

RAISING DAIRY HEIFERS

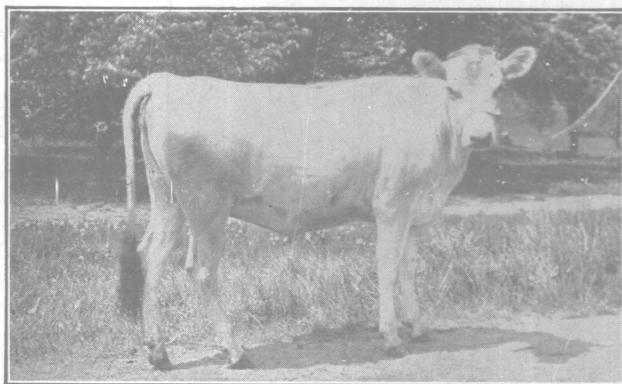
COST, FEEDING AND CARE

OHIO
Agricultural Experiment
Station

DEPARTMENT OF DAIRY HUSBANDRY

WOOSTER, OHIO, U. S. A., AUGUST, 1915

BULLETIN 289



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BULLETIN

OF THE

Ohio Agricultural Experiment Station

NUMBER 289

AUGUST, 1915

RAISING DAIRY HEIFERS—COST, FEEDING AND CARE

BY C. C. HAYDEN

INTRODUCTION

No greater problem confronts the dairyman today than that of securing a sufficient number of good cows to replenish his herd. They can not be as easily obtained as they could a few years ago because of the higher prices and the greater demand for high class cows. If this need is supplied, more dairy-bred heifers must be raised and the logical place to raise them is on the dairy farms. The increase in the value of feeds, both for raising calves and for milk production, has made it imperative that only calves of good breeding be raised. It is the object of this publication to report the results of raising heifers at the Station in Part I, and to give a few helpful hints on the feeding and care of calves in Part II. Much of the data presented in Part I was collected by R. E. Caldwell, B. E. Carmichael and others in charge of the dairy herd previous to the time the author came to the Station. Valuable assistance has been rendered by T. R. Middaugh in preparing the data for publication.

PART I

COST OF RAISING DAIRY HEIFERS

For a number of years, records of the feed consumed by heifers from birth to calving age have been kept at the Station. There are now available 69 records to one year of age, 51 to two years of age and 37 to calving time. These records are presented in the following pages.

Many questions are now being asked about the cost of raising cows and the subject has an important bearing on the economy of milk production. Carefully kept records show that the actual cost is much greater than is commonly estimated. Too frequently the cost has been based on the cost of feeds alone; and these at the actual cost of their production instead of market prices less the cost of marketing.

It is difficult to get more than approximate costs when not all the operations can be completely controlled, and careful data for one period may not be applicable during a succeeding period because of changes in cost of labor, prices of feeds, etc. In this report it is not possible to give the exact costs outside of feeds consumed, because the time required in caring for the heifers has not been kept separate from that required in caring for the remainder of the herd, and because more time was necessary to keep the records than would have been necessary simply to care for the heifers.

Before presenting these data, attention will be called to results obtained at other Stations. The Office of Farm Management of the Bureau of Plant Industry, United States Department of Agriculture, kept records of the heifers in a Wisconsin Jersey herd and recently published the results obtained on 117 calves. The costs as determined in that investigation were as follows:

TABLE I. COST IN WISCONSIN

Items	For 1 year	For 2 years
Value of calf at birth.....	\$7.04	\$7.04
Cost of feed.....	24.67	40.83
Cost of labor.....	4.45	7.81
Other costs.....	6.36	13.73
Total cost.....	42.52	69.41
Credit by manure.....	3.00	8.00
Net cost.....	39.52	61.41

This table shows a net cost of \$61.41 at two years of age in Wisconsin, 12.5 percent of which was for labor, 22 percent for other costs and 65.5 percent for feed. This cost is to two years of age, while heifers as a rule should not calve until 26 to 28 months of age, if large cows are desired. This additional time would add materially to the cost.

The following summary is taken from Bulletin 63 of the Storrs, Connecticut, Station:

TABLE II. COST IN CONNECTICUT

Cost of feed for 1st year.....	\$28.00
Cost of feed for 2nd year.....	27.00
Cost of labor to two years.....	10.00
Cost of bedding to two years.....	2.00
Interest, insurance, rent, taxes, etc., to two years.....	4.00
Total cost.....	71.00
Credit by manure.....	5.00
Net cost at 2 year of age.....	66.00

FACTORS USED

In the records given in the following pages, the costs for items other than feed have been estimated. Because of the fact that careful individual records of the feed were kept and that the record of labor was not kept separate from that of other labor, it was not possible to determine just what percentage of the labor should be charged to the heifers as necessary labor. A careful record of bedding was not kept. The question of what one should charge per month per head for pasture is not an easy one to settle, since so much depends on the age or size of the animal, the value of land, the kind of pasture, etc. Opinions vary greatly on this item. An estimate of these and other factors would probably approach as nearly the average as a carefully kept record on any farm because conditions vary greatly. The cost of labor will vary with the number cared for, local labor conditions, class of labor employed, etc. Taxes, insurance, etc. will vary with the tax-rate, and the value of the heifers, which depends on the breeding and the demand. An item which has not been mentioned in the above reports and which should be charged during the second year is the service fee.

Any grade heifer worth raising for a cow should be worth \$5. at birth. Purebred heifers would of course be worth much more, and in case of purebred heifers, the cost of registration should be taken into account.

The investigation reported in Bulletin 49 of the U. S. Department of Agriculture, Bureau of Plant Industry, shows that the labor requirement for heifers to 1 year of age was 7.13 minutes per day, and for heifers from 1 to 2 years of age, 4 minutes per day. Personally we believe this estimate to be low, especially for the second year and where a small number of heifers is kept. The statement is made that during the 171 days in pasture no labor was

required, which means that these heifers received no attention from the time they were turned to pasture in the spring until they were taken up in the fall. This certainly would be very bad practice to recommend on Ohio farms. 7.13 minutes per day at 15 cents per hour (the Station can not get suitable help even at this price) equals practically 1.78 cents, the cost per day for labor during the first year, or \$6.50 for the year. 4 minutes per day at 15 cents per hour equals 1 cent per day, or \$3.65 for the second year. It is probable that the average Ohio dairyman can not reduce his labor cost to this level. Therefore, we have chosen to use \$6.50 as the labor cost for the first year and \$5. as the labor cost for the second year.

A charge of \$2. for the first year and \$2.50 for the second year has been made for bedding. In sections of the state where much small grain is grown, this may be too high; while in other sections, it may be too low.

Under Ohio conditions, it is probably not possible to keep a good bull, as he should be kept, during his life of usefulness for less than \$50. per year; and if used on a herd of 30 to 35 cows, this would be at the rate of approximately \$1.50 per cow. In these estimates therefore, a charge of \$1.50 has been made during the second year as a service fee. In the majority of Ohio herds, the number of females of breeding age is much below 30; therefore, this cost is generally above \$1.50 per head.

For utensils, tools, veterinary fees, etc., a charge of \$1. per head is made.

No attempt is made to estimate the loss due to death, failure to breed, etc., which loss is frequently considerable. It will increase and decrease inversely with care.

Housing has been charged at the rate of \$2. per head per year.

Interest and taxes for the first year are charged at the rate of 5 percent and 1 percent respectively on the value of the calf at birth, plus the cost of tools, plus one-half the cost of feed, labor and bedding, less the credit for manure. Interest and taxes for the second year are charged on the net cost for the first year, plus the cost of tools, plus one-half the cost of feed, labor, bedding and service fee, less the credit for manure.

A credit for manure of \$3. for the first year and \$6. for the second year has been given. The yearling will probably consume about one-third as much feed as the mature cow and consequently produce about one-third as much manure. The manure is credited at the rate of \$2. per ton. Where the manure is allowed to waste, this credit can not be given. Summarizing these items, we have the following fixed charges:

TABLE III. CHARGES OTHER THAN FEED

	1 st year	2nd year	For 2 years
Value at birth.....	\$5.00	....	\$5.00
Cost of labor.....	6.50	5.00	11.50
Bedding	2.00	2.50	4.50
Service fees.....	. .	1.50	1.50
Tools, etc.....	1.00	.50	1.50
Housing	2.00	2.00	4.00
Interest and taxes (6%).....	1.29	3.39	4.68
Total fixed charges.....	17.79	14.89	32.68
Credit by manure.....	3.00	6.00	9.00
Net cost.....	14.79	8.89	23.68

Pasture has been charged at the rate of 30 cents per month during the first year, 90 cents per month during the second year and \$1.20 per month from two years to calving. This low charge is due to the fact that the pasture was often not sufficient to provide full feed and grain was fed.

In all computations the following prices for feeds were used:—

TABLE IV. PRICES OF FEEDS

Kind of feed	Cost per ton	Cost per cwt.,
Whole milk.....	.....	\$1.50
Skim milk.....	.....	.20
Corn meal.....	\$24.40	1.22
Wheat bran.....	24.00	1.20
Linseed oil meal.....	33.00	1.65
Cotton-seed meal.....	30.00	1.50
Soybeans (ground).....	33.00	1.65
Buckwheat.....	20.00	1.00
Soft corn (nubbins).....	12.00	.60
Dried beet pulp.....	24.00	1.20
Clover hay.....	12.00	.60
Timothy hay.....	12.00	.60
Alfalfa hay.....	20.00	1.00
Corn stover.....	4.00	.20
Corn silage.....	4.00	.20
Sweet clover hay.....	12.00	.60

In fixing the above prices, it is recognized that no set of prices will fit all localities nor apply for any great length of time in any given locality. An attempt has been made to fix the prices of home-grown feeds at about the price first quality feeds would bring at the farm at Wooster. The prices of purchased feeds are about the same as the Station has paid during the past few years. Where and when prices are above or below those given above, the cost will differ accordingly. If inferior or unsalable feeds are used, the cost may be reduced; however, inferior feeds usually mean that the calves will be inferior or that more of these feeds must be used.

RESULTS

All feeds given to these heifers were weighed and all refused were weighed again and deducted from the amounts fed. The calves were weighed within 24 hours after birth and in most cases on the last and first day of each succeeding month. The average of these two weights was taken as the weight on the first of the month*

The average birth weight of the Jerseys was 56 lbs. and that of the Holstein-Friesians 82 lbs. The feed consumed, the weight at one year, the weight at two years and the weight at calving, together with the cost of feeds consumed and total costs are shown in the tables which follow this discussion.

Table V gives the records of 40 Jersey heifers from birth to 1 year of age, and Table IX gives like records for 29 Holstein-Friesian heifers. The Jerseys made an average gain of 1.1 lbs. at a feed cost of \$27.75 and a net total cost of \$42.54. The Holstein-Friesians made a daily gain of 1.3 lbs. at a feed cost of \$29.31 and a net total cost of \$44.10. This does not show a large difference in the total cost but the Jerseys were fed relatively a little better than the Holstein-Friesians. These tables show that the heifers receiving the largest amount of milk and the smallest amount of pasture were most expensive which emphasizes the well known fact that heifers born in the fall and normally fed, cost less to one year of age than those born in the spring even though a normal amount of milk is fed to each. The calf born in the fall consumes its milk during the grain feeding season thus reducing the amount of grain required during that season. It is also smaller and eats less during that season. When spring comes it is older and ready to make the maximum use of pasture during the full pasture season. The spring-born calf consumes its milk during the cheap pasture season and must be fed on grain and roughage when it eats most.

A striking illustration of the fall-born calf is shown in No. 87 which had practically no grain while on pasture and cost less than \$18. for feed the first year; however, if full price had been charged for pasture, this difference would not have been so great, yet it would have been marked. It is not possible to have all calves born in the fall, nor is it possible for all dairymen to have an abundance of pasture for their heifers. Because of shortage of pasture and experimental feeding, it is not possible to draw from these records a fair comparison between spring and fall-born calves; but a study of the records show that calves born during the last half of the year cost considerably less than those born during the first half.

*Note that in some cases weights were not secured because heifers were at pasture on another farm.

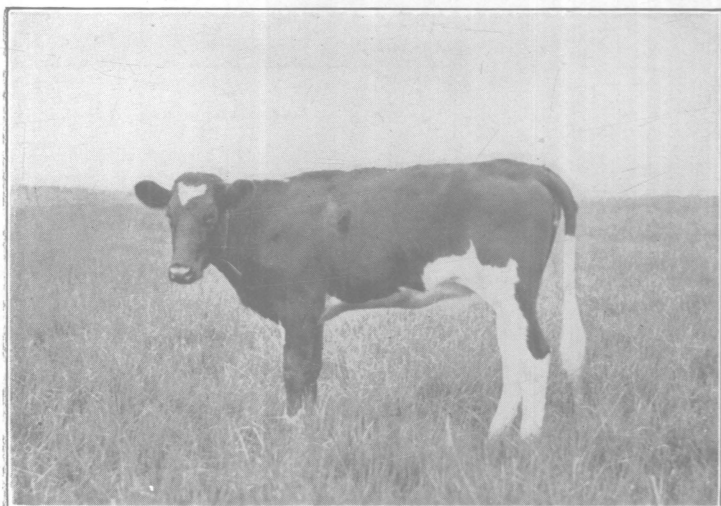


Fig. 1. Same type as No. 75 mentioned on page 8.

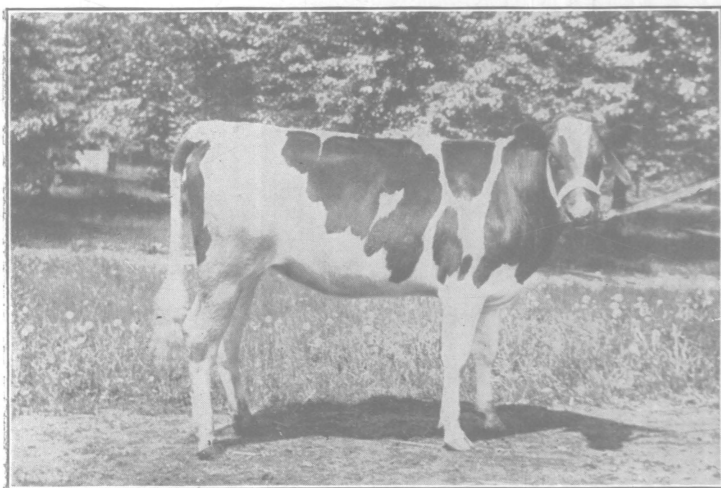


Fig. 2. A much better type. This heifer produced 10,278 lbs. of milk in 365 days after dropping her first calf.

Tables VI and X show that the daily gain of the Jerseys for the second year was .8 lb. while that of the Holstein-Friesians was 1 lb. The net total cost for the second year was \$36.01 and \$38.44 respectively. Note in Table X, that No. 111 had no pasture, made the greatest gain and cost the most.

Tables VII and XI show the combined results for the first and second years. Tables VIII and XII show the results from birth to calving. The average weight of the Jerseys at calving time was 822 lbs. and that of the Holstein-Friesians 1076 lbs. The Jerseys calved an average of 2 weeks earlier than the Holstein-Friesians. The cost to calving shown in these tables is much greater than is commonly supposed.

In Part II the statement is made that it does not pay to raise a calf which is not thrifty. A good example of this is found in No. 75. She was never thrifty. Possibly this was caused by injured digestion due to the very small amount of whole milk received. Considerable skimmilk was fed after one year of age because of her condition and the fact that the milk was plentiful. This heifer calved at 31 months of age, 4 months later than the average. She weighed 100 pounds less than the average and gave birth to a deformed calf, and was of no value as a milker. See Fig. 1.

Table XIII gives the average of the two breeds for the first year, the second year, the first and second year, and from birth to calving. The average cost for the first year was \$43.32, for the second year \$37.23, for the first and second year \$80.00 and that from birth to calving at 26½ months \$91.39, approximately \$3.45 per month. If a cow should return \$10. profit each year, it would take 9 years for her to repay the cost of her raising. This would more than cover the average period of usefulness; however, cows which do this, furnish their owner an independent job at which he can make fair wages and get a fair rate of interest on his investment.

These costs to two years of age and to calving seem high and are undoubtedly higher than the average for the state; but these heifers were much better than the average raised in the state. These costs could have been reduced by breeding the heifers to calve at 24 months of age or earlier, by feeding less or by feeding inferior feeds. Either of these would have made the heifers smaller and possibly inferior producers later. Small heifers or cows do not command as high prices as larger ones of equally good breeding. The costs could easily have been increased by more liberal feeding and the heifers would have been larger, though the difference probably would not have justified the extra expense.

TABLE V. JERSEY HEIFERS. RECORDS FROM BIRTH TO 1 YEAR OF AGE

Herd No.	Birth weight	Weight at 1 year	Daily gain	Feed consumed—Pounds							Feed Cost	Net other costs	Net total cost
				Milk		Grain	Silage	Hay	Stover	Days in pasture			
				Whole	Skim								
53	63	...	...	969	1678	574	301	637	388	183	\$31.86	\$14.79	\$46.65
56	52	577	1.4	763	2738	706	1555	1400	....	...	39.09	14.79	53.88
60	65	494	1.2	322	2385	405	237	611	....	159	21.94	14.79	36.73
61	67	416	.9	244	2412	430	152	721	....	159	21.16	14.79	35.95
62	56	510	1.2	278	3021	730	510	859	....	64	28.97	14.79	43.76
64	55	500	1.2	544	2418	637	578	325	....	155	26.08	14.79	40.87
68	61	593	1.4	647	6067	891	584	1006	....	68	41.06	14.79	55.85
69	65	482	1.1	262	4166	572	227	593	....	154	24.86	14.79	39.65
71	52	440	1.0	108	4040	579	168	541	....	154	22.03	14.79	36.82
72	54	540	1.3	38	4472	903	410	1004	....	99	29.11	14.79	43.90
73	63	487	1.2	66	5431	668	12	958	....	105	27.42	14.79	42.21
74	55	413	1.0	39	4510	494	143	470	....	154	20.55	14.79	35.34
77	43	403	1.0	442	4723	370	12	598	....	143	26.23	14.79	41.02
78	43	403	1.0	442	4723	370	12	598	....	143	26.23	14.79	41.02
78	55	486	1.2	395	4719	386	12	697	....	151	26.05	14.79	40.84
80	50	485	1.2	1360	3494	298	466	607	74	160	37.52	14.79	52.31
82	50	483	1.1	1063	4454	299	600	609	106	160	35.33	14.79	50.12
84	58	480	1.1	684	4536	385	1157	564	194	160	32.02	14.79	46.81
85	65	545	1.3	191	4133	423	1111	1227	132	38	27.85	14.79	42.64
87	52	430	1.0	128	3138	243	549	403	....	151	16.92	14.79	31.71
88	48	465	1.1	415	3351	249	652	454	....	151	22.24	14.79	37.03
91	45	430	1.0	993	2861	277	468	507	....	151	30.09	14.79	44.88
96	52	473	1.1	821	2151	433	900	689	....	151	29.60	14.79	44.39
97	58	465	1.1	625	2490	423	1034	723	39	151	27.73	14.79	42.52
98	55	462	1.1	496	2338	433	1196	707	64	151	25.90	14.79	40.69
99	46	...	...	491	1721	493	406	829	95	39	23.77	14.79	38.56
100	67	...	...	320	1707	495	441	828	99	48	21.38	14.79	36.17
101	42	...	...	384	1587	510	411	836	97	49	22.31	14.79	37.10
103	56	430	1.0	798	1050	614	298	834	....	99	28.98	14.79	43.77
105	55	440	1.0	686	466	734	99	650	....	145	27.55	14.79	42.34
106	56	365	.8	242	406	688	35	753	....	124	20.99	14.79	35.78
112	60	...	...	383	1776	794	149	768	22	124	28.78	14.79	43.57
113	65	450	1.0	383	1776	794	149	770	14	124	28.78	14.79	43.57
115	57	500	1.2	334	2208	884	...	746	74	124	30.57	14.79	45.36
116	55	500	1.2	324	2127	860	7	846	89	124	30.65	14.79	45.44
117	50	...	...	303	2569	796	...	393	....	93	22.94	14.79	37.73
118	62	455	1.0	490	3215	645	...	398	....	136	26.25	14.79	41.04
119	55	436	1.0	350	2868	773	...	400	....	160	25.61	14.79	40.40
122	58	475	1.1	628	965	864	2938	843	....	...	34.83	14.79	49.62
127	65	480	1.1	329	3286	1035	134	755	56	160	32.32	14.79	47.11
128	62	...	...	261	3657	1050	222	800	55	160	32.74	14.79	47.53
Average	56	472	1.1	465	2928	597	458	709	40	122	27.75	14.79	42.54

RAISING DAIRY HEIFERS

TABLE VI. JERSEY HEIFERS. RECORDS FROM 1 YEAR TO 2 YEARS OF AGE

Herd No.	Weight at 1 year	Weight at 2 yrs.	Daily gain	Feed consumed—Pounds						Feed cost	Net other costs	Net total cost
				Skim milk	Grain	Silage	Hay	Stover	Days in pasture			
53	...	...	.6	...	564	1411	1536	380	161	\$25.90	\$8.89	\$34.79
56	577	792	.6	...	604	2084	2598	...	89	30.15	8.89	39.04
62	...	...	.7	...	675	2672	818	454	145	23.69	8.89	32.58
64	500	768	.7	1396	477	2072	695	378	168	22.68	8.89	31.57
68	593	840	.6	...	947	1718	1363	430	191	30.51	8.89	39.40
69	482	720	.6	66	818	1139	1242	55	160	25.43	8.89	34.32
71	440	653	.6	...	792	1227	1297	57	160	25.49	8.89	34.38
72	540	835	.8	...	779	2970	579	1423	150	28.10	8.89	36.99
73	487	783	.8	...	1026	2847	809	622	150	30.96	8.89	39.85
74	413	780	.7	...	1003	1100	1124	231	160	27.47	8.89	36.36
77	403	660	.7	...	786	3521	551	530	150	27.39	8.89	36.28
78	486	785	.8	...	749	3500	614	568	150	27.37	8.89	36.26
80	485	817	.9	...	670	3591	744	390	150	26.66	8.89	35.55
85	545	...	1 0	...	784	3501	1083	170	140	29.84	8.89	38.73
87	430	...	...	428	740	2343	914	93	147	26.03	8.89	34.92
88	465	...	...	276	717	2213	908	107	163	27.73	8.89	34.48
91	430	...	...	356	791	2152	1300	82	163	27.73	8.89	36.62
96	470	...	...	...	669	2389	1200	113	163	26.39	8.89	34.77
97	465	...	...	...	712	2384	1207	124	163	27.46	8.89	35.28
98	462	796	.9	...	768	2532	1223	128	163	27.46	8.89	36.35
99	...	...	...	...	849	2438	891	136	170	27.18	8.89	36.07
100	...	...	...	...	849	2288	897	142	170	26.92	8.89	35.81
101	...	...	...	...	849	2290	913	151	170	27.04	8.89	35.93
103	430	...	...	...	928	2949	1112	131	190	31.41	8.89	40.30
105	440	...	...	...	808	2498	800	114	167	25.24	8.89	34.13
106	365	697	.9	...	835	1748	970	139	167	25.31	8.89	34.20
112	...	672	...	...	727	2780	816	112	167	24.79	8.89	33.68
113	450	718	.7	...	885	2259	930	69	167	27.89	8.89	36.28
115	500	820	.9	...	975	3749	965	22	167	30.49	8.89	39.38
Average..	472	758	.8	87	785	2,426	1,038	254	159	27.12	8.89	36.01

TABLE VII. JERSEY HEIFERS. RECORDS FROM BIRTH TO 2 YEARS OF AGE

Herd No.	Feed consumed—Pounds						Feed cost	Net other costs	Net total cost	
	Milk		Grain	Silage	Hay	Stover				Days in pasture
	Whole	Skim								
53	969	1678	1138	1712	2173	768	344	\$57.76	\$23.68	\$81.44
56	763	2738	1310	3639	3998		89	69.24	23.68	92.92
62	278	3021	1465	3182	1677	454	209	52.65	23.68	76.34
64	544	3814	1114	2650	1020	378	323	48.76	23.68	72.44
68	647	6067	1838	2302	2369	430	259	71.57	23.68	95.25
69	262	4232	1390	1366	1835	55	314	50.29	23.68	73.97
71	108	4040	1371	1395	1838	57	314	47.52	23.68	71.20
72	38	4472	1682	3380	1583	1423	249	57.21	23.68	80.89
73	66	5431	1694	2859	1767	622	255	58.38	23.68	82.06
74	39	4510	1497	1243	1594	231	314	48.02	23.68	71.70
77	442	4723	1156	3533	1149	530	293	53.44	23.68	77.12
78	395	4719	1135	3512	1311	568	301	53.60	23.68	77.28
80	1360	3494	968	4057	1351	464	310	64.18	23.68	87.86
85	191	4133	1207	4612	2665	302	178	57.69	23.68	81.37
87	128	3566	983	2892	1553	93	298	42.95	23.68	66.63
88	415	3627	966	3627	2865	1589	107	47.83	23.68	71.51
91	993	3217	1068	2620	1807	82	314	57.82	23.68	81.50
96	821	2151	1102	3289	1889	113	314	55.48	23.68	79.16
97	625	2490	1135	3418	1930	163	314	54.12	23.68	77.80
98	496	2338	1201	2728	1930	192	314	53.36	23.68	77.04
99	491	1721	1342	2844	1720	231	209	50.95	23.68	74.63
100	320	1707	1344	2729	1725	241	218	48.30	23.68	71.98
101	384	1587	1359	2701	1749	248	219	49.35	23.68	73.03
103	798	1050	1542	3247	1946	131	289	60.39	23.68	84.07
105	686	466	1542	2597	1450	114	312	52.79	23.68	76.47
106	242	406	1523	1783	1723	139	291	46.30	23.68	69.98
112	383	1776	1521	2929	1584	134	291	53.57	23.68	77.25
113	383	1776	1679	2408	1700	83	291	56.17	23.68	79.85
115	334	2208	1859	3749	1711	96	291	61.06	23.68	84.74
Average	469	3005	1349	2870	1805	291	277	54.51	23.68	78.19

RAISING DAIRY HEIFERS

TABLE VIII. JERSEY HEIFERS. RECORDS FROM BIRTH TO CALVING

Herd No.	Birth weight	Weight at calving	Age at calving	Feed consumed--Pounds							Feed costs	Net other costs	Net total costs
				Milk		Grain	Silage	Hay	Stover	Days in pasture			
				Whole	Skim								
53	63	780	29 mo.	969	1678	1502	1712	3930	768	379	\$74.30	\$27.38	\$101.68
62	56	800	26½	278	3021	1589	3206	1677	454	285	57.25	25.53	82.78
64	55	855	26½	544	3814	1515	3054	1466	378	351	58.46	25.53	83.99
68	61	910	29½	647	6067	2013	2499	2655	430	391	81.16	27.87	109.03
69	65	750	25½	262	4232	1542	1644	2110	55	314	54.47	24.79	79.26
71	52	770	28	108	4040	1802	3024	2151	833	314	59.96	26.64	86.60
72	54	880	24½	38	4472	1754	3380	1583	1423	285	59.52	23.87	83.39
73	63	795	24	66	5431	1694	2859	1767	622	257	58.46	23.68	82.14
74	55	800	30½	39	4510	2020	3449	1828	1380	374	66.32	28.49	94.81
78	55	855	27½	395	4719	1449	4451	1858	568	311	63.17	26.14	89.31
80	50	860	25	1360	3494	1121	4687	1550	464	310	68.56	24.42	92.98
85	65	811	26½	191	4133	1207	4612	2665	302	246	60.41	25.35	85.76
87	52	824	28½	128	3566	1543	4506	2331	171	309	58.34	27.01	85.35
88	48	857	34½	415	3627	1746	6166	2648	277	443	76.03	31.45	107.48
91	45	825	28	993	3217	1630	5121	2540	238	314	74.50	26.64	101.14
96	52	844	27	821	2151	1609	4959	2316	233	314	68.08	25.90	93.98
97	58	800	31½	625	2490	1497	5297	2295	263	446	69.98	29.05	99.03
98	55	890	27½	496	2338	1735	5078	2380	262	335	66.58	26.09	92.67
99	46	685	25½	491	1721	1342	2844	1720	231	256	52.83	24.79	77.62
100	67	783	25½	320	1707	1344	2729	1725	241	267	50.26	24.79	75.05
101	42	767	26	384	1587	1359	2701	1749	248	274	51.55	25.16	76.71
103	56	927	30	798	1050	2203	5685	2716	131	350	81.27	28.12	109.39
105	55	762	26½	686	466	1889	3795	1999	114	312	63.62	25.35	88.97
106	56	895	28	242	406	2324	4575	2353	139	291	66.18	26.64	92.82
Average	55	822	26½	471	3081	1643	3835	2167	426	322	64.22	26.28	90.50

TABLE IX. HOLSTEIN-FRIESIAN HEIFERS. RECORDS FROM BIRTH TO 1 YEAR OF AGE

Herd No.	Birth weight	Weight at 1 yr.	Daily gain	Feed consumed—Pounds						Feed cost	Net other cost	Net total cost	
				Milk		Grain	Silage	Hay	Stover				Days in pasture
				Whole	Skim								
55	87	610	1.4	589	2312	366	176	808	..	141	\$26.68	\$14.79	\$41.47
57	85	649	1.5	800	2319	789	1894	1574	..	..	41.44	14.79	56.23
58	76	...	...	441	2805	453	186	900	..	118	26.85	14.79	41.64
59	84	...	...	441	2811	836	1851	1516	..	..	37.60	14.79	52.39
63	91	668	1.6	215	3066	621	870	731	..	168	26.78	14.79	41.57
65	93	632	1.4	315	2752	784	1220	605	..	152	28.59	14.79	43.38
66	73	563	1.3	489	2297	776	1003	404	134	152	27.67	14.79	42.46
67	60	491	1.2	531	2567	629	649	477	..	152	26.82	14.79	41.61
70	78	590	1.4	189	5141	645	246	672	..	154	27.18	14.79	41.97
75	91	485	1.0	30	4925	719	431	579	..	154	25.02	14.79	39.81
76	73	550	1.3	52	4860	775	12	1041	..	90	27.83	14.79	42.62
79	67	455	1.0	1435	3651	337	304	603	54	160	39.04	14.79	53.83
81	84	608	1.4	1342	3198	341	583	655	196	160	38.02	14.79	52.81
83	82	577	1.4	1102	4677	503	841	729	209	160	40.46	14.79	55.25
86	73	490	1.1	222	3618	328	972	989	91	79	24.52	14.79	39.31
90	66	563	1.4	535	2663	263	434	556	..	151	22.98	14.79	37.77
92	89	560	1.3	565	2628	344	648	690	..	151	25.31	14.79	40.10
93	87	577	1.3	542	2571	374	563	705	..	151	25.14	14.79	39.93
95	93	595	1.4	715	2652	405	727	752	..	151	29.05	14.79	43.84
104	74	560	1.3	565	1050	641	284	930	..	127	27.07	14.79	41.86
107	93	582	1.3	278	444	920	78	777	..	124	25.21	14.79	40.00
108	66	640	1.5	193	2983	924	60	770	..	124	28.29	14.79	43.08
109	89	616	1.4	161	2925	947	51	872	..	124	28.78	14.79	43.57
110	90	515	1.1	368	315	1107	31	787	55	124	29.35	14.79	44.14
111	100	526	1.1	348	808	734	2707	764	..	..	25.78	14.79	40.57
120	87	556	1.3	418	2959	791	.....	511	..	160	27.81	14.79	42.60
121	91	591	1.3	312	2860	879	143	648	..	160	28.19	14.79	42.98
124	70	460	1.0	842	1896	806	.....	531	60	160	32.94	14.79	47.73
125	75	518	1.2	447	3044	990	40	682	55	160	29.49	14.79	44.28
Average.	82	564	1.3	499	2,786	656	586	768	29	128	29.31	14.79	44.10

RAISING DAIRY HEIFERS

TABLE X. HOLSTEIN-FRIESIAN HEIFERS. RECORDS
FROM 1 YEAR TO 2 YEARS OF AGE

Herd No.	Weight at 1 yr.	Weight at 2 yrs.	Gain per day	Feed consumed—Pounds						Feed cost	Net other costs	Net total cost
				Skim-milk	Grain	Silage	Hay	Stover	Days in pasture			
55	610	1025	1.1	....	593	....	2614	...	165	\$28.12	8.89	\$37.01
57	649	1031	1.0	....	744	990	2701	...	126	31.44	8.89	40.33
58	...	1030	...	....	593	....	2705	...	165	28.67	8.89	37.56
59	...	972	...	....	786	1439	2933	...	115	33.95	8.89	42.84
63	668	1030	1.0	....	615	1972	755	413	160	21.55	8.89	30.44
65	632	1028	1.1	....	789	1782	956	438	160	24.57	8.89	33.46
66	563	1085	1.4	436	962	1604	1078	307	160	27.93	8.89	37.82
67	491	850	.9	1264	666	1252	938	394	160	24.44	8.89	33.33
70	590	973	1.0	....	907	1200	1583	372	160	29.19	8.89	38.08
75	485	815	.9	1947	1297	1228	1531	358	158	38.00	8.89	46.89
76	550	988	1.2	....	789	2821	897	848	150	28.78	8.89	37.67
79	455	818	1.0	....	695	3556	644	594	151	26.78	8.89	35.67
90	563	....	....	172	726	2377	1173	118	163	26.06	8.89	34.95
92	560	....	....	16	697	2463	1260	120	163	26.09	8.89	34.98
93	577	....	....	....	720	2559	1285	115	163	27.66	8.89	35.55
95	595	....	....	....	718	2572	1267	126	163	26.58	8.89	35.47
104	560	814	.7	....	904	2542	1095	107	160	28.75	8.89	37.64
107	582	927	.9	....	931	2429	977	183	167	28.75	8.89	37.64
108	640	930	.8	....	1006	2486	937	168	167	29.06	8.89	37.95
109	616	943	.9	....	950	2814	935	225	167	29.01	8.89	37.90
110	515	890	1.0	....	951	3227	916	215	167	29.31	8.89	38.20
111	520	1158	1.7	....	2100	8119	2038	...	...	56.46	8.89	65.35
Average	571	962	1.0	174	870	2247	1419	232	151	29.55	8.89	38.44

TABLE XI. HOLSTEIN-FRIESIAN HEIFERS. RECORD
FROM BIRTH TO 2 YEARS OF AGE

Herd No.	Milk		Feed consumed—Pounds					Feed cost	Net other costs	Net total costs
	Whole	Skim	Grain	Silage	Hay	Stover	Pasture			
55	589	2312	959	176	3422	...	306	\$54.80	\$23.68	\$78.48
57	800	2319	1533	2884	4275	...	126	72.88	23.68	96.56
58	441	2805	1046	186	3605	...	283	55.52	23.68	79.20
59	441	2811	1622	3290	4449	...	115	71.55	23.68	95.23
63	215	3066	1236	2842	1486	...	328	48.33	23.68	72.01
65	315	2752	1573	3002	1561	438	312	53.16	23.68	76.84
66	489	2733	1738	2607	1482	441	312	55.60	23.68	79.28
67	531	3831	1295	1901	1415	394	312	51.26	23.68	74.94
70	189	5141	1492	1446	2255	372	314	56.37	23.68	80.05
75	30	6872	1928	1659	2110	358	313	63.02	23.68	86.70
76	52	4860	1564	2833	1938	848	240	56.61	23.68	80.29
79	1435	3651	1032	3860	1247	648	311	65.82	23.68	89.50
90	535	2835	989	2811	1729	118	314	49.04	23.68	72.72
92	565	2644	1041	3111	1950	120	314	51.40	23.68	75.08
93	542	2571	1094	3122	1990	115	314	51.80	23.68	75.48
95	715	2652	1123	3299	2019	126	314	55.63	23.68	79.31
104	565	1050	1545	2826	2025	107	287	55.82	23.68	79.50
107	278	444	1851	2507	1754	183	291	53.96	23.68	77.64
108	193	2983	1930	2546	1707	168	291	57.35	23.68	81.03
109	161	2925	1897	2865	1807	225	291	57.79	23.68	81.47
110	368	315	2058	3258	1703	270	291	58.66	23.68	82.34
111	348	808	2834	10826	2802	...	...	82.24	23.68	105.92
Average	445	2835	1517	2903	2215	243	272	58.12	23.68	81.80

RAISING DAIRY HEIFERS

TABLE XII. HOLSTEIN-FRIESIAN HEIFERS. RECORD
FROM BIRTH TO CALVING

Herd No.	Weight at birth	Weight at calving	Age at calving	Feed consumed—Pounds							Cost of feed	Net other costs	Net total cost
				Milk		Grain	Silage	Hay	Stover	Days in pasture			
				Whole	Skim								
63	91	1127	25½ mo	215	3006	1614	3380	1986	413	328	\$57.22	\$24.79	\$82.01
65	93	1150	25	315	2752	1904	3599	1864	461	312	60.52	24.42	84.94
66	73	1120	25	489	2733	1936	3069	1647	607	312	60.38	24.42	84.80
67	60	974	27	531	3831	1871	3225	1930	520	312	64.64	25.90	90.54
70	78	998	25	189	5141	1601	1778	2462	372	314	58.92	24.42	83.34
75	91	975	31	30	6872	2536	3945	2371	1278	379	81.46	28.86	110.32
76	73	1090	26	52	4860	1593	3562	1938	848	298	60.74	25.16	85.90
79	67	1030	31	1435	3651	1563	6190	2219	806	368	85.33	28.86	114.19
90	66	1050	26	535	2835	1236	3953	2125	206	314	56.93	25.16	82.09
92	89	1005	26	565	2644	1312	4453	2265	214	314	59.53	25.16	84.69
93	87	1145	28	542	2571	1728	5911	2606	269	314	69.39	26.64	96.03
95	93	1155	28¾	715	2652	1652	6993	2691	327	324	74.33	27.13	101.46
108	66	1166	27	193	2983	2556	5168	2172	168	291	73.41	25.90	99.31
Average	79	1076	27	447	3579	1777	4248	2175	499	322	66.37	25.91	92.28

TABLE XIII. AVERAGE SUMMARY OF BOTH BREEDS

Breed	Feed consumed—Pounds						Feed cost	Fixed charges less credit	Net total cost	
	Milk		Grain	Silage	Hay	Stover				Days in pasture
	Whole	Skim								
1st year										
40 Jerseys.....	465	2,928	597	458	709	40	122	\$27.75	\$14.79	\$42.54
29 Holsteins.....	499	2,786	656	586	768	29	128	29.31	14.79	44.10
Average.....	482	2,857	627	522	739	35	125	\$28.53	\$14.78	\$43.32
2nd year										
29 Jerseys.....	...	87	785	2,426	1,038	254	159	\$27.12	\$8.89	\$36.01
22 Holsteins.....	...	174	870	2,247	1,419	232	151	29.55	8.89	38.44
Average.....	...	131	828	2,337	1,229	243	155	\$28.34	\$8.89	\$37.23
1st and 2nd year										
29 Jerseys.....	469	3,005	1,349	2,870	1,805	291	277	\$54.51	\$23.68	\$78.19
22 Holsteins.....	445	2,835	1,517	2,903	2,215	243	272	58.12	23.68	81.80
Average.....	457	2,920	1,433	2,887	2,010	267	275	\$56.32	\$23.68	\$80.00
From birth to calving										
24 Jerseys.....	471	3,081	1,643	3,835	2,167	426	322	\$64.22	\$26.28	\$90.50
13 Holsteins.....	447	3,579	1,777	4,248	2,175	499	322	66.37	25.91	92.28
Average.....	459	3,330	1,710	4,042	2,171	463	322	\$65.30	\$26.09	\$91.39

PART II

FEEDING AND CARE

To be worth raising for dairy purposes, a heifer should have a dam which is a high producing cow and a sire which is from a high producing cow. She should be a strong healthy calf. She should not be twin with a male. The present careless methods of breeding, still practiced in many herds, must give place to more careful and systematic methods. This subject has been discussed in Circular 135 of this Station.

FEEDING

In a sense, the care of the calf should begin before it is born. The cow which is soon to freshen should be kept in a clean, dry place, preferably a large, well bedded, box stall and should be seen by the person in charge several times each day in order that he may be there when the calf arrives or soon thereafter to see that all goes well. In most cases, the calf will be able to get up and nurse within an hour after it is born but occasionally it needs assistance. There is always a risk in allowing a cow to calve in the pasture or elsewhere without attention.

It is well to remove the calf from the cow by evening of the third day, and it may be removed as soon as it has had one good nursing of the mother's milk. When the calf is weak, it should be left with the cow for at least a day or two. It should have the mother's milk for the first 5 to 7 days unless the udder is diseased and the milk is bad. Her milk at this time has the proper physical effect on the calf, starting properly the action of the digestive tract. If it does well until 10 days of age, it will probably continue to do well, barring all accidents and poor care.

If taken from the cow early, the calf usually learns to drink more quickly. At first it may be fed a small quantity of milk three times daily, though twice daily is usually sufficient. The amount of milk fed should vary from 6 to 10 lbs. (6 to 10 pints) daily, depending on the size and vigor of the calf and the quality (richness) of the milk.* Very rich milk may be diluted with one-third as much warm water. After the calf is one week old, this amount of milk may be raised to 8 to 12 pounds daily; that is, two feeds of 4 to 6 pounds each. Calves which are being raised for dairy purposes need not receive more than 12 to 16 pounds of milk per day even when changed to skimmilk. If the calf is to be fattened for veal, more milk should be fed.

*There are 8.6 pounds in 1 gallon of milk. 1 pint weighs practically 1 pound.

It is a quite common practice for farmers who are not selling their milk, to feed their calves too much skimmilk. This over-feeding is the cause of much indigestion and scouring. Only warm, sweet, whole milk should be fed until the calf is two weeks of age. It is possible to begin changing to skimmilk and adding other feeds at ten days of age, if the calf is strong and vigorous. If the calf is not strong and vigorous, the change should not be started until it is three weeks old. Better and more growthy calves will be secured, if the whole milk is continued even longer than three weeks.

During the first few days and during any change in feed, the condition of the calf should be watched carefully. If there are signs of indigestion or scouring, treat as directed on page 28; and it may be necessary to return to the previous method of feeding for a time. When the change to skimmilk is to be made, it should be done at the rate of $\frac{1}{2}$ to 1 pound ($\frac{1}{2}$ to 1 pint) daily, the rapidity of the change depending on the age and vigor of the calf. The skimmilk should be sweet and warmed to the same temperature as the whole milk (90 to 100 degrees Fahr.). The age at which the skimmilk may be discontinued (the calf weaned) will depend on the condition of the calf, the supply of milk, and the kind of feeds which are to take its place. It is possible to wean the calf at 60 days of age if the proper grains are substituted; but it is not desirable to make this change before the calf is 4 to 6 months of age if large, strong calves are desired. The longer the milk is continued, the better will be the calf. For an example of a daily record of feeding, see Table XIV on page 21. If a number of calves are kept together, they should be kept tied or in stanchions for 15 minutes after feeding milk to prevent their sucking ears and udders. (It is claimed that sometimes bad quarters in udders of heifers at calving time are due to having been sucked when calves.)

If skimmilk from a creamery is used, it should be heated to 160 degrees Fahr. for 15 to 20 minutes for the purpose of preventing the possibility of infection by tuberculosis or other disease germs which might be in the milk coming from other herds. The heating may also prevent scouring caused by filth germs in the milk. Sour milk, buttermilk, or sour skimmilk may be fed to calves 6 weeks to 2 months of age, if the change is made gradually and the condition of the calf is watched closely. To teach the calf to drink, give it the finger, place the hand down into the milk and gradually withdraw the finger. If it does not learn readily and is strong, allow it to become very hungry and it will learn much

more quickly. Care must be taken not to give it too much when hungry.

Vessels used. Pails in which the milk is fed should be washed after each feeding and would better be scalded or steamed. When possible, they should be placed in the sun to dry because the sun is a good germ killer. Troughs and vessels which can not be cleaned readily are not suitable vessels in which to feed calves, because the filth germs growing in the milk and saliva left in them are very apt to cause sickness. Keep such vessels clean and dry when not in use.

Calf Feeders. These devices are common on the market but they have not given as good results as pail feeding, largely because of the difficulty of keeping them clean. Dirty vessels may make a calf sick for the same reason that a dirty bottle may make a baby sick.

OTHER FEEDS

Grain. When the calf is from 10 to 15 days of age, it may be taught to eat grain. Previous to this age certain digestive juices are not secreted in sufficient quantities to digest well such feeds. This is due to the fact that the food materials in grains and other feeds differ from those in milk and are not as easily digested. Even after calves are 10 days to 2 weeks of age, scouring frequently results from the use of such feeds. Some calves can take grains much earlier than others of the same breed. Ground corn or ground oats or a mixture of the two feeds are probably the best grains to feed calves which are fed whole milk or skim milk. After the calves are one month of age, shelled corn and whole oats may be used with good results.

When ready to teach them to eat grain, place a small handful of the grain before them after they have taken their milk. This may be placed in the bottom of the pail or in some other vessel provided for that purpose. When calves are kept in stanchions, it may be dropped into a manger in front of them. It usually helps to rub a little of the grain into the mouth. The grain should not be fed in the milk to very young calves. The amount of grain should be increased very slowly according to the size, condition and appetite of the calf. Two to three pounds of grain per day by the time the calf is weaned is sufficient. It is better to slightly under-feed than to over-feed and thereby cause indigestion. The grain should always be fresh. Stale grains should never be allowed to collect in the feed box. Where small quantities of grain mixed with saliva are left in boxes, they often decay and become foul and the calf refuses to eat because of them.

While the calf receives ten or more pounds of milk, there is no need of feeding grains high in protein, such as, linseed meal, linseed oil meal, gluten feed, etc. Sufficient protein is supplied in the milk. As soon as the milk is decreased, some such grain should be added to the ration; but cotton-seed meal should not be used before the calf is six months of age, because in many cases serious results have followed its use. If feeding corn or oats or both when ready to reduce the milk, add about .1 pound linseed oil meal or .25 pound of bran for each pound (pint) of milk removed; or better, use one-half as much of each.

The following are good mixtures when the calf is off milk:

- | | | |
|-----------------------|------------------------|---------------------|
| (1) | (2) | (3) |
| 2 parts corn meal | 1 part corn meal | 5 parts corn meal |
| 1 part bran or shorts | 3 parts bran | 5 parts ground oats |
| 1 part oil meal | 1 part ground oats | 1 part blood meal |
| (4) | (5) | (6) |
| 1 part corn meal | 1 part corn meal | 1 part corn meal |
| 1 part middlings | 1 part ground oats | 1 part ground oats |
| 2 parts gluten feed | 1 part ground soybeans | Alfalfa hay at will |

All of the above rations except No. 6 may be fed with clover hay and silage unless the calves are on pasture. After the heifer is one year of age, she may be made to depend largely on clover or other legume hay and corn silage until near calving when she should receive some grain.

TABLE XIV. A TWO MONTHS FEED RECORD FOR A GOOD STRONG CALF

Age in days	First month					Age in days	Second month			
	Feed consumed—Pounds						Feed consumed—Pounds			
	Milk		Grain	Clover hay	Silage		Skim-milk	Grain	Clover hay	Silage
Whole	Skim									
1	With cow					31	12	8 oz.	3/4	1/2
2	With cow					32	12	8 "	3/4	1/2
3	8					33	12	8 "	3/4	1/2
4	10					34	12	8 "	1	1/2
5	11					35	12	8 "	1	1/2
6	11					36	12	8 "	1	1/2
7	12					37	12	8 "	1	1/2
8	12					38	12	8 "	1	1/2
9	12			1/4		39	12	10 "	1	1/2
10	12		2 oz.	1/4		40	12	10 "	1	1/2
11	12		2 "	1/4		41	12	10 "	1	1/2
12	12		2 "	1/4		42	12	10 "	1	1
13	12		2 "	1/4		43	12	10 "	1	1
14	11	1	2 "	1/4		44	12	12 "	1	1
15	10	2	3 "	1/4		45	12	12 "	1 1/2	1
16	10	2	3 "	1/4		46	12	12 "	1 1/2	1
17	10	2	3 "	1/4		47	12	12 "	1 1/2	1
18	9	3	4 "	1/2		48	12	14 "	1 1/2	1
19	9	3	4 "	1/2		49	12	14 "	1 1/2	1 1/2
20	8	4	4 "	1/2		50	12	14 "	1 1/2	1 1/2
21	8	4	4 "	1/2		51	12	14 "	1 1/2	1 1/2
22	7	5	4 "	1/2		52	12	14 "	1 1/2	1 1/2
23	6	6	4 "	1/2		53	12	14 "	1 1/2	1 1/2
24	5	7	4 "	1/2		54	12	1 lb.	1 1/2	1 1/2
25	4	8	4 "	1/2		55	12	1 "	1 1/2	1 1/2
26	4	9	4 "	1/2		56	12	1 "	1 1/2	1 1/2
27	3	10	4 "	1/2	1/4	57	12	1 "	1 1/2	2
28	1	11	6 "	1 1/2	1/4	58	12	1 "	1 1/2	2
29		12	6 "	1 1/2	1/4	59	12	1 "	1 1/2	2
30		12	6 "	3/4	1/2	60	12	1 "	1 1/2	2

The above table is given merely as an example. Many calves cannot be held to this schedule and it must be varied to suit the calf. At first much of the hay and grain will be left but it should be placed before the calf daily to teach it to eat. The hay should be leafy clover and not stems alone. It is not practical to weigh the hay in quantities less than one pound. Feed a small or large handful.

Roughage. At the same time the calf is being taught to eat grain, it may be taught to eat hay. Only hay of the best quality should be used for this purpose. The best hay is bright, leafy *clover* which has been cut early. When clover hay can not be secured, soybean or pea and oat hay may be raised to take its place. If timothy or other grasses must be used for hay, they should be cut early and cured in good condition for this purpose. Alfalfa hay is excellent after the milk is discontinued. It must be fed with more care than clover as it has a tendency to cause the bowels to become too loose when fed with milk. Place a bit of the fresh hay before the calf daily after 10 days of age. It will soon begin to pick at it and will rarely eat too much of it.

Stover, sorghum, ripe timothy, etc., are always poor roughages for growing animals but they are especially poor for *young* calves.

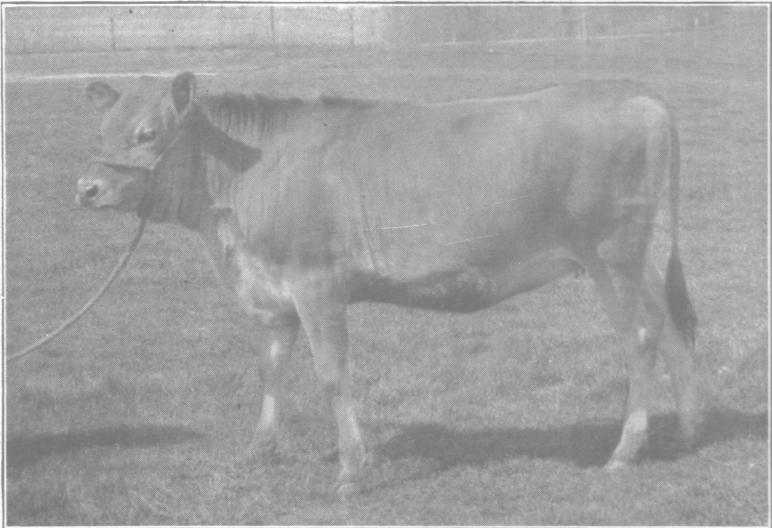
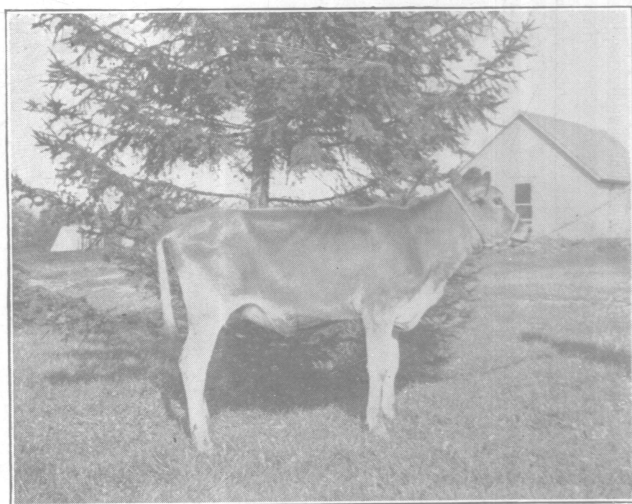


Fig. 3. This heifer is too fat.



Fig. 4. Heifer in proper condition.



Eig. 5. Much too thin in flesh.

Silage. When calves are 4 to 6 weeks of age, it is usually safe to begin feeding silage in small quantities. Begin with a small handful per day and note the results. If indigestion appears, discontinue for a time. If all goes well, increase the amount very gradually. After the calf is two months of age, it may be fed silage quite liberally; but one should not attempt at any time to compel a calf to depend largely on silage after the milk has been discontinued. It is not a good feed to be used alone for any kind of cattle. It should be used with hay or grain high in protein.

Pasture. It is not best to have small calves under two months of age on fresh green pasture in the spring. This is frequently the cause of indigestion, indicated by scouring. After they are three months of age, there is no better place for them than on good pasture. The very young calf had better be kept in a dry lot or on pasture which is so short that it can not get enough to cause trouble.

Fall calves usually make the largest yearlings at the least cost, because they are ready to go to pasture in the spring and make good use of it during the summer. At the prices commonly used, pasture is about the cheapest feed. Shade should be provided to protect calves in very hot weather.

Water. After calves are one month of age they should have access to pure water. This is very essential before as well as after the milk is discontinued. The water supplied should not be too cold and should be slightly warmed in winter. Where a minimum amount of milk is fed or where calves are raised on substitutes for milk, the amount of water should be limited, to young calves, because under such circumstances they frequently drink too much. Apparently this is an attempt by nature to make up for the shortage of milk.

It is well to supply the calf with a little salt. This is more important after the milk is discontinued. Milk contains the various minerals in sufficient quantities for the very young calf; hence, the salt is not so essential while plenty of milk is fed.

It is best to avoid any sudden and radical changes in the ration. Make changes gradually and watch the calf closely. Dairy calves need not be kept fat but should be kept in good growing condition. (See Figs. 3, 4 and 5.) A daily gain in weight of .8 to 1 pound for Jersey and Guernsey and of 1 to 1.4 pounds for Holstein-Friesian calves is about what may be expected under fairly good feeding and care. Greater gains may be obtained by more liberal feeding.

MILK SUBSTITUTES

Whole milk will produce the best calf and whole milk followed by skimmilk, the second best; but, butterfat at present prices is too valuable to justify its use for feeding *after* the calf has a good start in life. Even skimmilk is not available, if all the milk is sold from the farm. Under such circumstances, the problem of raising good heifers to replace the cows as they cease to be useful becomes an important and somewhat difficult one. Frequently the milk fed would have brought more money than the calf at weaning time. For this reason many calves have been destroyed at birth and any not worth raising are rightly destroyed.

In raising calves, one should not weigh their cost at weaning time against their market price at that time because they are worth more. The milk period is the most expensive period of feeding until the heifer is 2 years of age. Up to four months of age, a heifer will cost one-half as much as to one year of age. The cost for the second year is usually less than for the first year, because cheaper feeds can be used and less labor is required.

If some feed can be found which will successfully take the place of milk from the time the calf is 8 to 10 days old, and which is materially cheaper than milk, a great service will be rendered to the dairy industry. Some Experiment Stations and a good many other persons have experimented along this line but no really satisfactory feed has yet been discovered. There are feeds on the market that are fairly satisfactory after the calf has passed the greater part of the milk period. They are usually good supplements rather than substitutes. The best of these contain milk powder which is expensive.

EXPERIMENTS WITH SUBSTITUTES

Hay Tea. At the Kansas Station, an attempt was made to use hay tea as a substitute for milk but the results were not favorable. Two kinds of tea were used; one from mixed hay and the other from alfalfa hay. The tea from the mixed hay proved better than that from the alfalfa hay because the latter produced scouring which was difficult to control. It seems best to advise against any attempt to raise calves in this way.

At the Pennsylvania Station (Bulletin 60) the following rations were tried: No. 1 consisted of wheat flour 30 lbs., cocoanut meal 25 lbs., "nutrium" 20 lbs., linseed meal 10 lbs., dried blood 2 lbs.* No. 2 consisted of corn meal 13 lbs., nutrium 20 lbs., dried

*The "nutrium" was a skimmilk powder.

blood 2 lbs., flour 30 lbs., cocoanut meal 6 lbs., oat meal 6 lbs., flaxseed 1.5 lbs. The calves were fed whole milk until 7 to 10 days of age, after which time they were gradually changed to calf meal. No milk was used after the calves were over 14 to 18 days of age. These grew to be good thrifty calves at 4 to 5 months of age. At this time they weighed from 150 to 250 lbs. The objection to these meals is that they contain skim milk in the form of powder which is expensive and practically equal to feeding skimmed milk.

In the 16th Annual Report of the Massachusetts Station, the following experiment is reported: Blatchford's calf meal and the Pennsylvania ration No. 1 (See above) were used. The calf on the Pennsylvania ration gained 1.4 lbs. per day up to 6 months of age; and the other gained 1.1 lbs. per day up to 5½ months of age. These calves were fed whole milk until 9 to 14 days of age and some whole and skim milk until 4 to 5 weeks of age.

At the Ontario Station (An. Rept. Can. Dept. Agri. 1903) a test was made with cacao shells and waste boiled in water. Bran and oats were also fed. This seemed to be a fairly good substitute for skim milk after the calves were off whole milk.

At the Cornell Station (Bul. 304) a more extensive experiment was made. A larger number of calves was used and the following mixtures were tested: whole and skim milk, skim milk powder, Schumacker's calf meal and Blatchford's calf meal. Some blood meal was used "to prevent scouring." They received in all from 185 to 226 lbs. of whole milk per calf. The average gain per head was as follows: whole milk (202 lbs.) and skim milk gave a gain of 1.53 lbs. per day; whole milk (185 lbs.) and skim milk powder gave a gain of 1.23 lbs. per day; whole milk (226 lbs.) and Schumacker's calf meal gave a gain of 1.1 lbs. per day; and whole milk (207 lbs.) and Blatchford's calf meal gave a gain of .87 lbs. per day. The above shows that by far the best calves were obtained with whole and skim milk feeding and the next best with the feed containing the milk powder. The Indiana Station reports good results from the use of the following mixture when used with a small amount of milk: equal parts of linseed oil meal, reddog flour, hominy feed and blood meal. This summarizes the most important experimental work on milk substitutes published by the Stations in the United States, and is an indication of the results that may be expected from the use of such meals as are on the market. When purchasing calf meals, one should not forget that freight charges should be added to the cost price and that all such feeds are more trouble to prepare than the milk.

With a small amount of milk the following mixture would probably give fair results: 2 parts corn meal, 2 parts oat meal 2 parts linseed oil meal and 1 part blood meal.

CARE

As stated in the beginning, the calf should be kept in a dry place. This should be warm enough to prevent the calf from chilling soon after birth. When the calf is a week or two of age, it can stand considerable cold if kept dry and protected from cold drafts of air. It will do better in a cool, dry, well ventilated stable than in a warm, poorly ventilated or moist stable. In the latter case, the calf is very liable to take cold or pneumonia when doors are opened and blasts of cold air strike it suddenly. The warm moist stable is also an ideal place for the development and spread of calf diseases, some of which will be mentioned later. For these reasons, a dark, damp basement stable is not desirable. They should never be allowed to stand out in the cold rain, cold wind or snow. Stalls or pens should be large enough to permit exercise.

Probably the most convenient way of handling them is in small pens with only a small number together. In one side of the pen provide a row of stanchions, one for each calf and far enough apart to prevent their reaching each other. A long, narrow manger just wide enough to hold a pail may be constructed in front of the stanchions. (If the mangers are partitioned, two feet in length gives ample space.) It is better to have this manger made of cement or material that can be washed or cleaned. If placed in these stanchions while being fed milk and then supplied with grain or hay, they will learn to eat it instead of sucking each other. Where stanchions can not be had and there are only two or three calves, they may be tied to keep them apart. A liberal use of straw for bedding is always desirable.

Calves born in the spring or summer require less shelter but are frequently neglected too much. They should be kept in dry places as well as those born at other seasons and should be protected from flies as much as possible. A clean, dark, cool place will help them to avoid the heat and hide away from the flies. The least one should do, would be to provide good shade if they are kept in an open lot. Fly repellants may be used but they are not very satisfactory as they need to be applied daily. After calves are old enough to depend entirely on pasture, it is well to see them each day, salt them once or twice each week and be sure that they have plenty of pure water. They should not be neglected when the

pasture is short, if one wishes to keep them growing; nor, should they be compelled to depend on pasture so late in the fall that they begin to lose in weight. This frequently happens on the best farms and is not realized because the heifers are not weighed at intervals. At such times some other feeds such as soiling crops or grains should be supplied.

The age at which a heifer should be bred depends somewhat on her growth; but, in most cases, it is advisable to breed first during the 17th or 18th month of age.

DISEASES

Only a few of the most common diseases and their treatment will be discussed very briefly here. As in the case of other cattle, a calf suffering from any serious trouble, not well understood by the person in charge, should be treated by a veterinarian. Nothing is more important in raising calves than to keep their surroundings clean and sanitary. It is a good plan to clean and disinfect their quarters frequently. Where many calves are raised, it is a good practice to spray them occasionally with a solution of some of the common disinfectants on the market. These precautions prevent the growth of disease germs and the development of skin diseases and lice. The old saying that an ounce of preventive is worth a pound of cure is especially applicable in the care of calves.

Scours. Probably the most common and the most destructive disease among calves is that commonly called "scours." There are different forms of this disease, depending on the cause.

Indigestion is the most common cause of the trouble. Indigestion is really the disease and scouring the symptom. It may be caused by over-feeding, by feeding sour milk, or dirty milk, or by using dirty pails, dirty damp stalls, too early attempts to substitute other foods for milk, foods not suitable, etc. In any of these cases, the food ferments or decays in the calf rather than digests. Products are thus formed which irritate the intestines causing the calf to scour. Lack of properly assimilating the food and the absorption of poisons produced, cause the calf to weaken. Just how poisonous these products are is shown by the way the hair is sometimes "scalded" from the tail and buttocks of the calf which has scours. Calves should be treated at the very first appearance of the disease. Two things should be done at once: find the cause, and remove it; if over-feeding causes it, feed less; if bad milk causes it, change or pasteurize the milk. Give a dose of

from 1 to 2 ounces of castor oil to remove the irritating materials from the bowels. After these steps have been taken, add a teaspoonful of blood meal to the milk at each feed for a few days. If this can not be obtained, 20 grains of subnitrate of bismuth with a teaspoonful of creolin in solution may be given with or after the oil. In mild cases, the oil followed by two raw eggs may correct the trouble. The following mixture has given good results at the Station: prepared chalk 2 ounces, powdered Catechu 1 ounce, ginger $\frac{1}{2}$ ounce, opium 1 dram, and peppermint water 1 pint. (Dose: 2 to 4 tablespoonsful.)

Do not give tannic acid or other strong astringents before the bowels are cleaned out as these agents may cause the foul materials to be retained. Indigestion may start with constipation. Where this is noticed, a dose of castor oil should be given at once. In drenching calves, one should be very careful or the calves may be strangled and pneumonia may follow. This precaution should be taken with any weak animal.

White Scour. This is not due to indigestion directly; but, to infection with deadly disease germs. This disease usually starts the first or second day after the calf is born. The calf at once becomes very weak and expels a very foul, whitish material from its bowels. Most cases die within 36 hours. If the calf escapes the disease until a week or two old, it is usually safe. With this infectious type, treatment is not of much value. Once the disease gets established in a barn it may remain for years unless very thorough sanitary measures are carried out. The stables should be thoroughly cleaned and then soaked with a strong disinfectant.

The stall where the cow is to calve should be disinfected and well bedded before the cow is put into it. The cow herself should be sprayed with a disinfectant and the stall kept clean and dry. It may be necessary to take the cow to another building before calving and keep the calf there until it is two weeks old. The germ is supposed to enter the calf through the raw navel. In a herd where the disease is known to be present, the navel should be treated with a good disinfectant and tied up to keep out filth and infection as soon as the calf is born.

Lice. These insects frequently cause trouble with calves by keeping them from thriving properly. They are apt to be more plentiful in the winter when the calves have long hair and are kept in the barn. They are indicated by roughness of coat and by the calves licking themselves. Such symptoms should cause one to make an examination at once. It is difficult to get rid of them

entirely when once they get well established in a herd; but, they can be kept from doing much damage by proper methods. Spray the calf carefully all over with some of the commercial coal tar disinfectants or fly repellants. Repeat the spraying in 5 to 8 days to kill those which may hatch from the nits. At the same time clean out and disinfect the stalls and mangers. Do not make the disinfectants too strong or the hair may be removed from very young calves. The spraying when done in winter should be done on warm days and the calf should be kept warm until dry.

Pneumonia. In winter calves frequently die of pneumonia caused by chilling. Keep them in a dry place free from cold drafts to prevent it. Where calves are kept in close, poorly ventilated stables, see that doors are not opened permitting drafts of very cold air to blow directly on them. This is probably the most common cause.

Treatment. Keep the animal warm and dry and it is well to keep it blanketed. Feed only fresh warm milk frequently and in small quantities. It should be fed carefully to prevent strangling. Liniments or mustard plasters may be used over the chest. Recovery is usually slow. If the calf is valuable, call a veterinarian.

Dehorning. Where it is desirable to have the horns removed, it should be done before the calf is five days old. Clip the hair off close to the skin over the horn. Take a stick of caustic potash, moisten the end and rub it over the horn until a place about the size of a dime becomes raw. To prevent its spreading, rub vaseline around the spot. If too much is used, it makes the head very sore; if too little is used, the horn will not be killed. Caustic potash can be secured at almost any drug store. Wrap one end of the stick with paper before taking hold of it or it will injure the fingers. It must be kept tightly corked in a bottle free from moisture or it will dissolve.

Bloat. Occasionally calves bloat from eating green clover or other undesirable feeds. Such cases should be treated the same as in cattle. See Circular 136.

Sore feet, cuts, or other open wounds should be kept clean and carefully disinfected with creolin, or a 3 or 4 percent solution of carbolic acid. When possible such wounds should be tied up to prevent dirt getting in until they have healed.