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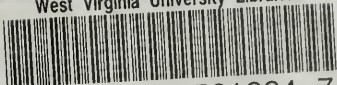
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Amounts of Feed and Labor Used in Raising Dairy Heifers

by H. O. HENDERSON, G. A. BOWLING,
and L. F. HERRMANN

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Amounts of Feed and Labor Used In Raising Dairy Heifers

by H. O. HENDERSON, G. A. BOWLING, and L. F. HERRMANN

THIRTY TO FORTY THOUSAND heifer calves are raised each year by West Virginia dairymen. A survey¹ based on prices prevailing in 1925-26 showed that the cost of raising a dairy heifer from birth to first calving was from \$70 to \$130. This means a total annual cost of from \$2,000,000 to \$5,000,000 to raise the dairy-herd replacements in the state. Although this cost may vary from year to year it always represents a large expense to the dairy farmer.

It has been shown by several investigators that the costs of feed and labor involved in raising dairy heifers comprise from 80 to 94 percent of the total cost. For this reason the only items considered in this study are the amount of feed and the amount of labor required to raise dairy heifers. Because of the fluctuations in the cost of these items the amounts required are reported in unit quantities rather than in terms of money value. It will be possible then, by applying the prevailing prices for feed and labor, to determine at any time the feed and labor costs for dairy-herd replacements. Eke¹ in an earlier publication from this station reported the housing, tax, interest, and other costs involved in raising dairy heifers to two years of age.

SOURCES OF DATA

Two types of material were used in this study: (a) records of feed consumed and labor required to grow dairy heifers to two years of age in the herd at the Agricultural Experiment Station at Morgantown, and (b) estimates of feed consumption and labor requirements as determined by a survey of practices on 122 farms in different parts of the state.

The Experiment Station herd records of feed consumption were started in April 1927 and have been kept continuously since that date. The amounts of feed fed from birth to six months of age were weighed daily. After the heifers were of this age their concentrate ration was weighed daily, but the weight of the roughage was determined only once each month.*

¹Eke, P. A. The Cost of Raising Dairy Cows in West Virginia. W. Va. Agr'l Exp. Sta. Bul. 224 (1929).

*There was an exception in the case of three Jersey and 11 Holstein-Friesian heifers which were raised under controlled conditions and for which all feed records are actual weights. The amount of feed consumed by these heifers compared very closely to that consumed by the heifers where the roughage was weighed but once a month, showing that the latter method of estimating roughage is sufficiently accurate.

The amount of labor required to raise the heifers was based on a series of records taken during one year. On one day in each month a record of the time spent in various operations was recorded. The time spent on that day was extended to represent the labor requirement for the month.

In the survey the feed consumption of heifers was determined by estimating the daily amounts of feed consumed in the pasture season and in the feeding season, by animals that were 6, 12, 18, and 24 months old at the beginning of each pasture season. The amounts of labor used were determined in the same manner.

EXPERIMENT STATION HERD STUDY

The dairy herd of the Station, situated at Morgantown, consists of 40 to 50 registered Holstein, Jersey, and Guernsey cows. The calves from these cows are raised for replacements so that there are always from 30 to 40 calves and heifers on the farm.

The farm upon which the herd is kept is not large enough to enable all the necessary feed to be grown, but sufficient silage corn is raised each year to supply the needs of the milking herd. At the time the collection of these data was begun, a few mangels and rutabagas were being fed each year, but later they were discontinued.

No grain is raised on the farm, and for that reason all concentrate feeds are purchased. The hay supply also is inadequate and must be supplemented. Most of the hay grown or purchased was alfalfa, although a small amount of soybean hay was grown. Such skimmilk as is needed for the feeding of calves is available. About 75 acres of pasture are used for the young stock and dry cows, but this does not provide as much pasture as could be used profitably.

TABLE 1—Average feed consumption of Holstein heifers

	Age in months							
	1-6	6-12	1-12	12-18	18-24	12-24	1-24	1-31.5
Whole milk (pounds)	460	...	460	...	...	...	460	460
Skimmilk	1758	904	2662	173	...	173	2835	2835
Grain	255	641	896	470	601	1071	1967	2744
Hay	352	962	1314	820	1106	1926	3240	4523
Silage	4	66	70	210	849	1059	1129	2184
Roots	...	17	17	29	110	139	156	287
Beet pulp	...	...	...	...	...	...	...	50
Pasture (days)	1	29	30	97	82	179	209	328
No. heifers	53-60	54-59	...	45-48	36-44	...	...	...

FEED CONSUMPTION

Since two different breeds of heifers of different size characteristics were involved in this study it is not desirable to present combined average data for the breeds involved. For this reason data on feed consumption for Holstein and Jersey heifers are presented separately.

Feed Consumption of Jerseys and Holsteins

The amounts of feeds consumed by Holsteins and Jerseys are shown in Tables 1 and 2, the difference between the breeds being mainly in the total quantity consumed. As would be expected, Holsteins consumed more of all feeds than did Jerseys, with the exception of whole milk, more of which was fed to Jerseys than to Holsteins. This was because Jerseys received whole milk over a longer period of time than did Holsteins. The proportion of grain to roughage was higher with Jerseys than with Holsteins.

TABLE 2—Average feed consumption of Jersey heifers

	Age in months							
	1-6	6-12	1-12	12-18	18-24	12-24	1-24	1-31.5
Whole milk (pounds)	473	...	473	...	...	...	473	473
Skim milk	1475	616	2091	29	...	29	2120	2120
Grain	205	635	840	570	504	1074	1914	2600
Hay	292	873	1165	859	732	1591	2756	3707
Silage	...	82	82	200	561	761	843	2761
Roots	...	37	37	31	6	37	74	74
Pasture (days)	2	37	39	75	99	174	213	367
No. heifers	20-28	18-23	...	15-18	8-16	...	...	...

TABLE 3—Average pounds of total digestible nutrients in feed consumed by Holstein heifers

Month	Lbs. total digestible nutrients	Month	Lbs. total digestible nutrients
1	33	13	176
2	62	14	164
3	91	15	141
4	108	16	121
5	129	17	99
6	152	18	103
7	165	19	130
8	162	20	146
9	166	21	162
10	178	22	187
11	179	23	232
12	174	24	289
Total	1599	Total	1950
Total for 24 months		3549	

The amounts of total digestible nutrients consumed by the animals of the two breeds bear the same relations as the total feeds, Jerseys receiving about 11 percent less than the Holsteins (Tables 3 and 4). The Jerseys appear to have been better fed than the Holsteins, since the Jerseys' requirements based on their weight were more than 11 percent lower than the Holsteins. At two years of age the Jerseys averaged 21 percent less in weight than the Holsteins although they had been fed only 11 percent less total digestible nutrients. The growth of both breeds was about normal (Figures 1 and 2), as they followed the Eckles² and Fitch³ normal curves fairly closely.

²Eckles, C. H. The Normal Growth of Dairy Cattle. Mo. Agr. Exp. Sta. Res. Bul. 36 (1920).

³Fitch, J. B., Cave, H. W. and Riddell, W. H. Normal Growth of Dairy Cattle. Twenty-seventh Annual Meeting Am. Dairy Sci. Ass'n (1932).

FIGURE 1

GROWTH OF HOLSTEIN HEIFERS

- - - HEIFERS AT IYIA AGRICULTURAL EXPERIMENT STATION
- ECLES NORMALS
- - - FITCH NORMALS

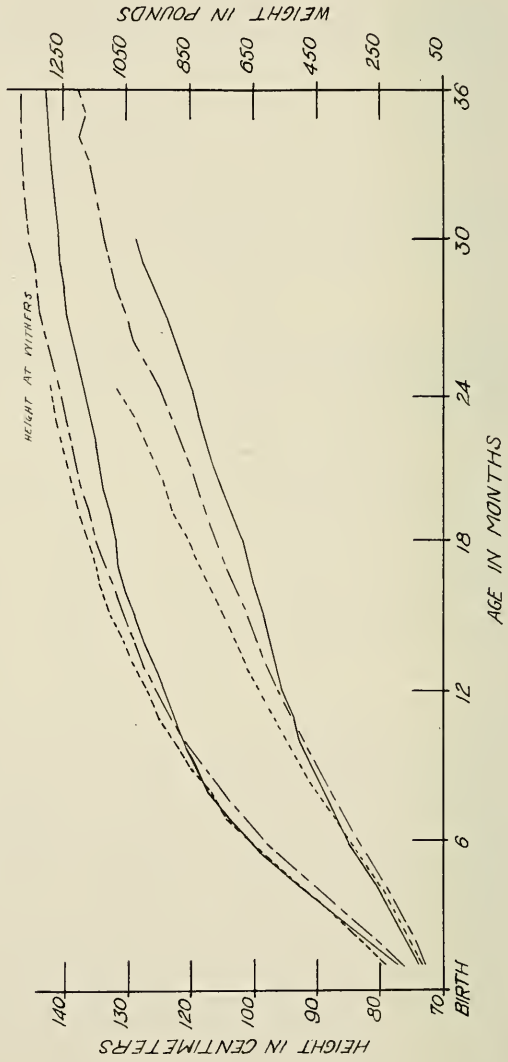
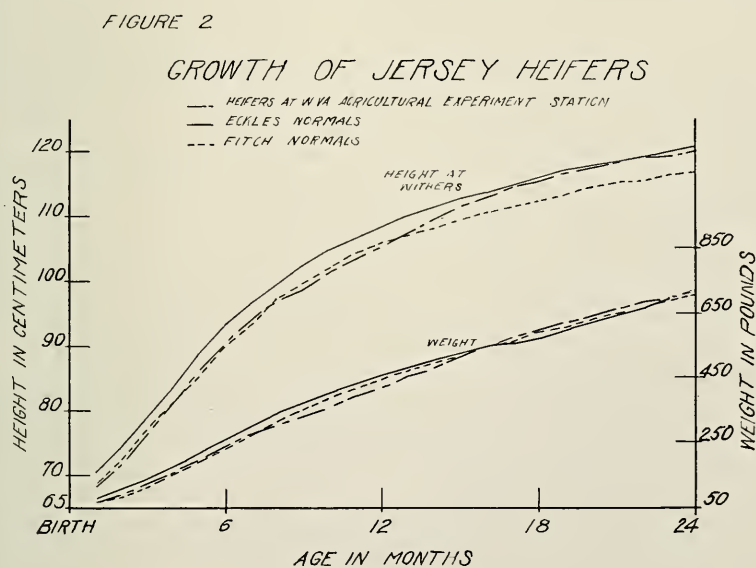


TABLE 4—Average pounds of total digestible nutrients in feed consumed by Jersey heifers

Month	Lbs. total digestible nutrients	Month	Lbs. total digestible nutrients
1	27	13	202
2	51	14	208
3	75	15	192
4	91	16	132
5	115	17	79
6	128	18	66
7	130	19	58
8	139	20	65
9	147	21	68
10	178	22	129
11	187	23	237
12	183	24	272
Total	1451	Total	1708
Total for 24 months		3159	

The Standardized System of Feeding

The average feed consumption of all heifers in this herd cannot be taken to represent the feeding method used, because at the time these records were two-thirds collected a marked change was made in the method of feeding. The data which show this most clearly are summarized in



Tables 5 and 6. Under the first system the amount of whole and skimmilk and the length of time that they were fed were fairly variable, and the grain and hay was fed in increasing amounts until the heifers were 12 months of age. Accordingly there was considerable variation in the quantities of those feeds. In the summer of 1931 the amount of milk fed, the length of time it was fed, and the time and rate of changing from whole to skimmilk were all standardized, with only occasional variations.

TABLE 5—Average feed consumption of Holstein calves when under unstandardized system

	Age in months						
	1-6	6-12	1-12	12-18	18-24	12-24	1-24
Whole milk (pounds)	606	...	606	...	...	...	606
Skimmilk	1724	1457	3181	283	...	283	3464
Grain	221	713	934	542	653	1195	2129
Hay	293	1011	1304	854	1011	1865	3169
Silage	6	112	118	336	1178	1514	1632
Roots	...	29	29	47	152	199	228
Pasture (days)	3	20	23	89	78	167	190

TABLE 6—Average feed consumption of Holstein calves when under standardized system

	Age in months						
	1-6	6-12	1-12	12-18	18-24	12-24	1-24
Whole milk (pounds)	271	...	271	...	...	...	271
Skimmilk	1770	102	1872	...	...	...	1872
Grain	302	540	842	358	468	826	1688
Hay	434	908	1342	761	1357	2118	3460
Pasture (days)	...	41	41	105	76	181	222

All calves were given whole milk for only 30 days, averaging nine pounds a day during that time. Skimmilk feeding was started at the beginning of the second month and continued to the end of the sixth month. Not more than 15 pounds of skimmilk was fed per day, the average being 12 to 13 pounds. Skimmilk was fed to six months of age because during the time covered by this study an ample supply of skimmilk was available. With a smaller amount of skimmilk available the time during which it was fed could have been reduced. Grain and hay feeding was started at the same time as skimmilk feeding. The amount of grain fed reached its maximum at six months under this system. The heifers over six months of age were required to depend more on roughage and pasture than on grain. This system of feeding will be called the standardized system, while the former system will be referred to as the unstandardized system, although it is one that is widely used by dairymen with satisfactory results.

The other changes reflect the cropping limitations of the farm. Silage, since the supply was limited, was taken from the heifer ration. Raising of root crops had been discontinued, so roots were no longer fed. More use was made of the pasture available. Calves were not put on pasture as young as they were under the old system, but spent more time on pasture after they were put out.

The total digestible nutrients fed under the two systems are compared in Table 7. The heifers fed under the standardized received only 82 percent as much digestible nutrients while barn-fed as did those in the earlier group. The number of days on pasture increased 17 percent. That accounts for some of the decrease in total digestible nutrients fed, but the decrease is due largely to a lower rate of feeding.

TABLE 7—Average pounds of total digestible nutrients in feed consumed by Holstein heifers

Month	Lbs. total digestible nutrients		Month	Lbs. total digestible nutrients	
	Heifers fed under:			Heifers fed under:	
	Unstandardized system	Standardized system		Unstandardized system	Standardized system
1	36	30	13	195	143
2	58	65	14	186	132
3	83	100	15	155	114
4	99	120	16	130	107
5	119	140	17	115	71
6	142	164	18	121	71
7	164	166	19	154	85
8	171	150	20	155	101
9	187	146	21	175	132
10	207	138	22	196	163
11	216	127	23	232	238
12	213	124	24	288	297
Total	1695	1470	Total	2102	1654
Total for 24 months			3797 3124		

TABLE 8—Average feed consumption of Holstein spring heifers

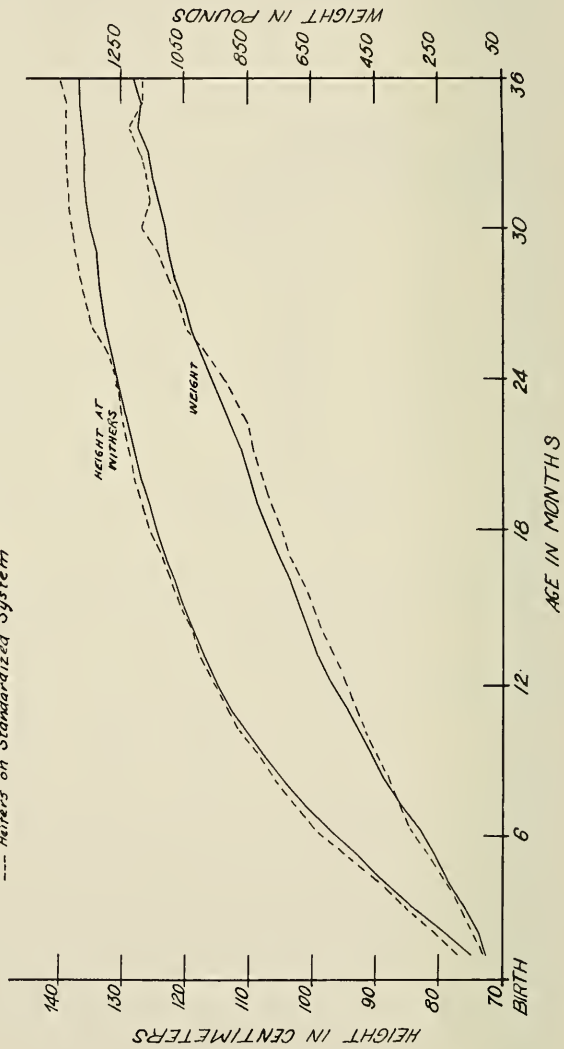
	Age in months						
	1-6	6-12	1-12	12-18	18-24	12-24	1-24
Whole milk (pounds)	414	...	414	...	...	...	414
Skim milk	1838	710	2548	93	...	93	2641
Grain	272	594	866	342	814	1156	2022
Hay	401	955	1356	549	1512	2061	3417
Silage	...	77	77	180	1246	1426	1503
Roots	...	9	9	25	118	143	152
Pasture (days)	...	35	35	122	41	163	198
No. heifers	29-33	26-28	...	21-24	16-20	...	...

The growth made by the two groups of heifers is shown in Figure 3. Heifers raised under the standardized system have had greater height at withers and less weight up to 24 months of age than have the heifers in the earlier group. At 24 months of age most of the heifers raised under the standardized system have been in the winter-feeding period, which probably explains in part the more rapid rate of growth at that age. The growth records of some of the smaller heifers in the standardized group are not complete beyond the 24th and 26th months, which causes the average to tend to be larger beyond that age. Irregularities after 20 months are due to the small number of animals on which the averages are based.

FIGURE 3

GROWTH OF HOLSTEIN HEIFERS

— Heifers on Unstandardized System
--- Heifers on Standardized System



Spring vs. Fall-Born Heifers

The feed consumption of spring and fall-born Holsteins (spring calves, born April 1 to September 30, and fall calves, born October 1 to March 31) is summarized in Tables 8 and 9. These records are not classified as to the system of feeding, but any differences due to the general feeding methods may be accounted for by referring to the discussion of the two systems of feeding given above. Of the fall heifers, 10 were fed under the standardized system and 23 under the old. Of the spring heifers, 16 were fed under the standardized system, and 7 under the old. The predominance of fall heifers fed under the old system and of spring heifers fed under the standardized system had the following effects: (1) fall heifers showed higher whole-milk consumption; (2) they consumed more skimmilk, particularly after six months of age; (3) they consumed less hay and grain during the first six months; and (4) they consumed more grain and less hay after the first six months.

TABLE 9—Average feed consumption of Holstein fall heifers

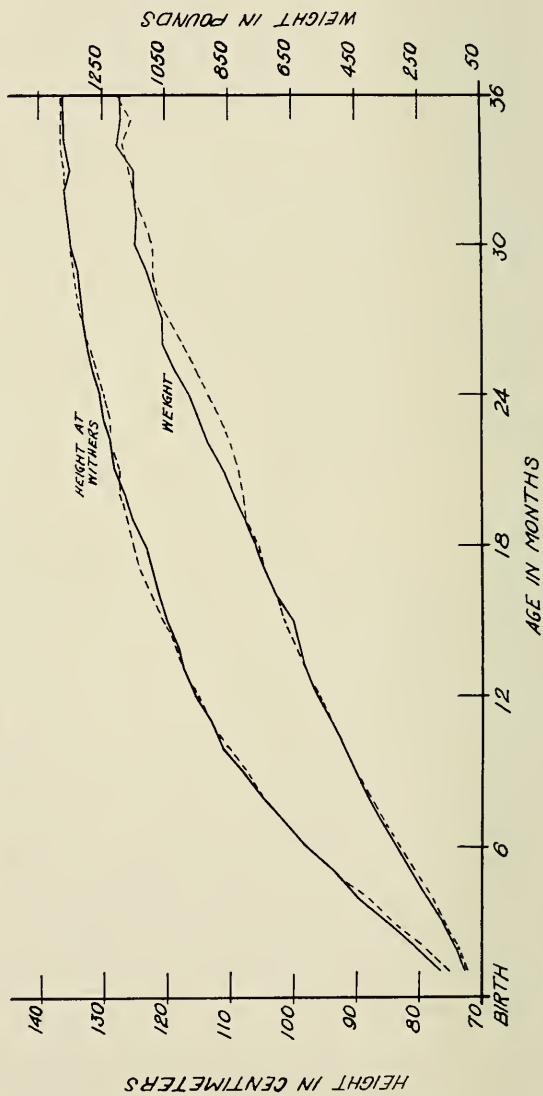
	Age in months						
	1-6	6-12	1-12	12-18	18-24	12-24	1-24
Whole milk (pounds)	508	...	508	...	...	...	508
Skimmilk	1655	1080	2735	249	...	249	2984
Grain	240	687	927	600	433	1033	1960
Hay	306	1019	1325	1049	784	1833	3158
Silage	...	57	57	227	547	744	831
Roots	...	25	25	34	102	136	161
Pasture (days)	2	24	26	70	106	176	202
No. heifers	24-32	28-31	...	24	20-24	...	...

Allowing for these effects, a number of significant differences between spring and fall heifers are apparent. The differences during the first year are due largely to the factors listed above. During the first six months fall heifers consumed more whole milk and less grain and hay than the spring heifers. During the second six months fall heifers consumed more skimmilk, grain, and hay than the spring heifers.

The differences occurring in the second year, however, are significant. The total number of pasture days is about the same for the two groups, yet the fall heifers required less feed while barn-fed than the spring heifers. The reason is that fall heifers were barn-fed during their second year when they were 13 to 15½ months old, weighing between 600 and 700 pounds — the age and weight at which spring heifers were being pastured. At the heavier weights of 19 to 22 months spring heifers were being barn-fed while fall heifers of the same age were on pasture. Most animals of both groups happened to be barn-fed at 23 and 24 months of age.

The quantities of total digestible nutrients consumed correspond with the total quantities of feed consumed. Table 10 shows the marked difference in the quantities consumed in the second year. Fall heifers were fed 14 percent less total digestible nutrients than spring heifers.

FIGURE 4
 GROWTH OF HOLSTEIN HEIFERS
 — BORN APRIL 1 - SEPT. 30
 --- BORN OCT. 1 - MAR. 31



The growth made by the two groups is shown in Figure 4. Low rates of growth are associated with the beginning of pasture periods, there being a lag at that time. The rate of growth reached normal or slightly greater than normal after the heifers had been on pasture for about two months, previous losses having been regained. Rate of growth in height at withers was less affected than were gains in weight.

TABLE 10—Average pounds of total digestible nutrients in feed consumed by Holstein heifers

Month	Lbs. total digestible nutrients		Month	Lbs. total digestible nutrients	
	Spring heifers	Fall heifers		Spring heifers	Fall heifers
1	34	33	13	105	247
2	64	58	14	68	257
3	99	81	15	67	212
4	116	99	16	82	152
5	136	122	17	117	83
6	159	143	18	124	64
7	174	156	19	227	49
8	177	149	20	278	35
9	166	174	21	289	70
10	172	186	22	257	131
11	154	203	23	258	214
12	132	235	24	264	311
Total	1583	1639	Total	2136	1825
Total for 24 months				3719	3464

TABLE 11—Time spent per heifer per month on 1- to 6-months-old calves

Month	No. of calves	Time expressed in minutes					Total
		Feeding			Cleaning stalls	Miscellaneous	
		Milk	Grain	Hay			
Jan.	18	143	24	29	78	133	407
Feb.	19	80	12	19	74	133	407
Mar.	16	99	13	22	86	148	368
Apr.	14	106	13	22	88	150	379
May	12	120	29	29	93	335	606
June	13	127	10	15	52	212	416
July	15	109	10	10	60	221	410
Aug.	13	126	19	25	71	217	468
Sept.	15	116	19	22	68	210	435
Oct.	16	113	18	18	60	210	426
Nov.	15	88	13	22	88	210	421
Dec.	22	95	17	17	62	155	346
Average	15.7	110	16	21	74	195	416
Percent of total		26	4	5	18	47	100

LABOR REQUIRED

The labor data gathered during 1933 are summarized in Tables 11 to 16. The distribution is shown of labor between the different chores in caring for calves and heifers. Feeding required 35 percent of the time spent on calves under six months of age (Table 11). Feeding milk required most of this time, or 26 percent of the total time spent on the calf. Cleaning and bedding took 18 percent, while the remaining 47 per-

TABLE 12—Average time spent per heifer on 6- to 12-month-old heifers

Month	Av. No. of heifers cared for	Time expressed in minutes				Total
		Feeding	Watering	Cleaning and bedding	Miscellaneous	
Jan.	4	155	83	62	191	491
Feb.	10	56	90	78	136	360
Mar.	10	61	87	67	110	325
Apr.	10	58	72	45	68	243
May	7	72	62	89	177	400
June	10	75	60	96	112	343
July	9	76	48	73	127	324
Aug.	5	93	50	81	155	379
Sept.	6	81	60	84	150	375
Oct.	6	74	78	93	155	400
Nov.	6	75	60	115	150	400
Dec.	5	74	62	124	155	415
Average	7.3	79	68	84	140	371
Percent of total		21	18	23	38	100

TABLE 13—Relation between total amount of labor expended on a 6-months-old calf and the number of calves cared for

Six-month period	Total hours labor	Av. no. of calves cared for
Jan. to June	41.5	15.3
Feb. to July	41.5	14.8
Mar. to Aug.	44.1	13.8
Apr. to Sept.	45.2	13.7
May to Oct.	46.0	14.3
June to Nov.	42.9	14.0
July to Dec.	41.8	16.0
Aug. to Jan.	41.8	16.5
Sept. to Feb.	39.1	17.5
Oct. to Mar.	38.0	17.7
Nov. to Apr.	37.2	17.3
Dec. to May	40.3	16.8

TABLE 14—Relation between total amount of labor expended on heifers between their sixth and twelfth months, and number of heifers cared for

Six-month period	Total hours labor	Av. no. of heifers cared for
Jan. to June	36.0	8.5
Feb. to July	33.2	9.3
Mar. to Aug.	33.6	8.5
Apr. to Sept.	34.4	7.8
May to Oct.	37.0	7.2
June to Nov.	37.0	7.0
July to Dec.	38.2	6.2
Aug. to Jan.	41.0	5.3
Sept. to Feb.	40.7	6.2
Oct. to Mar.	39.9	6.8
Nov. to Apr.	37.2	7.5
Dec. to May	37.2	7.7

cent was spent in mixing feeds, general care of the calf barn, attention to sick calves, and other duties that did not fall under the specified groups.

Feeding required only 21 percent of the time spent on heifers that were six to 12 months old (Table 12). Watering required 15 per cent, or nearly as much time as feeding. This item was necessary because a part of the animals did not have free access to water. The relative amount of time spent in cleaning and bedding was increased to 23 percent in these older calves. The time spent in miscellaneous chores was decreased to 38 percent of the total. The average number of minutes per month was less for calves of this age than for calves receiving milk.

The amount of time spent on each calf varied from month to month, mostly because of differences in the number of calves. During the six months between January 1 to June 30 an average of 15.3 calves were in the calf herd, and the total hours of labor spent on each calf in that period amounted to 41.5 hours. Compare this with the figures for the six months between October 1 and March 31, when with 17.7 calves in the herd the total labor per calf was 38.0 hours. Table 13 gives the numbers of calves and amounts of labor for six-month periods commencing with each month of the year.

TABLE 15—*Time spent on yearling heifers (Minutes per heifer per month)*

Month	Feeding	Watering	Cleaning and bedding	Miscellaneous	Total
Jan.	104	118	125	115	462
Feb.	61	107	117	90	375
Mar.	81	112	89	85	367
Apr.	92	100	48	68	308
May	...	...	...	74	74
June	...	...	...	72	72
July	...	...	...	74	74
Aug.	...	...	...	74	74
Sept.	...	...	...	72	72
Oct.	...	...	...	74	74
Nov.	150	135	95	120	500
Dec.	100	77	95	124	396
Total minutes for year					2848
Total hours for year					47.5

Figure 5 shows in graph form how the amount of labor increased as the number of calves decreased.

The same relationship between the number of animals and the time spent per animal existed for animals between six and 12 months of age. The data are shown in Table 14 and in Figure 6.

Labor on yearling heifers was distributed fairly evenly between the different chores during the six months of the year they were stabled. During the time spent on pasture their labor requirements were fairly low. An hour a day was spent in making a trip to the pasture to see the animals, to give them salt, and to bring animals into the barns for breeding (Table 15).

FIGURE 5
 RELATION BETWEEN LABOR PER CALF
 AND
 AVERAGE NUMBER OF CALVES PER MONTH
 (Hours of labor needed up to six months of age)

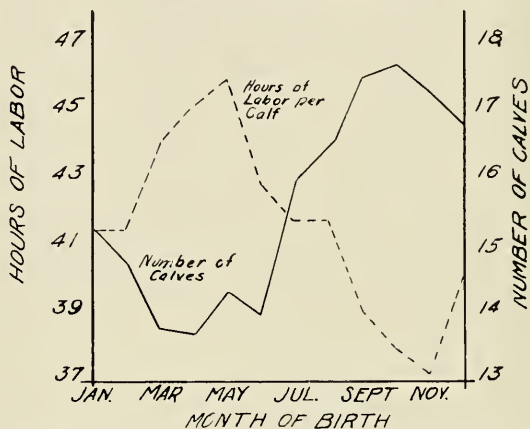
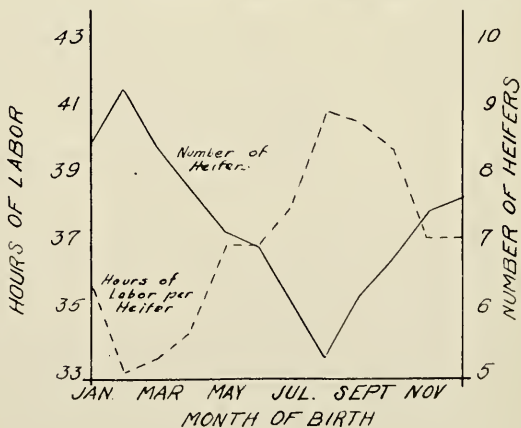


FIGURE 6
 RELATION BETWEEN LABOR PER HEIFER
 AND
 AVERAGE NUMBER OF HEIFERS PER MONTH
 (Hours of labor needed from 6 to 12 months of age)



The average amount of labor required per heifer during the first two years and the average amount required by animals born in different months are shown in Table 16.

TABLE 16—*Labor used in caring for heifers*

Month of birth	Hours of labor			
	1-6 Months	6-12 Months	First year	Second year
Jan.	41.5	38.2	79.7	...
Feb.	41.5	41.0	82.5	...
Mar.	44.1	40.7	84.8	...
Apr.	45.2	39.9	85.1	...
May	46.1	47.2	83.2	...
June	42.9	37.2	80.1	...
July	41.8	36.0	82.8	...
Aug.	41.8	33.2	75.0	...
Sept.	39.1	33.6	72.7	...
Oct.	38.0	34.4	72.4	...
Nov.	37.2	37.0	74.2	...
Dec.	40.3	37.0	77.3	...
Average	42.1	37.8	79.9	47.5

THE SURVEY STUDY⁴

The survey material used in this study was obtained in 1926 from 122 farmers situated in different sections of the state who estimated the feed and labor used in caring for 889 heifers. Supplementary information such as area of farm, nature of other farm enterprises, and type of market for the dairy products was not reported; hence the number of factors that can be studied is limited. The following factors influencing feed consumption were studied: (1) methods of milk feeding, (2) spring vs. fall calves, (3) purebreds vs. grades, and (4) breed differences. Labor requirements were studied for effects of (1) the number of heifers kept and (2) the number of pasture days per animal.

Feed Consumption of Spring vs. Fall Calves

It is impossible to set up any one method of feeding as typical for West Virginia. Methods varied considerably from farm to farm, and even within areas where similar farming practices should be found there was no uniformity in the methods of feeding heifers. The average feed consumption of all heifers is shown in Table 17.

There was considerable variation in the amounts of feed fed not shown in the above averages. In order to show this variation the range of quantities for each feed has been divided into several classes. Table 18 shows the distribution between classes of farms representing different methods of milk feeding. The figures for this and the following tables are percentages of a total of 122 farms. Forty-one percent of the farms fed only whole milk, and on 50 percent of these farms it was reported to be fed in quantities of over 1,000 pounds per calf. The other 50 percent of the farms feeding whole milk alone fed smaller quantities. More than 40 percent of the farms fed both whole milk and skimmilk on the same

⁴The survey material was collected by Dr. P. A. Eke of the Farm Economics Department during the summer of 1926.

general plan that was outlined in the study of the Experiment Station herd. The amount of whole milk fed per heifer on farms included in the survey, however, was greater than in the Experiment Station herd. On 16 to 17 percent of the farms the calves were given only skimmilk after the first few days.

TABLE 17—Average amounts of feed, pasture, and labor used in the raising of 889 dairy heifers

	First year	Second year	From birth to two years
Whole milk (pounds)	826	...	826
Skimmilk	1317	6	1323
Grain	274	369	643
Hay	585	1540	2125
Silage	419	1429	1848
Fodder	86	131	217
Straw	2	14	16
Pasture (days)	142	190	332
Labor (hours)	40	25	65

TABLE 18—Variation in kind and amounts of milk fed to heifers (Percentage of all farms in study)

	Whole milk only		Whole and skimmilk	Skim-milk only
	Over 1,000 pounds	Under 1,000 pounds		
	Percent	Percent	Percent	Percent
Spring calves	22	19	42	17
Fall calves	21	20	43	16

TABLE 19—Average feed consumption of heifers during their first year, under different systems of milk feeding

	Whole milk only		Whole and skimmilk	Skim-milk only
	Over 1,000 pounds	Under 1,000 pounds		
Whole milk (pounds)	2299	520	536	...
Skimmilk	...	...	2027	2748
Grain	266	336	271	221
Hay	558	602	604	539
Silage	447	498	326	552
Fodder (corn)*	11	26	...	82
Straw	9	...	...	...
Pasture (days)	143	132	151	133
Labor (hours)	35	45	42	35

*No distinction was made between fodder and stover. Probably a considerable portion of the feed classed as fodder was actually stover.

The quantities of feeds consumed along with the different methods of feeding milk are shown in Table 19. The most marked difference was between the groups receiving only whole milk. With the smaller amount of whole milk fed there was an increased amount of all other feeds. Silage, fodder,* and straw were most variable because they were fed on only a few farms. They supplied only a small part of the total amount of digestible nutrients received by the heifers. There was very little difference in the amounts of hay and grain consumed regardless of the quan-

tity of milk fed, except that the group receiving less than 1,000 pounds of whole milk received a larger amount of grain than the other groups.

The range in amounts of grain fed to calves under a year old is shown in Table 20. The average amount of grain fed per heifer on all farms was 274 pounds, falling in the 200 to 400-pound class. Forty-seven percent of spring calves received more than 400 pounds, while 73 percent of fall calves received less than 200 pounds.

TABLE 20—*Variation in amounts of grain fed to heifers during the first year (Percentage of farms)*

	Pounds of grain			
	None	Under 200	200-400	Over 400
	Percent	Percent	Percent	Percent
Spring calves	8	20	25	47
Fall calves	20	53	22	5

TABLE 21—*Variation in amount of hay fed to heifers during the first year (Percentage of farms)*

	Pounds of hay			
	None	Under 400	400-800	Over 800
	Percent	Percent	Percent	Percent
Spring calves	2	2	39	57
Fall calves	17	65	17	1

TABLE 22—*Variation in amount of silage fed to heifers during the first year (Percentage of farms)*

	Pounds of silage			
	None	1-1000	1000-2000	Over 2000
	Percent	Percent	Percent	Percent
Spring calves	51	9	27	13
Fall calves	85	14	1	0

The range in amounts of hay fed to calves under one year old is shown in Table 21. The average for all farms falls in the 400 to 800-pound class, but of the spring calves 57 percent received more than 800 pounds, while of the fall calves 82 percent received less than 400 pounds.

The range in amounts of silage fed to calves under one year old is shown in Table 22. The cause for a considerable portion of the varying amounts of silage shown in averages was that many farms did not feed silage to the heifers. Again there was a difference between spring and fall calves. Spring calves received silage on 49 percent of the farms, while fall calves received silage on only 15 percent of the farms.

The number of days of pasture received up to one year of age by fall calves was much greater than that received by spring calves, as 98 percent of the farms gave them 100 days or more of pasture. Spring calves, however, received more than 100 days of pasture on only 42 percent of the farms (Table 23).

Tables 24 to 27 show the variations in quantities of feed consumed by heifers from 12 to 14 months of age. The difference between spring and fall calves was not as marked during the second year as it was during the first. It is noticeable that the fall heifers tend to fall into the lower classes in larger numbers than do spring heifers except in the case of pasture days, where there is no appreciable difference.

TABLE 23—Variation in the number of days heifers were on pasture during the first year (Percentage of farms)

	Days on pasture			
	None	Under 100	100-199	Over 199
	Percent	Percent	Percent	Percent
Spring calves	21	36	34	8
Fall calves	0	2	67	31

TABLE 24—Variation in amount of grain fed to heifers during their second year (Percentage of farms)

	Pounds of grain			
	None	Under 300	300-500	Over 500
	Percent	Percent	Percent	Percent
Spring calves	25	17	20	38
Fall calves	32.5	13	22	32.5

TABLE 25—Variation in amount of hay fed to heifers during their second year (Percentage of farms)

	Pounds of hay			
	None	Under 1,000	1,000-2,000	Over 2,000
	Percent	Percent	Percent	Percent
Spring calves	2	16	56	26
Fall calves	2	25	56	17

TABLE 26—Variation in amount of silage fed to heifers during their second year (Percentage of farms)

	Pounds of silage				
	None	Under 1,000	1,000-2,000	2,000-3,000	Over 3,000
	Percent	Percent	Percent	Percent	Percent
Spring calves	49	2	7	13	29
Fall calves	53	5	8	22	12

TABLE 27—Variation in number of days heifers were on pasture during their second year (Percentage of farms)

	Pasture Days			
	None	Under 150	150-215	Over 215
	Percent	Percent	Percent	Percent
Spring calves	1	3	84	12
Fall calves	0	2	86	12

Purebred vs. Grades

The difference between the feed consumption of grade heifers and purebred heifers is shown in Table 28. Grade heifers received only 56 percent as much whole milk and only 66 percent as much grain as did purebred heifers. They received slightly more skimmilk and considerably more hay. The low quality feeds — fodder and straw — were fed only on farms keeping grade animals. Purebred heifers did not spend as much time on pasture as did grade heifers.

TABLE 28—Average feed consumption and labor requirements of grade and purebred heifers

	First year		Second year	
	Grade	Purebred	Grade	Purebred
Whole milk (pounds)	696	1247	...	...
Skimmilk	1395	1150	...	20
Grain	232	354	297	525
Hay	589	316	1528	1454
Silage	441	415	1462	1629
Fodder	66	...	609	...
Straw	7	...	17	...
Pasture (days)	142	130	190	185
Labor (hours)	41	41	26	26

TABLE 29—Average feed consumption of different breeds

First year	Purebred Jersey	Grade Jersey	Purebred Holstein	Grade Holstein
Whole milk (pounds)	932	794	1976	596
Skimmilk	1354	1382	634	871
Grain	350	224	328	256
Hay	515	592	566	441
Silage	311	494	664	565
Fodder	22	50	...	68
Straw	...	...	...	15
Pasture (days)	128	143	137	162
Labor (hours)	45	42	34	34
Second year				
Skimmilk (pounds)	30	...	...	...
Grain	550	303	408	329
Hay	1540	1528	1300	1326
Silage	1310	1510	2478	1598
Fodder	22	36	...	110
Straw	...	...	...	165
Pasture (days)	182	192	188	186
Labor (hours)	28	27	21	17

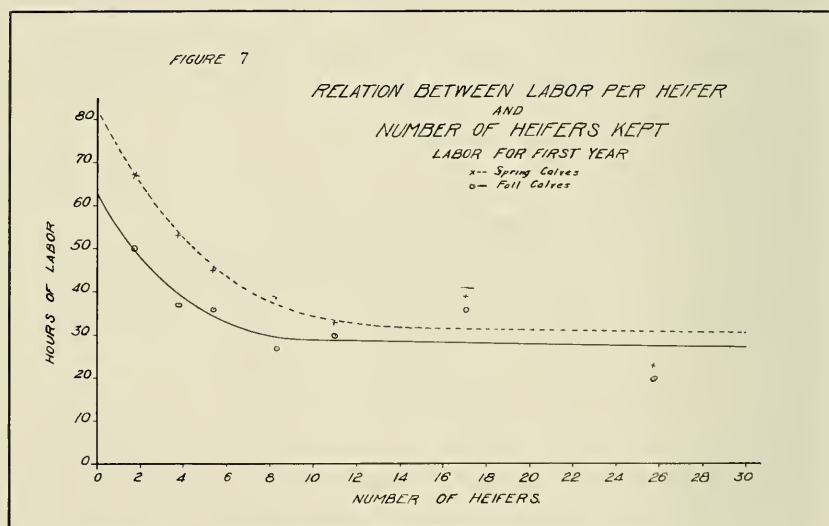
Breed Differences

Only two breeds were represented by enough herds to justify comparing them. There were 26 herds of purebred and 45 of grade Jerseys; 11 of purebred and 6 of grade Holsteins. Feed consumption figures are given in Table 29.

LABOR REQUIRED

Effect of Number of Heifers

The relation between the hours of labor required per heifer and the number of heifers kept per farm was determined by plotting the average hours of labor for different sizes of herds. Figure 7 shows the resulting curve for first year's labor on spring and fall calves. Adding one or two calves cut down the amount of labor per head considerably when less than six or eight calves were raised. As the number of heifers was increased beyond 12 there was little effect on the number of hours of labor required per heifer. Fall heifers require less labor during the first year than spring heifers; therefore the number of heifers kept does not affect the time spent per fall heifer as much as it affects the time spent per spring heifer.



NOTE: Each plotted point is the average of from 6 to 27 records.

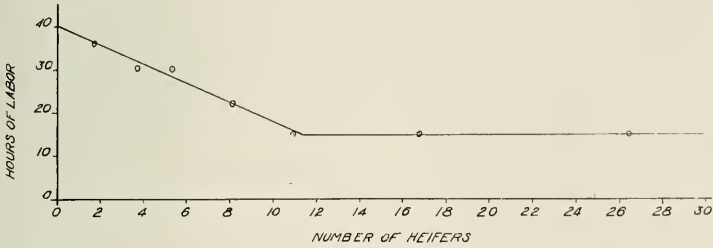
The relation between labor per heifer and number of heifers for the second year is shown in Figure 8. Increasing the number of heifers kept reduced the labor per heifer about the same amount for each heifer added until a herd size of 11 heifers was reached. In herds of more than 11 heifers the labor per heifer averaged the same regardless of the number.

Effect of Number of Days on Pasture

The relation between the hours of labor per heifer and the number of days the heifers were on pasture was determined by plotting in a manner similar to that described above. The results are shown in Figure 9 for the first year. No relation could be said to exist between these factors in the case of spring calves. This probably was due to the fact that

FIGURE 8

RELATION BETWEEN LABOR PER HEIFER
AND
NUMBER OF HEIFERS KEPT
YEARLING HEIFERS

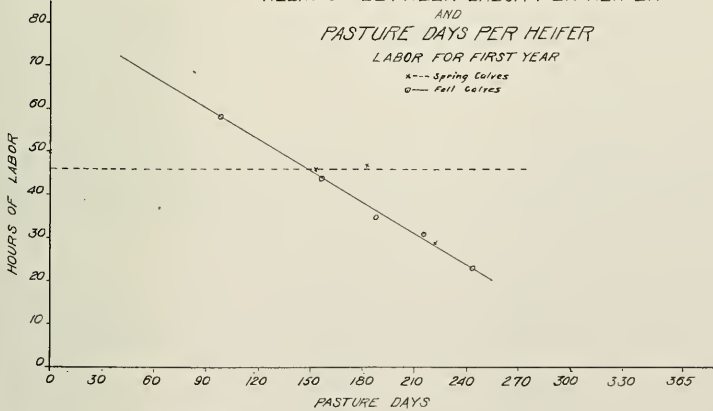


NOTE: Each plotted point is the average of from 5 to 30 records.

much of the labor item for spring calves was made up of time spent in feeding milk, a chore that must be performed even when calves are on pasture. During the second six months of their first year, when they no longer received milk, they were kept in the barn, with the usual high labor requirements of the winter season. Fall calves, on the other hand,

FIGURE 9

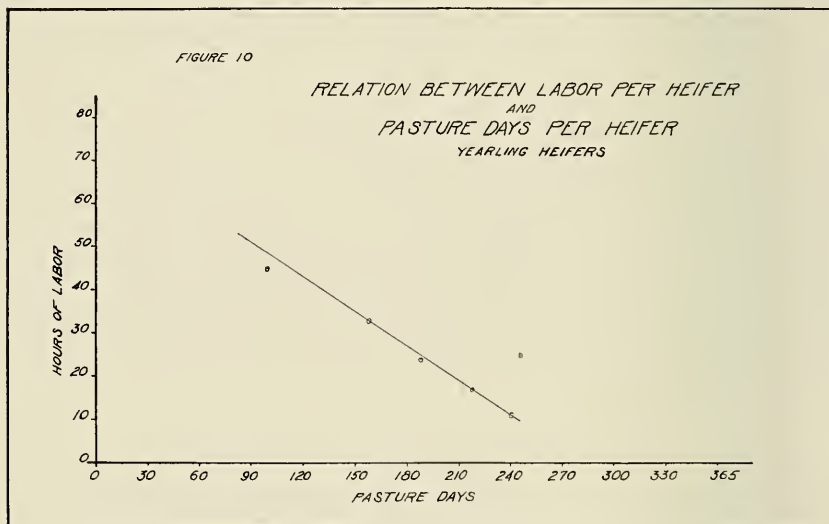
RELATION BETWEEN LABOR PER HEIFER
AND
PASTURE DAYS PER HEIFER
LABOR FOR FIRST YEAR
x--- Spring Calves
o--- Fall Calves



NOTE: Each plotted point is the average of from 3 to 25 records for spring calves, and 3 to 58 records for fall calves.

were kept in the barn while receiving milk, and were turned out as soon as pasture was available. Their labor requirements were then decreased to the lower level needed for their care while on pasture. Changing the number of pasture days had the same effect on hours of labor whether much or little pasture was used. An increase of 30 days of pasture resulted in a decrease of 7.4 hours in the amount of labor required during the first year.

Figure 10 shows the relation between labor per heifer that existed during the second year. The relation is the same as for calves. However, the effect apparently disappears at about 240 days of pasture, since after that point the hours of labor appear to remain constant. The decrease in hours of labor per heifer was 7.7 for each additional 30 days of pasture during the second year.



NOTE: Each plotted point is the average of from 3 to 52 records.

The labor requirements of grade vs. purebred heifers, as given in Table 29, appear to be identical. This is contrary to expectations based on the feed records, which indicate better care for the purebreds. After determining the effect of size of herd and amount of pasture on hours of labor, the difference may be evaluated more exactly.

Grade herds averaged 6.4 heifers per herd, while purebred herds averaged 7.9 heifers per herd. From the curve for fall calves in Figure 7, the most conservative estimate shows that the grade herds should have required three hours more work per head the first year than the purebred herds when the difference in the number of heifers kept is allowed for. The difference due to greater use of pasture by grades may be found in Figure 9. If grades had been on pasture 130 days they would have required 1.5 more hours of labor. Altogether, the net difference shows

that for herds of equal size, with equal pasturing, grade herds received 4.5 less hours of labor per heifer than did purebreds.

It is similarly calculated that during the second year they received a total of 4.3 hours less of labor than they should have had to be as well cared for as the purebreds.

SUMMARY AND CONCLUSIONS

Data are presented in this bulletin covering the feed consumption and labor involved in raising dairy heifers in West Virginia.

The data were collected from two sources. Those from the Experiment Station herd were based on actual data regularly recorded, while those collected throughout the state were gathered by the survey method.

Holstein and Jersey heifers were involved in the study in the Station herd, and the data were summarized separately for each breed. In order that the data collected may be of value for several years they were summarized in terms of feed consumed and labor required. These two items constitute from 80 to 94 percent of the total cost of raising dairy heifers. In these studies it was found that the following average amounts of feed and labor were required to raise the heifers from birth to two years of age:

	<i>Exp. Sta.</i> <i>Holsteins</i>	<i>Exp. Sta.</i> <i>Jerseys</i>	<i>W. Va.</i> <i>farm heifers</i>
Whole milk (lbs.)	460	473	826
Skimmilk (lbs.)	2835	2120	1323
Grain (tons)	1.0	1.0	.32
Hay (tons)	1.85	1.5	1.4
Pasture (months)	7.0	7.0	11.0
Labor (hrs.)	127	127	65

By using these figures and multiplying them by the price of each feed in his immediate vicinity any dairyman can very easily arrive at the feed and labor cost of raising heifers. As an example let us assume that the price of whole milk is \$2.00 per hundred pounds, skimmilk \$.50 per hundred pounds, grain \$26.00 per ton, hay \$15.00 per ton, pasture \$1.00 per month, and labor 15 cents per hour. Applying these prices to the average feed and labor requirements it is found that for the two breeds studied at the Experiment Station and the heifers included in the farm survey, the costs for the various items would be as follows:

	<i>Exp. Sta.</i> <i>Holsteins</i>	<i>Exp. Sta.</i> <i>Jerseys</i>	<i>W. Va.</i> <i>farm heifers</i>
Whole milk	\$ 9.20	\$ 9.46	\$16.52
Skimmilk	14.17	10.60	6.62
Grain	26.00	26.00	8.32
Hay	27.75	22.50	21.00
Pasture	7.00	7.00	11.00
Labor	19.05	19.05	9.75
Totals	\$103.17	\$94.61	\$73.21

It should be remembered that these data represent averages only and that the feeding practices varied widely from farm to farm. By taking these averages as a guide, however, and by using prevailing feed prices it should be possible for farmers to calculate with a fair degree of accuracy the cost of raising dairy heifers from year to year.

In addition to the data on average feed and labor requirements some very interesting facts were obtained. It was found in the Station herd that calves born in the spring and summer months required more feed and labor than those born in the fall and winter months. This was because they used less pasture and were larger and heavier than the fall and winter heifers during the winter feeding season. At these same weights the fall and winter heifers were on pasture. This seemed to be true also in the case of heifers studied in the survey.

In both the Experiment Station and survey studies it was found that the amount of labor expended per heifer decreased with (1) an increase in the number of heifers in the herd and (2) an increase in the number of pasture days per heifer. It should be of especial interest to West Virginia dairy farmers that the cost of raising heifers can be decreased through an increased use of good pasture.

The data presented indicate that West Virginia dairy farmers could reduce the cost of growing heifers by feeding less than the average amount of whole milk that is being fed. This is true especially of breeders of registered cattle who fed five times as much whole milk as was being fed to the Station herd. Where it is practical to do so, skim milk or a satisfactory substitute could replace a portion of the whole milk.

There was considerable difference in the feed and labor requirements for growing heifers on the farms and in the Station herd, and this difference is reflected directly in the costs. The two greatest differences were in the labor required and the amount of grain consumed.

Because of the fact that the Station herd is expected to be kept in the best of condition from the standpoint of appearance, more labor is expended than would be necessary in order to raise heifers under ordinary farm conditions. In regard to the difference in feed consumption between the Station and dairy farm heifers, however, there seems to be only the question of adequate feeding. As shown in Figures 1, 2, 3, and 4 the heifers raised at the Experiment Station were fed just about the right amounts of feed to make normal growth. As the heifers from West Virginia farms were fed considerably less than the heifers at the Station, it is safe to conclude that they did not make normal gains and were somewhat under-sized at two years of age. Under such conditions it would be necessary for these heifers to make a greater than normal amount of their growth after they had come into production. While such a procedure is quite common it is perhaps more expensive, as the cheapest gains ordinarily can be made while the animals are young and going through the ages corresponding to most rapid normal growth. For

this reason the Experiment Station heifers, while costing more at two years of age, probably cost no more when they reach maturity than the heifers grown on West Virginia farms, except for the differences in the use of pasture and labor.

