
Oregon Agricultural College Extension Service

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Cost of Producing Milk and Butter-fat

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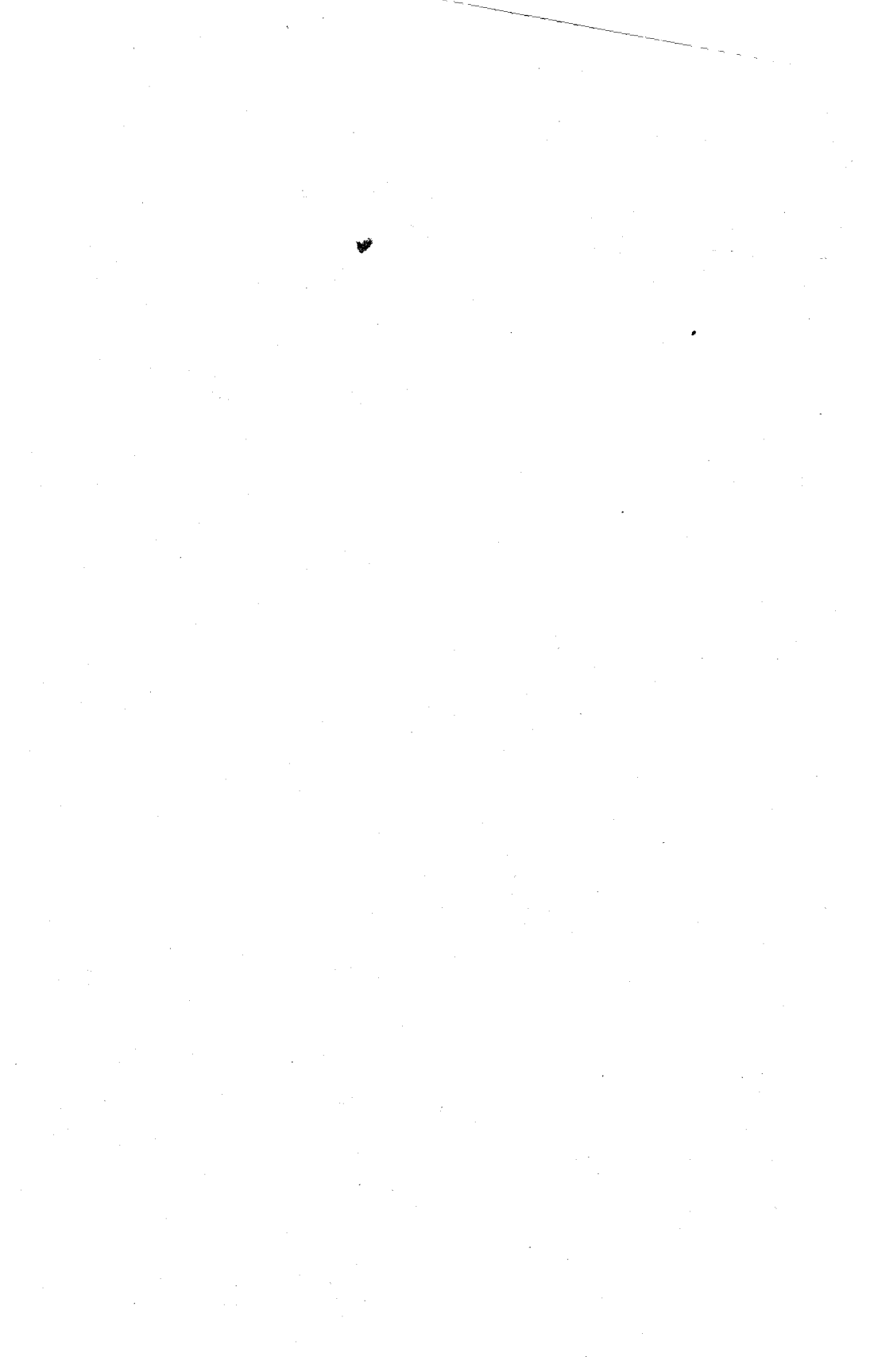


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SUMMARY

1. Production per cow was the most important factor in the economy of production. All costs per unit of production decreased as production per cow increased.

2. The well-fed cow was the higher producer and the more profitable.

3. The production of 240 pounds of fat per cow was the point above and below which profits were made or losses sustained.

4. There were wide variations in production costs due in part to local conditions and in part to management and productive capacity of herds.

5. Labor and overhead costs per cow and per unit of production decreased as the herds increased in size.

6. The larger herds were the poorer producers, due largely to lighter feeding.

7. Because of the lower production, the larger herds did not decrease the net cost per unit even though labor and overhead costs were decreased.

8. The labor income per hour varied from 13 to 43 cents according to production per cow.

9. The returns per dollar expended for feeds, including home-raised feeds, varied from \$0.77 to \$1.18 as the production per cow increased.

10. The requirements, on the herd basis, for producing 100 pounds of milk were: succulents, 181 pounds; hay, 90 pounds; grain and mill feed, 33 pounds; labor, 3.2 hours; pasture cost, 19 cents.

11. The requirements on the same basis for producing one pound of butter-fat were: succulents, 34 pounds; hay, 18 pounds; grain and mill feed, 8 pounds; labor, 45 minutes; pasture cost, 5 cents.

12. Seventy-six percent of all feeds were home raised. Only 16 percent of all labor was hired labor.

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HOW DATA WERE OBTAINED

In order to determine the requirements and cost of production of milk and butter-fat the Extension Service of the Oregon Agricultural College has conducted a study on a large number of dairy farms for the past three years. As the intention of this project was to secure local information which would prove of practical value to the dairyman in the proper management of his dairy enterprise, detailed data relating not only to inventory values and financial transactions, but also to feed, labor, and production records were secured. Accordingly, in 1920, visits were made to, and survey records obtained from 120 dairymen. In 1921 records were obtained from 67 of the same dairymen, and in 1922 from 82, making a total of 269 records for the three-year period. These surveys were supplemented in part by monthly reports from a number of these dairymen.

The records secured the first year were entirely on the survey basis. On this first visit each dairyman was provided with a farm account book with feed, labor, and production forms, and was asked to keep records for the following years. This proved of value in obtaining subsequent data.

AREA COVERED BY SURVEY

This project was conducted in four counties—Multnomah, Clackamas, Columbia, and Washington—and for the three years—1920, 1921, and 1922. Classification into the three following groups seemed desirable: (1) condensery milk, (2) market milk, (3) cream. The average cost for each group represents the cost at the farm. No delivery costs are included.

METHOD OF COMPUTATION

In determining cost, all farm-raised feed was charged at farm prices—the value at the farm. Purchased feed was charged at actual costs. All labor put on the dairy enterprise, whether performed by hired help, the farmer, or members of his family, was charged at the current wages paid for general farm help. Miscellaneous expenses included taxes and interest on the dairy investment (cows and equipment), depreciation on equipment, and such general expenses as veterinary fees, cow-testing expense, cans, etc. Credits comprising the farm value of manure, increase in value of dairy herd or young stock, and in the cream sections the value of skim milk fed to other livestock, were deducted from the "Total Cost" to arrive at the "Net Cost."

The results as given in the following tables are on the herd basis; that is, the requirements and cost per cow or per unit of production include the requirements and cost for the entire herd (cows, young stock, and bull).

The requirements of feeds and labor in producing 100 pounds of milk and their respective costs were figured separately. This makes it possible to use the unit requirements and apply existing prices to determine cost at any period, a fact which should make these data of future value, while if presented on the cost basis only, the results would be of but temporary interest.

VOLUME AND EXTENT OF BUSINESS

Table I gives a miscellaneous summary of the volume and extent of business done. It will be noticed that the average of 90 herds visited each year totaled 1256 cows, or an average of 14 cows to the herd. It also shows the feed cost to approximate 60 percent, labor 30 percent, and overhead 10 percent of the total cost of producing dairy products.

FEED AND LABOR REQUIREMENTS PER COW

In Table II are summarized the average feed and labor requirements per cow for one year. While the average for all farms showed 5 tons of succulents, 2.2 tons of hay, 1 ton of grain, and 19.3 days of labor, there was some variation within the different groups. The condensery group apparently fed about 50 percent more succulents, 20 percent more hay, 40 percent more grain, and required 18 percent more labor than the average requirement per cow for the market milk and creamery groups. This was largely due to the fact that market milk and butter-fat farms had much more pasture available, as will be brought out in the next table. The condensery group had higher producing cows.

Another feature brought out in Table II is the apparent consistency in annual requirements per cow. For instance, the condensery group shows succulent requirements per cow to have been 6.4, 6.6, and 6.5 tons for the years 1920, 1921, 1922, respectively. The other factors for any particular group for the three years show but little variation. This consistency in quantity of feeds indicates reliability in data submitted.

ANNUAL COST PER COW

Table III shows the annual costs of keeping a cow. It applies values to the amounts as indicated in Table II. For instance, after subtracting credits we find that, including all farms for the three years, it cost an average of \$163 to keep a cow for one year. There was some variation in the average cost for the different groups, the condensery group showing a cost of \$30 higher than the market milk and cream groups. The market milk group with almost 800 pounds less milk production and the cream group with \$43 worth of credits instead of \$25, due to the value of skim milk, are undoubtedly the chief reasons for this difference. When compared one year with another, each group shows a variation in net cost per cow; this of course is due primarily to the fluctuations in the market and farm values of feed.

TABLE I. MISCELLANEOUS SUMMARY
(All farms—269 records)

	All farms— 269 records				Condensery— 92 records				Market milk— 70 records				Creamery— 107 records			
	1920	1921	1922	Ave.	1920	1921	1922	Ave.	1920	1921	1922	Ave.	1920	1921	1922	Ave.
Total cows	1686	981	1111	1256	556	267	357	390	611	435	294	447	519	279	460	419
Total herds.....	120	67	82	90	44	21	27	30	32	22	16	23	44	24	39	36
Average number of cows per herd.....	14.0	14.5	13.6	14.0	13.0	12.0	13.0	12.7	16.0	19.0	18.0	17.7	12.0	11.6	12.0	11.9
Average production per cow.....					lbs. Mk	lbs. Mk	lbs. Mk	lbs. Mk	lbs. Mk	lbs. Mk	lbs. Mk	lbs. Mk	lbs. BF	lbs. BF	lbs. BF	lbs. BF
.....					5963	6676	6370	6336	5510	5342	5738	5563	250	269	258	259
Percent feed is of total cost.....	59	56	61	59	61	57	58	59	58	58	64	60	58	54	62	58
Percent labor is of total cost.....	31	30	27	29	30	30	29	30	33	30	27	30	32	31	25	29
Percent miscellaneous is of total cost....	9	14	12	12	9	13	13	11	9	12	9	10	10	15	13	13

TABLE II. ANNUAL FEED AND LABOR REQUIREMENTS PER COW
(All farms—269 records)

Items	All groups				Condensery				Market milk				Butter-fat			
	1920	1921	1922	Ave.	1920	1921	1922	Ave.	1920	1921	1922	Ave.	1920	1921	1922	Ave.
	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons
Succulents	4.72	5.00	5.27	5.00	6.46	6.68	6.58	6.57	3.88	4.30	4.63	4.27	3.85	4.64	4.68	4.39
Hay	2.12	2.02	2.40	2.18	2.20	2.27	2.15	2.46	1.96	1.59	2.02	1.86	2.22	2.23	2.45	2.30
Grain and mill-feed.....	1.01	.92	1.09	1.01	1.29	1.40	1.18	1.28	.74	.62	.86	.74	1.01	.97	1.12	1.04
Labor (days).....	20.4	18.7	18.9	19.3	20.8	22.6	21.9	21.8	19.6	15.6	15.9	17.0	20.8	20.4	18.5	19.9

TABLE III. ANNUAL COSTS PER COW
(All farms—269 records)

Items of cost	All groups				Condensery				Market milk				Butter-fat			
	1920	1921	1922	Ave.	1920	1921	1922	Ave.	1920	1921	1922	Ave.	1920	1921	1922	Ave.
Succulents	\$27.83	\$21.84	\$24.90	\$24.86	\$32.12	\$24.77	\$29.31	\$28.73	\$25.51	\$20.46	\$22.25	\$22.74	\$25.97	\$21.29	\$23.19	\$23.48
Hay	44.95	29.98	39.15	38.03	48.89	35.83	39.32	41.35	40.41	24.53	33.98	32.97	46.04	33.13	42.31	40.49
Grain and mill feed	48.01	26.67	36.31	37.00	61.51	39.43	36.61	45.85	36.19	17.84	29.48	27.84	47.46	28.67	40.45	38.86
Pasture	12.20	11.78	11.01	11.66	6.26	8.81	8.29	7.79	17.21	14.22	11.25	14.23	12.69	10.70	12.97	12.12
Total feed	132.99	90.26	111.37	111.54	148.78	108.84	113.53	123.72	119.32	77.05	96.96	97.78	132.16	93.79	118.92	114.96
Labor	71.33	48.75	49.16	56.41	72.84	58.65	57.00	62.83	68.76	39.91	41.44	50.04	72.73	53.42	48.00	58.05
Miscellaneous	21.97	21.59	22.40	21.99	23.36	25.33	25.86	24.85	18.65	16.08	13.38	16.04	24.59	26.74	25.47	25.60
Total cost	226.29	160.61	182.93	189.94	244.98	192.82	196.39	211.40	206.73	133.04	151.78	163.85	229.48	173.95	192.39	198.61
Credits	33.08	22.54	23.23	26.28	27.27	29.24	18.97	25.16	15.28	12.00	8.14	11.81	60.25	32.80	36.18	43.08
Net cost	133.21	138.07	159.70	163.66	217.71	163.58	177.42	186.24	191.45	121.04	143.64	152.04	169.23	141.15	156.21	155.53

FEED AND LABOR REQUIREMENTS PER 100 POUNDS MILK

Table IV is Table II reduced to a basis of 100 pounds of milk, leaving out the butter-fat group. This shows that the average requirement of all groups for the three years to produce 100 pounds of milk was: succulents 181 pounds, hay 90 pounds, grain 33 pounds, and labor 3.2 hours. With this as a basis the average farm can at any time determine its production costs.

TABLE IV. FEED AND LABOR REQUIREMENTS
PER 100 POUNDS OF MILK
(All milk farms—162 records)

Items	—All milk—				—Condensery—				—Market milk—			
	1920	1921	1922	Ave.	1920	1921	1922	Ave.	1920	1921	1922	Ave.
Succulents	178	178.7	187.5	181	216	196.6	206	206	141	165	162	156
Hay	76	93	100	90	76	116	110	101	71	60	87	73
Grain and mill feed	34	31	33	33	44	41	35	40	27	23	30	27
Labor (hours)	3.4	3.1	3.2	3.2	3.5	3.3	3.4	3.4	3.3	2.8	2.8	3.0

COST OF PRODUCING 100 POUNDS OF MILK

Table V is Table III reduced to a basis of 100 pounds of milk, leaving out the butter-fat group. The interesting point in this table is the comparison of net cost per 100 pounds of milk for the different years: The net cost of producing 100 pounds of milk for 1920 was \$3.54, while in 1921 it was only \$2.34. In 1922 there was a slight rise to \$2.67.

TABLE V. COST OF PRODUCING 100 POUNDS OF MILK
(All milk farms—162 records)

Items of cost	—All milk—				—Condensery—				—Market milk—			
	1920	1921	1922	Ave.	1920	1921	1922	Ave.	1920	1921	1922	Ave.
Succulents	\$0.50	\$0.38	\$0.43	\$0.43	\$0.54	\$0.37	\$0.46	\$0.46	\$0.46	\$0.38	\$0.39	\$0.41
Hay .....	.78	.49	.61	.63	.76	.54	.62	.64	.74	.46	.59	.60
Grain and mill feed .....	.84	.44	.55	.61	1.10	.59	.58	.76	.65	.33	.51	.50
Pasture .....	.21	.21	.16	.19	.10	.13	.13	.12	.31	.27	.20	.26
Total feed	2.33	1.52	1.75	1.86	2.50	1.63	1.79	1.98	2.16	1.44	1.69	1.77
Labor	1.24	.80	.82	.95	1.22	.88	.89	1.00	1.25	.74	.72	.90
Miscellaneous .....	.34	.33	.33	.33	.38	.38	.40	.39	.34	.31	.24	.30
Total cost	3.91	2.65	2.90	3.14	4.10	2.89	3.08	3.37	3.75	2.49	2.65	2.97
Credits .....	.37	.31	.23	.30	.45	.44	.30	.40	.28	.22	.14	.21
Net cost	3.54	2.34	2.67	2.84	3.65	2.45	2.78	2.97	3.47	2.27	2.51	2.76

REQUIREMENTS AND COST PER POUND OF BUTTER-FAT

Tables VI and VII show the requirements and costs of the cream group reduced to a pound butter-fat basis, the average requirement being 34 pounds succulence, 18 pounds hay, 8 pounds grain, and 45 minutes of labor to produce one pound of butter-fat.

TABLE VI. FEED AND LABOR REQUIREMENTS
PER POUND OF BUTTER-FAT
(107 records)

Items	1920	1921	1922	Ave.
Succulents	31 lbs.	34 lbs.	36 lbs.	34 lbs.
Hay	18 lbs.	16 lbs.	19 lbs.	18 lbs.
Grain and mill feed.....	8 lbs.	7 lbs.	9 lbs.	8 lbs.
Labor	48 min.	45 min.	42 min.	45 min.

TABLE VII. COST OF PRODUCING A POUND OF BUTTER-FAT
(107 records)

Items	1920	1921	1922	Ave.
Succulents	\$0.10	\$0.08	\$0.09	\$0.09
Hay .....	.19	.12	.16	.16
Grain and mill feed.....	.19	.11	.16	.15
Pasture .....	.05	.04	.05	.05
Total feed .....	.53	.35	.46	.45
Labor .....	.29	.20	.18	.22
Miscellaneous .....	.10	.10	.10	.10
Total cost .....	.92	.65	.74	.77
Credits .....	.24	.13	.14	.17
Net cost .....	.68	.52	.60	.60

VARIATION IN COST

In calculating unit costs for a given group of farms it has been the practice to direct attention to the "average cost." An average figure, however, does not convey an adequate picture of the costs that are represented. It is important to know something about the range in costs. Table VIII shows the variation in costs per 100 pounds of milk on the farms producing whole milk for each of the three years. The approximate average farm price received by the dairymen producing whole milk was \$3.00 per cwt. in 1920 and \$2.00 per cwt. in 1921 and 1922. It is interesting, therefore, to note that approximately 28 percent of the milk was produced at a profit in 1920, 22 percent in 1921, and 15 percent in 1922. The reasons for the variation in costs to the individual dairymen, and what made it possible to produce a certain portion of the milk at a profit, are the outstanding practical questions of interest. An attempt to analyze the results is made in the following tables and graphs.

BETTER FEEDING INCREASES PRODUCTION

About the first thing that a dairyman thinks about in reducing costs is production per cow. That it is necessary to keep cows of good breeding is generally recognized although not always followed; at the same time, it is important to feed right. Much improvement can be brought about by better feeding. Table IX with its supplementary graph brings out the relation of amounts of feed, represented by cost, to production per cow.

All farms for 1921 and 1922* were classified and grouped according to the value of feed per cow. All herds averaging less than \$70 worth of

* 1920 was omitted from this average because of the abnormal high prices for feed that year.

TABLE VIII. VARIATIONS IN NET COST PER 100 POUNDS WHOLE MILK
(162 records, Portland district, 1920, 1921, 1922)

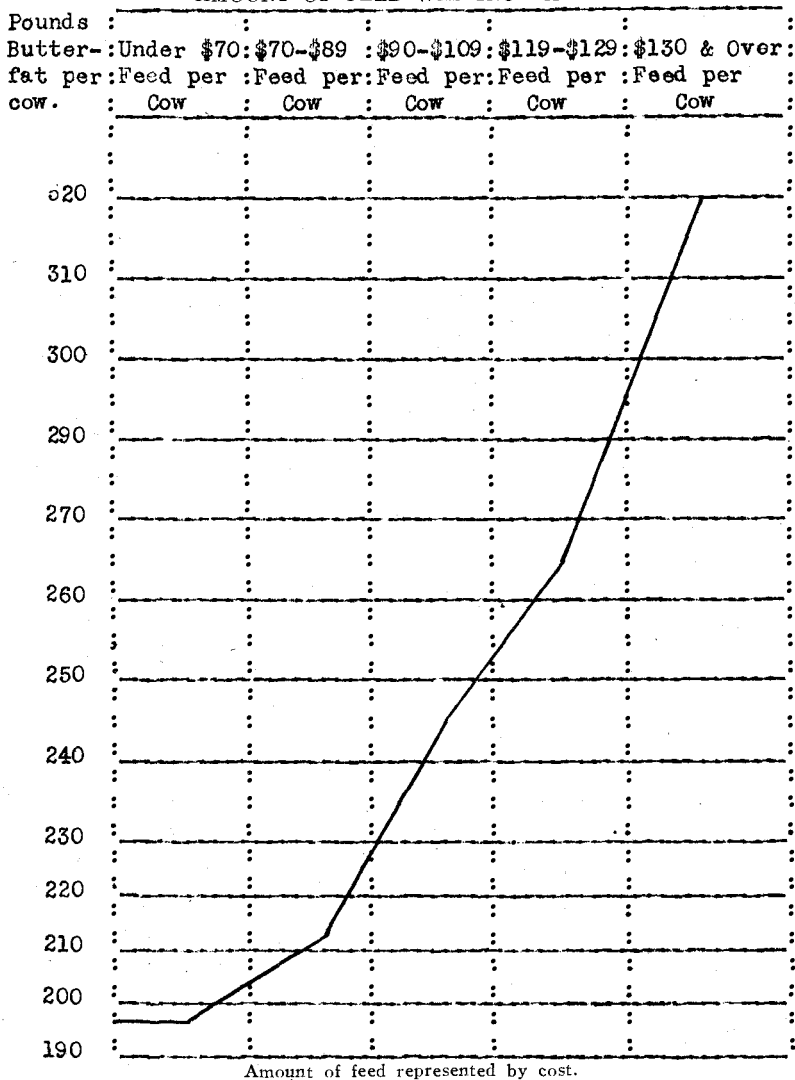
1920 (76 herds)				1921 (43 herds)				1922 (43 herds)			
Net cost per cwt.	Number of herds	Milk per herd	Cumula- tive produc- tion	Net cost per cwt.	Number of herds	Milk per herd	Cumula- tive produc- tion	Net cost per cwt.	Number of herds	Milk per herd	Cumula- tive produc- tion
		lbs.	%			lbs.	%			lbs.	%
\$2.60	2	75,478	2.3	\$1.80	2	175,348	8.6	\$1.80	2	76,997	5.2
2.70	3	129,312	8.1	1.90	3	101,197	16.1	1.90	3	70,280	9.2
2.80	4	93,348	13.6	2.00	3	76,793	21.9	2.00	1	204,100	14.6
2.90	2	75,919	15.9	2.10	6	112,230	38.5	2.10	1	27,437	15.1
3.00	8	102,569	28.2	2.20	2	76,348	42.3	2.20	2	93,258	19.8
3.10	4	93,821	33.8	2.30	3	139,873	52.7	2.30	4	122,384	32.1
3.20	6	75,505	46.3	2.40	1	105,714	55.3	2.40	3	95,377	39.4
3.30	5	115,071	49.2	2.50	2	74,922	59.0	2.50	2	151,731	47.1
3.40	8	119,646	63.5	2.60	6	90,692	72.5	2.60	4	113,259	58.5
3.50	3	65,922	66.5	2.70	3	108,142	80.5	2.70	3	83,214	64.8
3.60	2	117,533	70.0	2.80	2	74,263	84.2	2.80	3	77,858	70.7
3.70	1	26,620	70.4	2.90	4	67,174	90.9	2.90	2	133,374	77.4
3.80	6	80,434	77.6	3.00	2	80,525	94.8	3.00	1	81,068	79.4
3.90	2	48,216	79.1	3.10	1	25,482	95.5	3.10	3	74,963	85.2
4.00	2	70,986	81.2	3.20	1	39,311	96.5	3.20	2	54,059	87.8
4.10	1	73,588	82.3	3.30	--	-----	-----	3.30	--	-----	-----
4.20	3	73,094	85.6	3.40	1	45,596	97.6	3.40	3	60,524	92.2
4.30	3	58,798	88.3	3.50	1	95,670	100.0	3.50	--	-----	-----
4.40	1	43,359	88.9	-----	--	-----	-----	3.60	2	105,860	97.8
4.50	--	-----	-----	-----	--	-----	-----	3.70	--	-----	-----
4.60	3	101,443	93.4	-----	--	-----	-----	3.80	--	-----	-----
4.70	1	80,532	94.7	-----	--	-----	-----	3.90	--	-----	-----
4.80	1	58,643	95.5	-----	--	-----	-----	4.00	2	44,283	100.0
4.90	2	46,498	96.9	-----	--	-----	-----	-----	--	-----	-----
5.00	3	68,366	100.0	-----	--	-----	-----	-----	--	-----	-----
Average cost, \$3.54.				Average cost, \$2.34.				Average cost, \$2.67.			

TABLE IX. RELATION OF AMOUNT OF FEED PER COW TO PRODUCTION PER COW

Amount of feed represented by cost (149 records, 1921 and 1922)

Group	Feed cost per cow	Number of cows	Production per cow, fat	Number of herds	Average cows per herd
Group I.....	Under \$ 70	352	197	16	22.0
Group II.....	\$ 70-\$ 89	465	213	28	16.6
Group III.....	\$ 90-\$109	539	245	38	14.2
Group IV.....	\$110-\$129	420	268	32	13.1
Group V.....	Over \$130	316	320	35	9.0

GRAPH 1. THE PRODUCTION PER COW INCREASED AS THE AMOUNT OF FEED WAS INCREASED



feed per cow annually were classified in Group I. Group II included all herds where the average value of feed fed annually per cow varied between \$70 and \$90. Groups III, IV, and V followed in regular order.

The effect feed had on production is apparent. It will be noted that there was a constant increase from 197 pounds of fat per cow in Group I to 320 pounds of fat per cow in Group V. Graph 1, which accompanies Table IX, illustrates this relationship in a more definite manner.

It will be further noted that there was a greater amount of feed fed per cow in the smaller herds than in the larger ones. The average number of cows per herd was 22 in Group I, which gradually diminished to 9 in Group V. This may not always be the case, but was true here because the larger herds were in the districts where pasturing was more prevalent and considerably less grain was fed.

VOLUME OF BUSINESS DECREASES COST

Table IX and Graph 1 show that increased feed had a direct bearing on the production. Increased production per cow indicates quality of business. Volume of business is also of importance. In Table X we note that as the size of the herds increased from less than 8 to more than 22, the labor and overhead expenses which constitute 40 percent of the total cost of producing dairy products, dropped from \$105 per cow to \$68. Graph 2 brings this out in definite form. The fact that there was a slight irregularity in the smoothness of this graph in Group IV may be due to

TABLE X. RELATION OF NUMBER OF COWS PER HERD TO LABOR AND OVERHEAD COST PER COW
(All farms)

Number of cows per herd	Number of cows	Labor and over- head
Under 8	335	\$105
8 to 12	955	91
13 to 17	1005	83
18 to 21	307	84
22 and over	1071	68

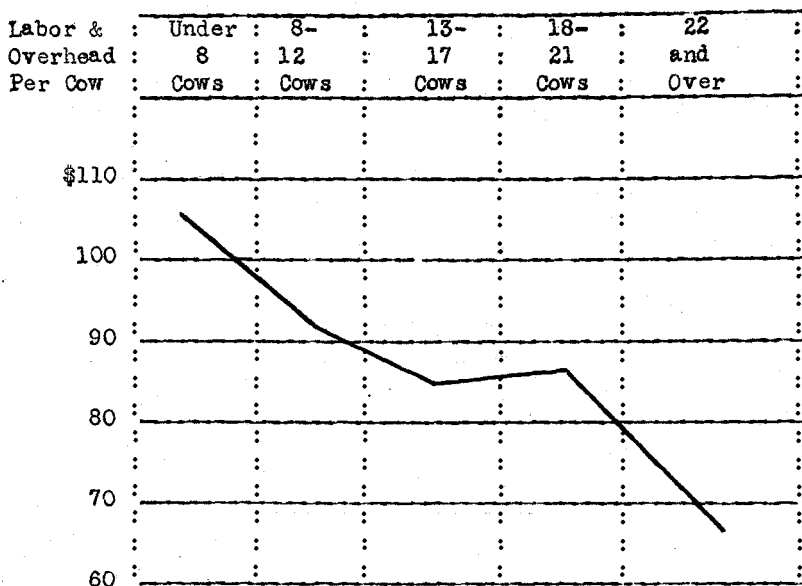
two factors. The small number of cows (307) falling into this group may not have been sufficient to give a true average, and it is possible that a herd of 18 to 21 cows is not an efficient unit. Perhaps one man can efficiently care for a herd of 13 to 17 cows, or two men could care for a herd of 22 to 25 cows. A herd of 18 to 21 cows is too large for one man and too small to be efficiently handled by two men.

The saving in labor and overhead effected by the larger herds was apparently offset by their lower production per cow. The smallest herds had an average production of 289 pounds of fat per cow, and this gradually decreased to 224 pounds for the largest herds. A study of conditions on the farms showed that this decreased production was not due primarily to less care and labor but to less feed. With similar feeding and similar cows, the larger herds should show a lower net cost per pound of butter-fat as well as a lower labor and overhead expense per cow.

Now that several factors have been worked out to show the effect of volume of business on decreasing cost and of better feeding on increased production, it may prove of interest to analyze this problem from another

angle and see what effect increased production has on several efficiency factors. To make these comparisons all farms for all years were thrown together and reclassified into six groups according to the production per cow. Whole milk herds were reduced to a butter-fat basis, using 4% as an average butter-fat test, and averaged in with the butter-fat herds. Group I included all herds where the average production was less than 160 pounds of fat annually; Group II, 160 pounds to 200 pounds; Group III, 201 pounds to 240 pounds; Group IV, 241 pounds to 280 pounds. Group V, 281 pounds to 320 pounds, and Group VI, all herds where the average production was over 320 pounds of fat.

GRAPH 2. LABOR AND OVERHEAD COSTS PER COW DECREASE AS THE NUMBER OF COWS PER HERD INCREASE



HIGH PRODUCING COWS RETURN PROFIT ON FEED

In Table XI an attempt is made to show the relation of production per cow to feed return and feed cost per cow and to return per dollar expended for feed. Graph 3 supplements Table XI in bringing out the fact that it was only in herds producing 240 pounds of fat or over that more was received for the feed than it cost. Graph 4 answers the question in another way. This indicates that after all expenses except feed had been considered, the herds producing less than 160 pounds fat, 160 pounds to 200 pounds, and 200 pounds to 240 pounds, returned but 77, 86, and 96 cents, respectively, for every dollar's worth of feed consumed. On the other hand, for the groups averaging 240 pounds to 280 pounds, 280 pounds to 320 pounds, and over 320 pounds fat annually the returns per dollar expended for feed averaged \$1.05, \$1.18, and \$1.09, respectively.

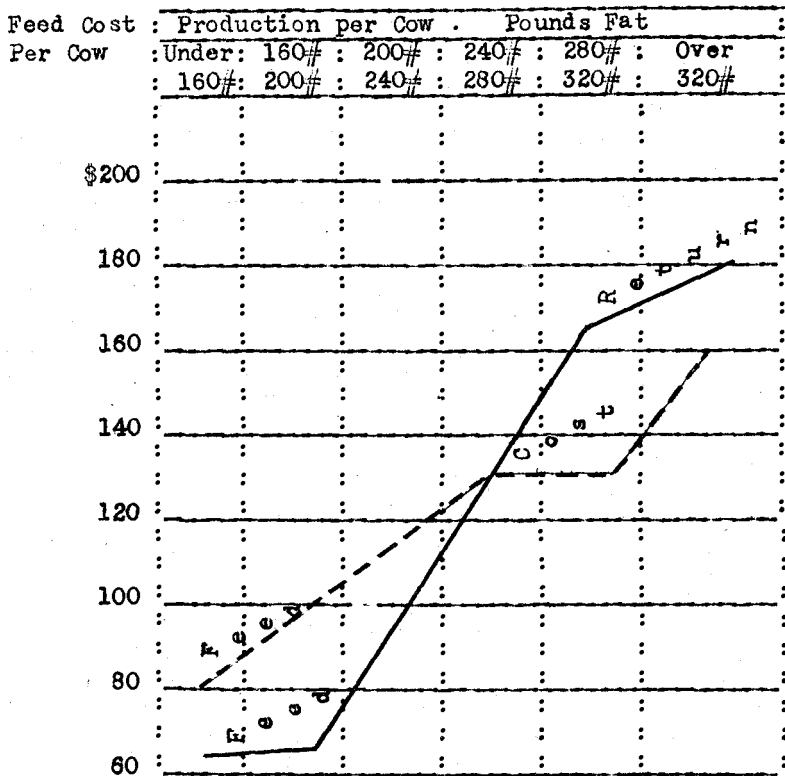
TABLE XI. RELATION OF PRODUCTION PER COW TO FEED RETURN AND
FEED COST PER COW AND TO RETURN PER
DOLLAR EXPENDED FOR FEED
(All farms)

Production per cow, butter-fat	Number of cows	Feed return per cow*	Feed cost per cow	Return per dollar expended for feed†
<i>lbs.</i>				
Under 160	276	\$ 60.67	\$ 78.84	\$0.77
160 to 200	764	76.26	88.76	.86
201 to 240	1003	104.83	109.28	.96
241 to 280	676	137.03	130.57	1.05
281 to 320	692	161.17	136.10	1.18
Over 320	346	174.77	160.14	1.09

* Feed return is the income remaining after all expenses but feed have been paid and is the amount left with which feed cost is to be met.

† Labor and overhead costs have been deducted prior to making this determination.

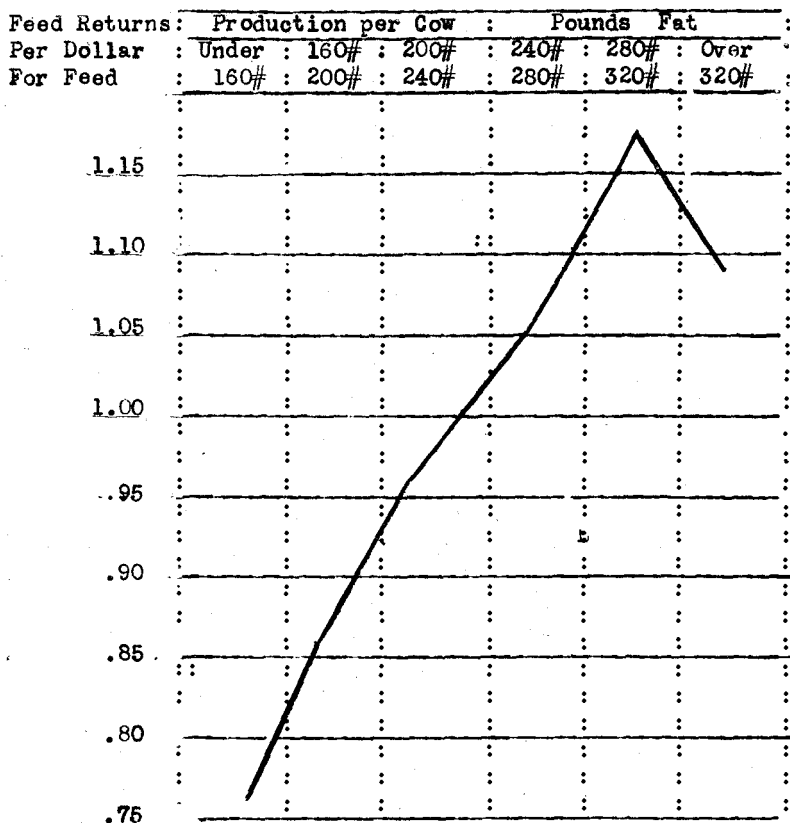
GRAPH 3. RELATION OF PRODUCTION PER COW TO FEED COST
AND FEED RETURN PER COW



HIGH PRODUCING COWS GIVE GOOD RETURN FOR LABOR

To size up the results on returns for labor instead of for feed, Table XII has been prepared. Here all costs except labor have been deducted from receipts, and the remainder is the amount that pays for labor and is, therefore, the labor return or labor income. Effort is made to show the relation of production per cow to labor return and labor cost per

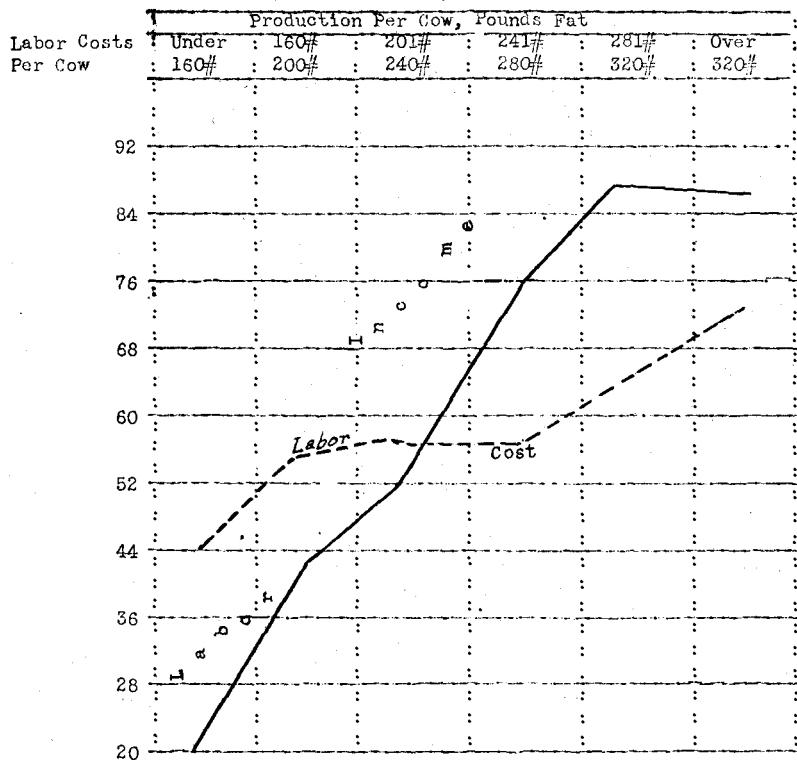
GRAPH 4. THE HIGHER THE PRODUCTION PER COW THE HIGHER THE RETURN PER DOLLAR EXPENDED FOR FEED



cow and labor income per hour. Graph 5, which supplements Table XII, shows a result similar to Graph 3 of Table XI. It required somewhat more labor per cow in the higher producing herds, but returns for labor did not equal its cost in herds averaging less than 240 pounds of fat. To put the results on a labor-income-per-hour basis, it was found that this income passed the 30-cents-per-hour point, which was practically the average cost of labor, at the 240-pound-butter-fat mark. That there is somewhat less return for labor, as was the case for feed in the 320-pound

group, is due in part to high overhead owing to smallness of herds, and possibly may indicate also that the point of profitable return under ordinary dairy farm conditions has been reached.

GRAPH 5. RELATION OF PRODUCTION PER COW TO LABOR COST AND LABOR INCOME PER COW

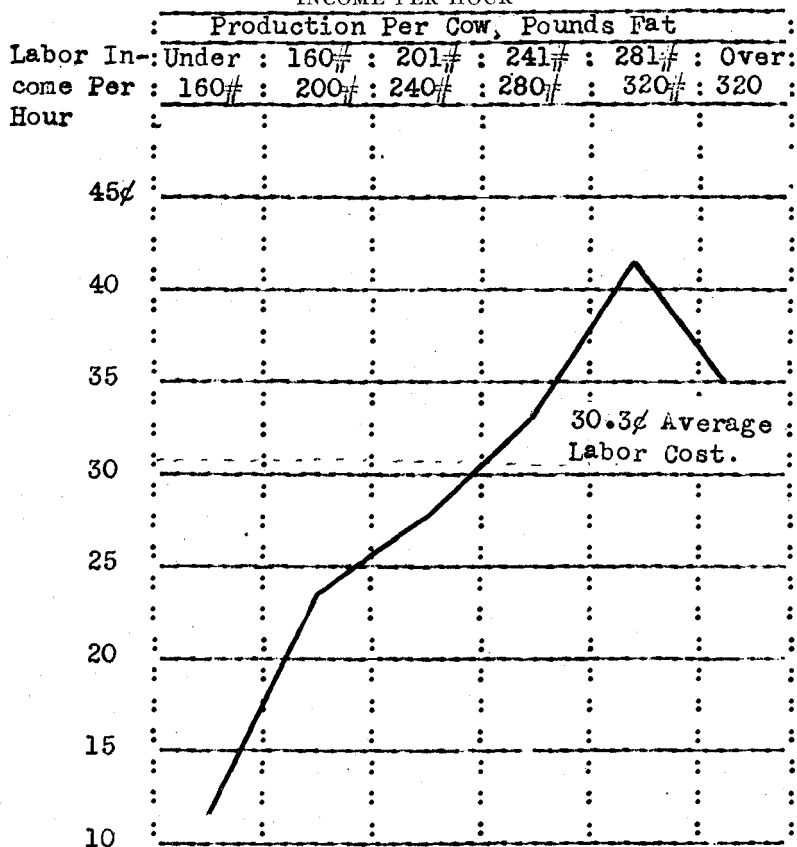


Labor cost per cow represented in dollars.

TABLE XII. RELATION OF PRODUCTION PER COW TO LABOR INCOME AND LABOR COST PER COW AND TO LABOR INCOME PER HOUR
(All farms)

Production per cow, butter-fat	Number of cows	Labor income per cow	Labor cost per cow	Labor hours per cow per year	Labor income per hour
<i>lbs.</i>					
Under 160	276	\$ 19.08	\$ 42.49	102	\$ 0.13
160 to 200	764	41.48	54.40	167	.25
201 to 240	1003	52.93	55.65	187	.28
241 to 280	676	74.66	54.85	224	.34
281 to 320	692	87.68	64.49	206	.43
Over 320	346	85.65	73.97	248	.35

GRAPH 6. INCREASED PRODUCTION PER COW GAVE A HIGHER INCOME PER HOUR



HIGH PRODUCING COWS REDUCE COST OF FAT

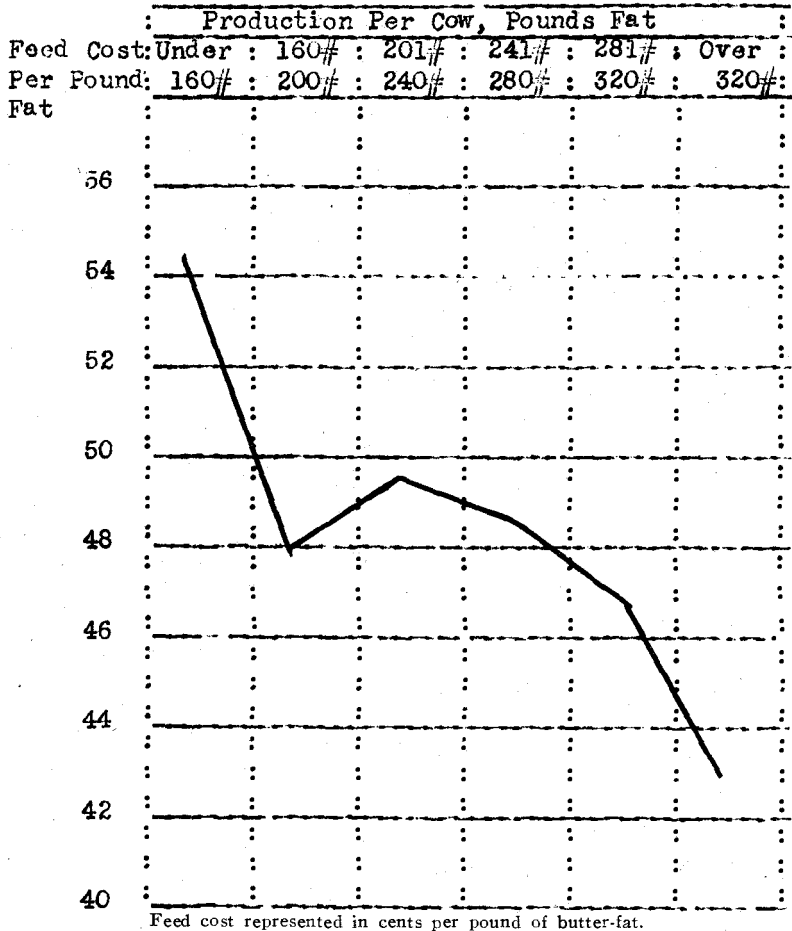
The relation of increased production to the various factors has been considered separately. It now remains to see what relation it has to the final factor, net cost. Accordingly, Table XIII has been prepared to show what relation production per cow has to feed cost, amount of labor, and total net cost per pound of fat. From Graph 7 we note that the feed cost per pound of fat decreased from 55 cents in the low producing group to 43 cents in the high producing group. With the single exception, of Group I, which included only a small number of cows, we find the amount of labor required to produce a pound of fat decreased constantly from 54 minutes in the low producing herds to 40 minutes in the high producing herds. Considering all factors, feed, labor, and miscellaneous expenses and then deducting credits we have the final test of the relation of production to cost in the last column of Table XIII. This supplemented by Graph 9 shows that there was a direct relationship between production per cow and net cost per pound of fat. It is noted here that

the net cost of production was 84 cents a pound in the low producing herds and that there was a constant decrease to 63 cents per pound in the 320 pound herds. The slight increase in the group over 320 pounds has been previously explained.

TABLE XIII. RELATION OF PRODUCTION PER COW TO FEED COST, AMOUNT OF LABOR AND NET COST PER POUND FAT

Production per cow butter-fat	Number of cows	Feed cost per lb. of fat	Minutes labor per lb. fat	Net cost per lb. fat
<i>lbs.</i>				
Under 160	276	\$0.55	43	\$0.84
160 to 200	764	.48	54	.76
201 to 240	1003	.50	51	.73
241 to 280	676	.49	50	.71
281 to 320	692	.47	43	.63
Over 320	346	.43	40	.68

GRAPH 7. INCREASED PRODUCTION PER COW LESSENS FEED COST PER POUND FAT



FEED PURCHASED AND LABOR HIRED

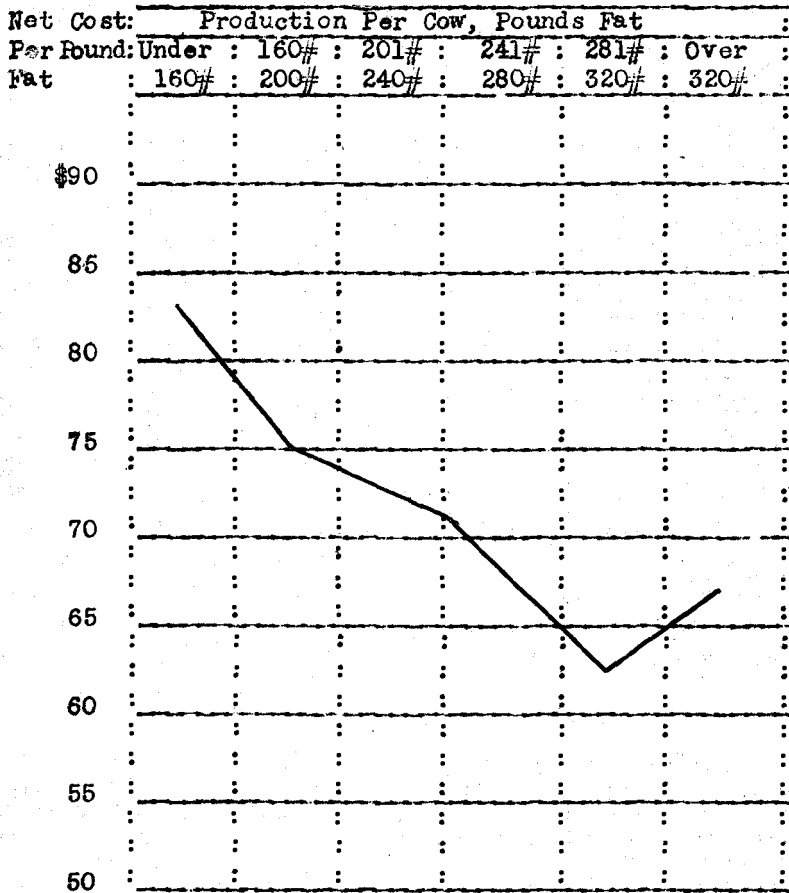
There is always much controversy and considerable speculation as to whether it pays to purchase mill feed or depend primarily on farm-raised feeds. The information obtained was not conclusive. It was of interest to note that the higher fed and consequent higher producing cows were given more purchased feed, due apparently to the fact that on all farms about the same amount of feed per cow is raised. If then

GRAPH 8. LABOR PER POUND FAT DECREASES AS PRODUCTION PER COW INCREASES



the cows produce more than the average an increased amount of grain is purchased. The average of all farms shows 24 percent of the feed purchased. This was principally mill feed. Eighteen percent of all farms purchased over 40 percent of their total feed fed. It was further found that 16 percent of all labor was hired.

GRAPH 9. INCREASED PRODUCTION PER COW DECREASES
NET COST PER POUND FAT



FARM BUSINESS SUMMARY

In order to view the results of the entire farm business on the same farms from which have been determined the factors governing the cost of production, Table XV has been prepared. As indicated, this is a farm business summary showing the capital investment, sources of receipts, items of expense, and the net return for each of the three years, 1920, 1921, and 1922.

TABLE XV. FARM BUSINESS SUMMARY
(281 records)

	1920	1921	1922	Average
Number of farms.....	130	69	82	281
Total farm acres.....	140	139	117	132
Total crop acres.....	54	51	61	55
Capital:				
Real estate	\$ 17,350	\$ 19,018	\$ 14,996	\$ 17,121
Stock and equipment.....	4,380	4,358	3,695	4,144
Total capital.....	\$ 21,730	\$ 23,376	\$ 18,691	\$ 21,265
Receipts:				
Crops	\$ 516	\$ 341	\$ 266	\$ 374
Livestock	600	228	383	404
Milk and cream	2,261	1,674	1,549	1,828
Poultry	71	78	95	81
Miscellaneous	265	122	142	176
Total receipts.....	\$ 3,713	\$ 2,443	\$ 2,435	\$ 2,863
Expenses:				
Labor	\$ 389	\$ 254	\$ 266	\$ 303
Feed	778	662	413	618
Crop	180	153	103	145
Machinery	174	170	186	177
Taxes	132	187	160	160
Auto	110	77	77	88
Miscellaneous	284	93	228	202
Total expenses.....	\$ 2,047	\$ 1,596	\$ 1,433	\$ 1,693
Farm income	\$ 1,666	\$ 847	\$ 1,002	\$ 1,170
Interest on investment at 5 percent	1,087	1,168	934	1,063
Labor income	\$ 579	\$ -321	\$ 68	\$ 107
Value family labor.....	1,643	1,529	1,338	1,503
Value of living from farm.. (estimated)	500	500	500	500

SIZE OF FARM INVESTMENT

Reference to the table shows that the average size of these dairy farms was 132 acres, of which 55 was in cultivated crops. The average investment in land and buildings amounted to slightly over \$17,000, which was approximately \$130.00 per acre. In addition to this, each farm averaged over \$4,000 investment in stock and equipment, making a total investment approximating \$21,000. It will be remembered from Table I that the average number of cows kept was about 14 for each year. These facts give some indication as to the size or volume of business conducted.

FARM RECEIPTS AND EXPENSES COMPARED

A comparison of gross receipts for the different years shows \$1,270 more income in 1920 than in 1921 or 1922. Over half of this difference is due to the reduced income from milk which sold at approximately \$3.00 per hundred in 1920 and only \$2.00 in 1921 and 1922. Furthermore, it will be noticed that almost two-thirds of the gross income each year is from dairy products. The fact that each year from \$800 to \$1400 of this gross income is from sources other than dairy products indicates, however, considerable diversification.

There has been a small but constant decrease in expenses. The items particularly contributing to this decrease have been less hired labor and less purchased feed; both of which are variable and more affected by market conditions than the other items of expenditure.

FARM INCOME, INVESTMENT, AND RETURN

When the total expenses are subtracted from the gross income, we have left over a net farm income of \$1666, \$847, and \$1002 for the three years 1920, 1921, and 1922, respectively. This net farm income represents what is earned by capital and all family labor after cash operating expenses have been deducted. Out of this amount interest on borrowed capital must be paid. If interest on capital were figured at 5 percent and this amount deducted from the farm income there would be a labor income left for the family of \$579 in 1920, a minus \$321 in 1921, and \$68 in 1922.

These figures may not appear to furnish much ground for optimism, but in this connection it should be remembered that they are average ones and that records of profitable, well managed farms are included with those which through various circumstances including poorer management have been unprofitable. It should also be noted that the value of "living from the farm" has been estimated at \$500. This value may vary from \$300 to \$1000 per year depending on conditions on each farm. With these values included a more optimistic view may be taken.

CONCLUSIONS

The data used in this study were obtained at a time which is now considered abnormal. It was so considered because during 1921 prices of feed and labor were very high and the prices of farm products were also comparatively high. The following year the opposite condition prevailed, while in 1922 farm products were no higher, labor about the same as the year before, but feed considerably higher, especially hay, due to a crop shortage.

Even with these unsettled conditions a little more than one-fifth of the dairymen produced milk and fat at a price less than that received. Such a record is not unfavorable under the circumstances, and especially is this true when it is considered that in 35 percent of the herds there were fewer than 12 cows and that the average production per cow in 27 percent of the herds was less than 200 pounds of butter-fat per year.

A number of factors affected the economy of production; namely, production per cow, amount of feed, size of herd, and the amount of investment. Of these, the production per cow was the more important. The data submitted clearly show that as production per cow increased the cost per unit of production decreased, and that with cows producing less than 240 pounds of butter-fat per year costs exceeded income, but with higher producing animals profits were made. If profits are to be made from the lower producing cows a very favorable location, an unusually good market, or exceptionally good management is necessary. The records would indicate the value of knowing the individual production of all animals, since a low producer in a comparatively high averaging herd would affect that average and tend to increase production costs.

The amount of feed per cow is considered second in importance as affecting economy of production, yet this effect was indirect in that it was only through increased production which higher feeding induced that it was a factor at all. The poorer fed herds were consequently the poorer producers, and the better fed herds were the higher producers and

the more economical. Productive capacity is apparently of doubtful value unless provided with an adequate supply of raw material.

Next in importance was the size of herd. The difference in "labor and overhead cost" per cow between the groups of smallest and largest herds was \$37 per year. Possibly some of the larger herds should have received better care, which would have resulted in a higher cost, but lack of care could not account for so great a difference. A decrease of \$10 per cow annually in "labor and overhead" would have decreased the cost of production two cents per pound of fat. In this study the maximum size for a herd could not be determined but apparently there should not be fewer than 10 cows.

The fourth factor is the "amount of investment." In many studies it is shown that the amount of capital is inadequate. This may be no exception, but of possibly greater importance is the amount of capital per unit of production. The record shows that the investment in real estate averages \$17,000 on 132 acres of which 55 are in cultivation. This is an average investment of \$130 per acre and with 64 percent of the income from the dairy amounts to a real property investment of \$3.60 for each pound of butter-fat produced per year. It would seem that an increased amount of cultivated acres should be purchased for that amount of capital, which in turn would make possible the handling of an increased number of cows or would produce enough more feed to make possible an increased production from those already owned. In either case the capital per unit of production would be decreased, with a resultant lowering of costs. It is also possible that the value of real estate still reflects the high-price period and may be lowered. If this occurs costs would be similarly affected. The amount of cost reduction possible through decrease in capital will not be large, but any saving is worth consideration.

Success in dairying is not alone dependent on adequate markets. It is even more dependent on a knowledge of costs, in that such information is necessary to determine what constitutes an adequate market. The proper attention to the efficiency factors here named should be of material assistance in the successful management of the dairy enterprise.

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