Milk Cost Production (Costings)

UNIVERSITY OF MANCHESTER

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MANAGEMENT FOR MILK PRODUCTION

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Research in Cost of Feeding.

Farmers are in a position to manufacture more or less food for their live stock in their fields, or to purchase from merchants less or more food which has been manufactured elsewhere. The majority of farmers are convinced that the cost of feeding with grass and hay grown by themselves is less than the cost of feeding with purchased concentrated foods. This conviction is shared by others who have investigated the subject, and the object of this study is to ascertain as accurately as possible within a limited area how far it is founded on facts, and also to measure the amount of gain or loss which arises from the pursuit of one method or the other.

As manufacturers of grass and hay farmers have to use machinery which is complicated in its nature, and by no means easy to work. Soil can behave in a great many awkward ways; so can grass; and so can cattle and other live stock. To get the greatest value out of them all they must be made to work fully in combination.

In the statements made and the figures given in this report an attempt is made to describe the experience of sixteen farmers in Lancashire and Cheshire. During 22 weeks of summer, from May 1 to September 30, 1933, they had 485 cows which gave 153,632 gallons of milk. The cows grazed 542 acres of pasture and 470 acres of aftermath, which they shared with dry stock equal to 241 more cows. They received a considerable amount of purchased concentrated feed during the period.

Table I shows the amount of starch equivalent obtained per cow from purchased feed on each farm together with its cost per lb., and also the amount of starch equivalent obtained from grass with its cost per lb. It also gives the actual cost of the starch equivalent consumed by the cows. The information in Columns 1, 2, and 3 was obtained from the weekly feeding records. Column 4 was got by subtracting the figures in Column 1 from those in Column 5 of Table VI. The cost of grazing was got from the rent per acre together with costs of fertilisers, cultivations and other expenditure on the fields.

Table I.

Actual Consumption and Cost of Starch Equivalent per Cow.

Farm	S.E. obtained from feed other than grass.	Cost			Cost per lb. S.E.	S.E. obtained from grass.	Cost			Cost per lb. S.E.
No.	lb.	£.	s.	d.	pence.	lb.	£.	s.	d.	pence.
	1.		2.		3.	4.		5.		6.
4.	824	3	15	6	1.10	932	2	8	0	.62
5.	771	3	3	3	.98	930	2	13	10	.69
6.	768	3	0	6	.94	796	2	13	6	.80
7.	842	3	15	1	1.07	792	3	12	5	1.09
8.	711	2	17	1	.96	947	2	5	6	.58
9.	658	2	11	10	.94	1355	3	10	7	.63
10.	364	1	11	7	1.04	1742	4	7	6	.60
11.	846	4	1	0	1.15	788	2	3	6	.66
13.	1009	4	4	10	1.00	779	2	11	1	.79
14.	526	2	5	0	1.02	1220	2	5	5½	.45
15.	539	2	2	8	.95	1157	2	8	5	.50
17.	956	4	13	0	1.16	1255	2	18	2	.55
20.	747	3	13	8	1.10	947	3	4	10	.82
21.	391	2	0	9	1.25	1270	4	4	0	.79
22.	794	3	5	5	.99	958	3	4	11	.81
41.	174		14	1	.97	1675	2	15	8	.40
					Average 1.04					Average .67

It will be seen that on all the farms except one the cost of 1 lb. of starch equivalent obtained from the grass is less than the cost of the same amount obtained from concentrates, and this shows that milk produced from grass costs less than milk produced from purchased feed. From

this again it would seem profitable that farmers should get as much as possible of their milk from grass. But this does not mean that no concentrates should be used in summer. Records have shown that when used in combination with grass in a dry summer purchased feed has increased the yield sufficiently to reduce the cost per gallon.

Table II.

Costs of Concentrates and Mixed Feeding.

Farm No.	Cost of Total Requirements of S.E. if concentrates only were used for feeding. pence per gallon.	Actual Cost under farmers' practice of grazing and feeding concentrates. pence per gallon.	Reduction - Increase + pence per gallon.
4.	6.27	4.81	- 1.46
5.	5.83	4.89	- .94
6.	6.36	5.89	- .47
7.	6.74	6.86	+ .12
8.	5.96	4.56	- 1.40
9.	4.97	3.86	- 1.11
10.	5.24	3.42	- 1.82
11.	7.25	5.76	- 1.49
13.	6.16	5.62	- .54
14.	5.86	3.66	- 2.20
15.	5.66	4.18	- 1.48
17.	5.59	3.94	- 1.65
20.	6.58	5.87	- .71
21.	7.68	5.47	- 2.21
22.	5.66	5.11	- .55
41.	5.19	2.42	- 2.77

The figures in both these tables represent the experiences of a few Lancashire and Cheshire farmers in the production of grass, in the purchase of feed and in the yields of milk during the summer of 1933. There is a difference between one farm and another. But this is not all. The figures for 1933 taken together with those for 1932 show that the same farmers had different experiences in the two years. The cost of feeding from grass was lower in 1933 than in 1932. All the farmers, each in his own way, have set themselves in the last few years to

cultivate their grass with the object of getting more profitable crops. In every case they have succeeded, and frequently the progress of improvement has been rapid.

Table III.

Comparative Costs.

Farm	1932. S.E. per cow obtained from grass.	1932. Cost			1932. Cost per lb. S.E.	1933. S.E. per cow obtained from grass.	1933. Cost			1933. Cost per lb. S.E.
No.	lb.	£.	s.	d.	pence	lb.	£.	s.	d	pence.
2.	1418	3	11	2	.60	-	-	-	-	-
3.	800	3	0	11	.91	-	-	-	-	-
4.	701	3	15	0	1.28	932	2	8	0	.62
5.	-	-	-	-	-	930	2	13	10	.69
6.	897	3	3	0	.84	796	2	13	6	.80
7.	731	3	19	10	1.31	792	3	12	5	1.09
8.	-	-	-	-	-	947	2	5	6	.58
9.	1142	3	18	9	.83	1355	3	10	7	.63
10.	686	3	1	6	1.07	1742	4	7	6	.60
11.	-	-	-	-	-	788	2	3	6	.66
13.	470	2	17	9	1.47	779	2	11	1	.79
14.	1024	3	1	5	.72	1220	2	5	5½	.45
15.	1040	3	0	3	.69	1157	2	8	5	.50
16.	1054	4	10	3	1.03	-	-	-	-	-
17.	1112	4	12	10	1.00	1255	2	18	2	.55
20.	673	2	12	7	.94	947	3	4	10	.82
21.	1061	4	4	11	.96	1270	4	4	0	.79
22.	474	2	10	8	1.28	958	3	4	11	.81
41.	1769	4	1	3	.55	1675	2	15	8	.40
42.	1171	4	3	0	.85	-	-	-	-	-

This table shows a progressive advantage in improving the grass. There may have been something favourable in the season in 1933 compared with 1932, and the large reduction in some of the costs may be partly due to this, but on a few farms for which figures are available the reduction has been consistent over a number of years in spite of variations in the seasons. There are farmers in the Midlands where the cost of 1 lb. of starch equivalent obtained from the grass is only .26d. and .27d. And some of the fields on those farms are not yet giving perfect crops of grass. There is no Lancashire or Cheshire farm where the end of improvement is in sight, and therefore

none on which the cost of producing milk may not yet be reduced. Experience on every farm demonstrates that the cost of producing grass diminishes with the progress of good farming for grass.

The time has not come to analyse fully the kinds of management which account for these results, but it may be said that the reductions in cost between 1932 and 1933, which are large on a number of farms, are chiefly due to expenditure on cultivations and fertilisers in the former and earlier years, which produced their effect in the latter year. There was nothing extravagant. On every farm the money used was too hardly earned to be spent in a lavish fashion. The road to the final standard of improvement is too stiff and too long to be accomplished at a gallop.

Further information and explanation of how the figures in these tables are arrived at are given in the following pages.

Table IV. gives the acreage of pasture and meadow on the farms, and rent per acre.

Table IV.

Farm No.	Pasture acres.	Meadow acres.	Rent per acre shillings.
4.	8	12	64
5.	31½	30	52
6.	12	24	38
7.	20	27	44
8.	19	19	37
9.	47	26	68
10.	43	31½	61
11.	69	104	23
13.	34	31	40
14.	64	36	32
15.	4½	6½	74
17.	27	26	60
20.	35	27	24
21.	10½	15	64
22.	19	23	41
41.	101	40	42½

In constructing Table V. the farm stock have been reduced to a common unit. The unit chosen was one cattle unit and the following equivalents were used in the calculation.

1 cow	=	1 cattle unit.
1 other cattle over 2 years	=	1 cattle unit.
1 other cattle 1 - 2 years	=	¾ cattle unit.
1 other cattle ½ - 1 year	=	½ cattle unit.
1 work horse	=	1¾ cattle units.
1 young horse	=	2/3 cattle unit.
1 sheep (excluding lambs under 3 months)	=	1/5 cattle unit.

Table V. gives the number of cattle units carried on the acreage, and the area of land allowed for grazing of each unit.

Table V.

Farm No.	Cattle units.	Pasture acres.	After-math acres.	Pasture per cattle unit acres.	After-math per cattle unit acres.	Total Grazing per cattle unit acres.
4.	18	8	12	.44	.66	1.10
5.	49	31½	30	.64	.61	1.25
6.	22	12	24	.54	1.09	1.63
7.	20	20	27	1.00	1.35	2.25
8.	24	19	19	.79	.79	1.58
9.	99	47	26	.47	.26	.73
10.	70	41	24	.58	.34	.92
11.	100	69	104	.69	1.04	1.73
13.	54	34	31	.63	.57	1.20
14.	62	64	36	1.03	.58	1.61
15.	14	4½	6½	.32	.46	.78
17.	41	27	26	.65	.63	1.28
20.	22	35	27	1.59	1.22	2.81
21.	12	10½	15	.87	1.25	2.12
22.	19½	19	23	.97	1.18	2.15
41.	100	101	40	1.01	.40	1.41

Table VI. gives the requirements - maintenance, production and total - with the yield of milk all per cow during the summer period. Distinctions in the maintenance requirements are made in Column 1 according to

the type of cow kept. Irish Shorthorns, Ayrshire and various crosses are given a smaller requirement than the heavy type of Shorthorns.

Table VI.

Theoretical Requirements of Starch Equivalent.

Farm No.	Maintenance Requirements per cow per day lb.	Total Maintenance Requirements per cow lb.	Yield of milk in period per cow gallons.	Production Requirements per cow lb.	Total Requirements per cow lb.
	1.	2.	3.	4.	5.
4.	6.4	986	308	770	1756
5.	6.4	986	286	715	1701
6.	6.4	986	231	578	1564
7.	6.4	986	259	648	1634
8.	6.4	986	269	672	1658
9.	6.9	1063	380	950	2013
10.	6.9	1063	417	1043	2106
11.	6.4	986	259	648	1634
13.	6.9	1063	290	725	1788
14.	6.4	986	304	760	1746
15.	6.4	986	284	710	1696
17.	6.9	1063	459	1148	2211
20.	6.4	986	283	708	1694
21.	6.4	986	270	675	1661
22.	6.4	986	307	766	1752
41.	6.4	986	345	863	1849

Dr. H. E. Woodman has pointed out that grass provides a greater amount of starch equivalent than is allowed for in this report. For a cow of 10 cwt. his practice is to allow an increase of 15% to represent what is used to make good the wastage due to the exercise involved in grazing. This is an important point where an attempt is being made to assess the value of each food measured by what it contributes of every kind. Exercise is invariably associated with grazing and with health. The energy necessary to support the exercise is provided by the grass, which should receive credit in proportion.

But this gives an opportunity of referring to the limitations of these records. Their object is to show the result of an economic experiment carried out by a number

of farmers under varying conditions, not to give a complete, detailed, statistical analysis of all the distinguishable elements in the farmers' experiences, not to present separately and exactly the cost of maintenance and the cost of production. The whole, actual, combined cost of these is shown. The cows are not weighed once a day, or even once in six months. Their weight is estimated. If the estimated weight differs from the actual weight, this affects only the proportion of the food going to maintenance on the one hand, and to production on the other. It does not affect the total cost. The weight is kept as nearly constant as possible, and so is the management in every respect, except that of providing a greater proportion of the food consumed by the cows from grass. This is the experiment. The results must be significant, and they are so.

The question of minerals is of increasing interest. Farmers who began to use lime and slag seven or eight years ago expressed their conviction four or five years ago that their use had reduced disease among their cows. More recent experience has confirmed the earlier, and farmers who began the use of minerals later have equally convinced themselves. They attribute an increased yield of milk to improved health brought about in what seems almost too short a time, too directly, by acess to pastures or meadows generously treated with minerals. The task of showing how far the improvement is due to herbage and how far to minerals is not one for the economist, but for the botanist and chemist. If anything further is sought on these lines a veterinary specialist would require to take part.

Winter Period October 2[illegible] to April 30. - 211 days.

Table VII.

Theoretical Requirements of Starch Equivalent.

Farm No.	Maintenance Requirements per cow per day lb.	Total Maintenance Requirements per cow lb.	Yield of milk in period per cow gallons.	Production Requirements per cow lb.	Total Requirements per cow lb.
	1.	2.	3.	4.	5.
4.	6.4	1350	422	1055	2405
5.	6.4	1350	436	1090	2440
6.	6.4	1350	317	793	2143
7.	6.4	1350	316	790	2140
8.	6.4	1350	369	923	2273
9.	6.9	1456	495	1238	2694
10.	6.9	1456	528	1320	2776
11.	6.4	1350	317	793	2143
13.	6.9	1456	369	923	2379
14.	6.4	1350	449	1122	2472
15.	6.4	1350	358	895	2245
17.	6.9	1456	516	1290	2746
20.	6.4	1350	318	795	2145
21.	6.4	1350	355	888	2238
22.	6.4	1350	362	904	2254
41.	6.4	1350	259	648	1998

Table VIII.

Farm No.	Theoretical Requirements of S.E. per cow. lb.	S.E. obtained from purchased feed per cow. lb.	S.E. obtained from hay per cow. lb.
	1.	2.	3.
4.	2405	2073	332
5.	2440	1912	528
6.	2143	1492	651
7.	2140	1736	404
8.	2273	1668	605
9.	2694	2244	450
10.	2776	1701	1075
11.	2143	1496	647
13.	2379	1796	583
14.	2472	1956	516
15.	2245	1674	571
17.	2746	1868	878
20.	2145	1455	690
21.	2238	1130	1108
22.	2254	1610	644
41.	1998	540	1458

Table IX.

Farm No.	Weight of hay per cow lb.	Weight of S.E. per cow (assuming 1 lb. hay = .37 lb. S.E.)	Weight of S.E. from Column 3. Table VIII	Ratio of Columns 2 : 3.
	1.	2.	3.	4.
4.	2506	927	332	1 : .35
5.	2585	956	528	1 : .55
6.	2534	937	651	1 : .69
7.	2618	968	404	1 : .41
8.	1679	621	605	1 : .97 ±
9.	2475	915	450	1 : .49
10.	2416	894	1075	1 : 1.20 ±
11.	2878	1065	647	1 : .60
13.	2534	937	583	1 : .62
14.	3298	1220	516	1 : .42
15.	2363	874	571	1 : .65
17.	2684	1020	878	1 : .86 ±
20.	2877	1064	690	1 : .64
21.	3130	1158	1108	1 : .95 ±
22.	2564	949	644	1 : .67
41.	1791	662	1458	1 : 2.20 ±

The feeding value of "medium hay" is represented by the figure 1 on left hand of Column 4. The figures on the right hand, nearly all fractions, represent by comparison the actual feeding value on the sixteen farms. The object of improvement is to get the actual feeding value up to 1.3, the feeding value of "very good hay".

The inferior place held by grass in the summer ration of cows in this area has been emphasised. It is nothing compared with the insignificant position accorded to hay in winter. Meadows have received more one-sided treatment than pastures. They have been dunged as often as three times a year on some farms, with no lime or phosphates to balance this. The quality of the hay has been reduced to the lowest degree. While there has been superfluous and wasteful feeding of concentrates, the figures in the two previous tables, however surprising they may be, probably reflect accurately the feeding value of hay on all the farms. The five marked with an asterisk, where

hay has played nearly its full part, or more than its full part, are farms where the meadows have been generously treated with lime, phosphates, and some with nitrogen in mineral form over a period of years. The abnormally high ratios of feeding value obtained from Nos. 10 and 41 are due chiefly to grazing which took place before and after the summer period. The anxiety to make sure of a high yield causes men to overfeed with concentrates, but the experience on these sixteen farms suggests that if the farmers do for their meadows what they have done for their pastures, the meadows will do for them what the pastures have done.

Table X.

Consumption of Starch and Protein Equivalent.

Farm	Starch Equivalent. Theoretical Requirements per cow. lb.	Amount fed per cow. lb.	Excess of 2. over 1. per cow. lb.	Protein Equivalent. Theoretical Requirements per cow. lb.	Amount fed per cow. lb.	Excess of 4. over 3. per cow. lb.
No.	1.	2.		3.	4.	
4.	2405	3000	+ 595	391	623	+ 232
5.	2440	2869	+ 429	398	413	+ 15
6.	2143	2429	+ 286	327	380	+ 53
7.	2140	2705	+ 565	327	452	+ 125
8.	2273	2290	+ 17	358	325	- 33
9.	2694	3160	+ 466	453	641	+ 188
10.	2776	2595	- 181	473	549	+ 76
11.	2143	2561	+ 418	327	455	+ 128
13.	2379	2734	+ 355	377	489	+ 112
14.	2472	3177	+ 705	429	632	+ 203
15.	2245	2549	+ 304	370	459	+ 89
17.	2746	2888	+ 142	538	583	+ 45
20.	2145	2519	+ 374	327	488	+ 161
21.	2238	2287	+ 49	350	434	+ 84
22.	2254	2559	+ 305	354	386	+ 32
41.	1998	1203	- 795	292	279	- 13

In Table X. the theoretical requirements of starch and protein equivalents are given with the actual amounts fed. The maintenance requirements of protein have been taken at .65 lb. to .74 lb. according to type of cow, and

.6 per gallon for production.

It will be seen that on all the farms except two the amount of starch equivalent fed was in excess of the theoretical requirements of the cows. Most of the farmers concerned would probably say that they knew this, that they intended to over-feed, by this standard, but the results provide reasons for testing again the balance of their rations. The application of the protein equivalent formula gives a similar result expressed in terms of protein.

Table XI. has been designed to test the balance of the ration. The ratio of the protein equivalent to the starch equivalent varies with the amount of milk produced. A cow weighing 1000 lb. and giving 1 gallon of milk requires 6 lb. of starch equivalent, including 0.6 lb. of protein equivalent for maintenance, and 2.5 lb. of starch equivalent including 0.6 lb. of protein equivalent for production of 1 gallon. The ratio of this ration is 1.2 lb. of protein equivalent to 8.5 lb. of starch equivalent, that is 1 : 7. If a cow of the same weight was giving 4 gallons of milk per day the ration should contain 3 lb. of protein equivalent and 16 lb. of starch equivalent, a ratio of 1 : 5.3. Thus the ratio grows narrower as the yield increases.

Table XI. deals only with the ratio of the production ration. Maintenance requirements have been subtracted from the amounts fed in every case.

Table XI.

Protein - Starch Equivalent Ratio in Production Ration.

Farm No.	Gallons per cow.	Starch Equivalent available for Production. lb.	Protein Equivalent available for Production. lb.	Protein - Starch Equivalent Ratio.
4.	422	1650	486	1 : 3.39
5.	436	1519	276	1 : 5.50
6.	317	1079	243	1 : 4.44
7.	316	1355	315	1 : 4.30
8.	369	940	188	1 : 5.00
9.	495	1704	485	1 : 3.51
10.	528	1139	393	1 : 2.90
11.	317	1211	318	1 : 3.80
13.	369	1278	333	1 : 3.83
14.	449	1827	495	1 : 3.69
15.	358	1199	322	1 : 3.72
17.	516	1432	427	1 : 3.35
20.	318	1169	351	1 : 3.36
21.	355	937	297	1 : 3.15
22.	361	1209	249	1 : 4.85

The theoretical composition of a feed suitable for the production of 1 gallon of milk is 2.5 lb. of starch equivalent, containing 0.6 lb. of protein equivalent. The ratio of such a feed would be 1 : 4.2 A ratio wider than this indicates a deficiency in protein, and one narrower an excess. The majority of the farms dealt with show the ratios too narrow, and therefore suggest that too much protein was being fed, and protein is the most expensive ingredient in the ration.
