of the butter; though had the entire output of the dairy been from cows fed exclusively on raw cotton seed, the case might have been different. With cotton seed at anywhere near its present price ($6.67 per ton, Sept. 20, 1890), or even nine dollars, its price in 1889, it will certainly produce cheaper butter than will any other grain ration obtainable here, though we do not advise the feeding of a full ration of the raw seed when it is desired to make a fine quality of butter. The proportion of raw seed which can be fed without injury to the

quality of the butter product is a question which is still unsettled, and one which will receive our attention during the coming winter.

CONCLUSIONS.

From the work so far accomplished, it appears

I. That for the production of milk a ration composed of Lespedeza hay and cotton seed is the most economical.

II. That cotton seed is more economical than cotton seed meal, as a grain ration.

III. That Lespedeza hay is more economical than Bermuda hay.

IV. That corn meal is too expensive for use in this State.

V. That the ration which will produce milk at the least cost is also the most economical ration for butter; if no consideration be given to the quality of the latter.