

DAIRY PRODUCTION IN OHIO

OHIO  
Agricultural Experiment  
Station

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<sup>5</sup>On leave of absence.

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# BULLETIN

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## Ohio Agricultural Experiment Station

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### DAIRY PRODUCTION IN OHIO

R. I. GRADY AND M. O. BUGBY

#### OBJECT OF COLLECTING EVIDENCE

The work, the results of which are reported within the following pages, was planned to determine the actual conditions on Ohio farms, to interest dairymen in keeping records of the production of their cows and to assist them in computing their profits or losses. This work was started in 1907 by the Cooperative Department of the Ohio Experiment Station. In 1910 there were eighty-one dairymen in twenty-six counties cooperating with the Station.

**Complete records necessary.**—Previous to 1910 no attempt had been made to show the total expense and the total income for each cow and for the herd. The records merely showed the total production of milk and of fat, the disposition of and the receipts for product, the cost of feed and the profit or loss above feed cost for each cow in the herd. As more complete information was desired, an attempt was made to collect all available data pertaining to the dairies, from the raising of calves to the marketing of products.

#### METHODS OF SECURING DATA

**Duties of cooperator.**—In the original plan, a milk scale, a Babcock tester and suitable blanks for keeping records were loaned to dairymen applying for them, and they were instructed in their use. In return they were to send to the Station at the end of each month a report of the milk produced daily by each cow, the amount of feed consumed and the disposition of all products. From these data monthly summaries were computed and returned to the dairymen. These summaries showed the profit or loss above feed cost for each cow during the month and enabled the dairyman to select the profitable and unprofitable cows in his herd. Much of the information obtained was not complete and was frequently inaccurate because of poor methods of keeping records and lack of understanding of

methods. Therefore, when the more complete and accurate records were desired it became necessary to send someone to the dairies at regular intervals to take inventories, to get missing data and to give instructions in testing milk and keeping records. Many of the dairymen who had been cooperating up to this time quit because they were unwilling to furnish all the data required; the Station discontinued cooperation with others because their records did not seem to be reliable.

Blanks as follows were furnished to the cooperators.\*

1. **Monthly milk sheet.**—This was to be used for recording the amount of milk produced by each cow at each milking; the dates on which samples of milk were taken and tested; the percent of fat in the milk of each cow; the date on which each cow was bred; the date of calving; the sex and the weight of the calf at birth and the disposition and value of calf. The milk of each cow was to be tested once each month.

2. **Monthly feed sheet.**—On this was to be entered the amounts of each feed supplied daily to each animal; the number of days the animals were on pasture; the character and value of pasture; the proportions in the feed mixtures, whether feeds were purchased or produced, and the prices of all feeds.

3. **Monthly complete sheet.**—On this sheet was to be entered the hours of man and horse labor expended; the distribution of labor; the amount of product used, fed and sold and an itemized account of all expenses and of all income.

#### HOW RECORDS WERE HANDLED

**Duties of Station.**—The records were to be sent to the Ohio Experiment Station at the end of each month. From these records the Station computed a feed statement, which showed the amounts and the cost of each feed and of all feeds consumed by each animal and the herd; a herd statement which gave the amount of milk, the percent of fat in the milk, the amount of fat, the cost of feed, the value of product (based on the price received by the cooperator for the product sold) and the profit above feed cost for each cow; also the total production of milk and fat, the total cost of feed, total value of product and the total returns above feed cost for all the cows; and a complete statement which gave an itemized account of all expense and of all income for the herd. One copy of each of the above statements was sent to the cooperator and another was placed on file in the office.

At the beginning of each year a representative of the Station took an inventory of animals, buildings and equipment devoted to the dairy. On the inventory sheet was entered the name, the herd number, the breed, the age and the value of each animal in the herd,

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\*See Appendix.

the value of the land around the barn which was used as a lot for the cows, of the buildings, of the water supply and of the equipment used in the dairy.

When the cooperator had sent in records for 12 months the monthly statements were summarized and a yearly summary for the herd was made out. This summary gave the feed cost, labor cost, equipment charges, land and building charges, service fees, depreciation, interest, insurance and taxes on money invested in animals and miscellaneous charges, the production, the value of product, the value of calves at birth, the value of manure and the increase in the inventory value of animals for the herd and per animal for each class of animals in the herd. This summary also showed the cost and the income per 100 pounds of milk and per pound of fat, the labor cost and the feed cost per 100 pounds of milk and per pound of fat and the expense per dollar of income.

#### INFORMATION CONCERNING COOPERATORS

In the following tables are included data from eighty-four yearly summaries of thirty-three Ohio herds. There are yearly records of 1,124 cows. The dairy farms, whose managers were cooperating, varied in size from 42 acres to 270 acres. As a rule the larger herds were on the larger farms. The average number of acres in the farms of the cooperating dairymen was 141.

These farms were located in seventeen counties. All sections of the state were represented except the southwestern part. The counties which are devoted more intensively to dairying had the larger number of herds cooperating.

The dairymen who sent in records were evidently intellectually above the average in the State. It is not likely that dairymen much below the average would think it worth while to keep such detailed records for an entire year. The number of herds containing purebred animals is also an evidence of a desire to improve the dairies. A few of the cooperators were college graduates, many had attended college for a short time and the majority of them had had some previous experience in testing milk. There were others, however, who gained their experience in testing milk and keeping records from this cooperative work.

In one of the thirty-three dairy herds reported records were kept for 6 consecutive years; in seven, records were kept 5 years; three for 4 years; three for 3 years; three for 2 years and sixteen kept records for but 1 year. There were several other instances

where the dairymen kept records for an entire year or more, but because of errors in their reports the records could not be used.

The largest herd, whose owner cooperated, contained twenty-seven cows; the smallest contained 4.6 cows (an animal in the herd for a part of the year only is considered a fraction of a cow). There were seven herds which contained more than nineteen cows; there were thirteen herds that contained between ten and eighteen cows, inclusive, and thirteen herds which contained less than ten cows. The average number of cows in these 33 herds was 13.3.

In 13 herds the majority of the cows were purebred animals, either Jerseys, Holsteins or Shorthorns. Thirteen of the herds contained principally grades; that is, the animals had one-half, or usually more, of the blood of a recognized breed. The remaining seven herds which were reported contained but a small percentage of the blood of any of the improved breeds.

Table I gives some general information regarding the dairies cooperating.

TABLE I.—COOPERATING DAIRY HERDS: GENERAL INFORMATION

Number of herd	Time records were kept	Size of herd	Breed of cattle	Location	Size of farm
	<i>Years</i>	<i>Cows</i>		<i>County</i>	<i>Acres</i>
1	5	4.9	Shorthorn .....	Belmont .....	103
2	1	12.3	Grade Jersey .....	Williams .....	154
3	3	16.8	Grade Holstein .....	Williams .....	160
4	1	5.7	Grade Holstein .....	Clermont .....	125
5	1	6.3	Grades .....	Huron .....	94
6	5	20.2	Grade Jersey .....	Athens .....	220
7	3	21.0	Grades .....	Muskingum .....	132
8	1	9.8	Grades .....	Erie .....	130
9	1	12.9	Holstein .....	Geauga .....	90
10	1	5.8	Jersey .....	Columbiana .....	33
11	5	19.9	Grade Jersey .....	Muskingum .....	208
12	4	9.9	Grades .....	Belmont .....	126
13	3	11.7	Jersey .....	Trumbull .....	270
14	1	14.3	Grade Jersey .....	Ashtabula .....	73
15	5	8.8	Grades .....	Trumbull .....	58
16	1	8.3	Jersey .....	Belmont .....	72
17	1	9.0	Holstein .....	Geauga .....	101
18	1	19.8	Grade Holstein .....	Geauga .....	156
19	5	14.4	Grade Jersey .....	Erie .....	140
20	2	23.4	Holstein .....	Trumbull .....	190
21	1	14.4	Grades .....	Coshocton .....	225
22	1	17.6	Holstein .....	Summit .....	160
23	4	7.9	Jersey .....	Medina .....	82
24	6	14.8	Jersey .....	Columbiana .....	122
25	5	11.2	Grade Holstein .....	Lorain .....	209
26	2	12.1	Grade Holstein .....	Trumbull .....	154
27	1	4.6	Jersey .....	Columbiana .....	42
28	4	9.6	Jersey .....	Summit .....	109
29	2	16.6	Grades .....	Belmont .....	113
30	1	9.0	Grade Jersey .....	Mahoning .....	65
31	1	19.4	Holstein .....	Cuyahoga .....	80
32	5	15.9	Grade Holstein .....	Lorain .....	214
33	1	27.0	Grade Jersey .....	Columbiana .....	157



## COST SYSTEM USED BY COOPERATORS

**Determining feed costs.**—In reporting the amounts of the various grains fed to each animal daily, the cooperator did not always weigh each feed at each feeding. The amount of a given feed that a certain pail or scoop would contain was carefully determined, then as long as it was desirable to feed the same quantity of that particular grain or mixture it was unnecessary to make another weighing. If a grain mixture were being fed, which was usually the case, the proportion of each grain which was contained in the mixture was reported on the feed record. Some of the men accurately weighed the amounts of silage and other roughage that was supplied at each feeding. Others would weigh the amounts of the given feeds until they were able to judge closely the weight by the amounts that were in the basket or in a pile.

In calculating the cost of the various feeds, the actual price paid per 100 pounds or per pound was used. If the feeds were produced on the farm the price used was that which could have been obtained for them on the farm. The extra expense for hauling purchased feeds was included in the labor charges. Pasture was charged at the rate prevailing in the community.

**Cost of bedding.**—This is included in the total cost of feeds. It was rather difficult to obtain any exact figure on the amount of bedding actually used. In many cases the bedding consisted largely of refuse from the mangers. Some of the cooperators reported the amount of straw used, in addition to the refuse, but the majority of them preferred to have it estimated. When no bedding was reported it was estimated that 600 pounds of straw yearly was used for each cow or bull, 400 pounds of straw for each yearling, and 200 pounds of straw for each calf. The cost of the estimated straw was computed at current prices.

**Labor.**—The labor charge is the second item in importance in the cost of keeping a dairy herd. In this investigation all labor expended by both man and horse in the dairy work was reported. The man labor was divided into five classes: the regular daily work, which included (1) feeding, milking, care of cows and bulls, care of equipment and cleaning stables; (2) young-stock labor, which included all time spent in caring for the young stock; (3) manufacturing and marketing; and (4) other dairy work which included the time spent in hauling feeds, buying and selling animals, care of sick cows, etc.

The amount of time expended in the first four divisions of man labor did not vary greatly from day to day in any one herd. For

this reason it was not necessary to keep a record of the exact number of hours and minutes expended each day of the month. The cooperator usually kept an accurate account for a few days of the month, then if the size of the herd did not change and if the cows were given the same care, he would report the same amount of labor for each day of the month or until some change was made in the time required daily. It was necessary to keep an accurate account of the time spent in miscellaneous work.

**Cooperator's ability not considered.**—All industries, including the dairy, require some thought and skill, and if they are to be intelligently handled some person must assume this responsibility. Some investigators estimate this charge at 10 percent of the total cost of keeping a herd. In these reports, the cooperator reported only the hours actually spent in labor.

As the records were sent in the dairymen reported the rate per hour at which they valued man and horse labor. These rates varied greatly among the cooperators. The rate per hour of man labor ranged from 12½ cents to 25 cents and of horse labor ranged from 5 cents to 20 cents. In order that the labor charges of the various herds might be comparable, in making the yearly summaries, man labor was charged at 15 cents per hour and horse labor at 8.2 cents per hour in all of the herds.

**Land and buildings.**—The land and building charges were computed from the inventory values of the land in the barn lot, and of the buildings at the beginning and the end of the year. Generally some of the buildings were used for purposes other than the dairy, when this was done the dairy was charged with the percentage of the whole value which it used. Interest and taxes were charged on the land and buildings at the rate of 5 percent for interest and 1 percent for taxes. Three-tenths percent was charged for insurance on buildings. The first inventory values were used for calculating the interest, insurance and taxes.

The difference between the first inventory value plus any repairs and additions and the second inventory value constituted the depreciation. If no repairs were made on buildings during the year and the cooperator reported the same value at the beginning and at the end of the year, a depreciation of 3 percent was made in working up the yearly summary. The sum of the interest, insurance, taxes and the depreciation was charged against the herd for a land and buildings charge. In prorating the land and building charges among the various classes of animals in the herd, each cow or bull was considered one unit, each yearling two-thirds of a unit and each calf one-third of a unit.

**Equipment.**—The equipment inventory gave the values at the beginning and the end of the year of all equipment used in connection with the dairy. From these values the equipment charges of the dairy were computed. Interest, insurance and taxes were computed on the first inventory value of equipment (interest 5 percent, insurance 0.3 percent and taxes 1 percent.). The difference between the first inventory value plus repairs and purchases, and the second inventory value gave the depreciation on equipment. The sum of the interest, insurance, taxes and depreciation on equipment was the equipment charge. This charge was made against cows only.

**Service fees.**—When a bull was kept in the herd he was credited with enough herd service from the cows so that his yearly expense and income were equal. A bull would have an income by increasing in value, from outside service and from the value of manure. This income was subtracted from his total expense and the difference charged to the cows for service. If no bull was kept in the herd, the actual cost of service was used.

**Interest, insurance and taxes.**—Interest, insurance and taxes on animals which were in the herd at the beginning of the year were computed on the first inventory values of animals for the entire year or the exact number of days the animals were in a class. If an animal entered any class during the year, interest, insurance and taxes were computed on the value of the animal when it entered the class and for the exact number of days it remained. The combined rate of the interest, insurance and taxes on all classes of animals was 6.3 percent.

In taking the first inventory value of an animal the price for which the animal could have been sold was used. When the second inventory was being taken the market price was left out of consideration as much as possible. The object was to compare the individual at the time of the second inventory with itself at the time of the first inventory. In other words, would an animal like the individual was at the end of the year be worth more or less than an animal like it was at the beginning of the year?

**Depreciation and appreciation.**—When an animal changed from one class to another, as from the calf to the yearling or from the yearling to the cow class, the class which the animal was in was credited and the class to which the animal was changed was debited with the value of the animal when the change was made. The first inventory value, the purchases and the change in class debits were debited to each class of animals. The second inventory, the sales and the change in class credits were credited to each class of

animals. If that which was credited to any class was more than that which was debited, it was considered that the animals in that class had increased in value; if that which was credited was less the animals in that class had decreased. The amount which any class decreased or increased in value was used as the depreciation or the appreciation respectively for that class.

**Miscellaneous charges.**—Such expenses as for supplies, veterinary fees, hauling and freight were taken from the monthly complete records on which they were entered by the cooperator. The actual cost of these miscellaneous expenses was used.

**Young-stock loss.**—Records were kept of all expenses for and all income from the young-stock, as well as for the cows. When the expense was greater than the increase in value plus any other income the difference was called the loss on young-stock and was included in the gross expense of cows. In some herds the income from young-stock was greater than the expense; if such were the case the cows were credited with the gain on young-stock.

**Value of calves at birth.**—The value of calves at birth was credited to the cows and debited to the calf class. The value used was that reported by the cooperator when the calf was 3 days old.

**Value of manure.**—The value of manure was computed from the table in Henry & Morrison's "Feeds and Feeding," Sixteenth edition, which gives the fertilizing constituents of various feeds. The amount of each kind of feed consumed by each class of animals was multiplied by the factors given in the table, which represent the amounts of nitrogen, phosphoric acid and potash in that particular feed. In making these calculations, it was assumed that 75 percent of the nitrogen, 80 percent of the phosphoric acid and 80 percent of the potash in the feed were recovered in the manure; and that nitrogen was worth 16.3 cents per pound, phosphoric acid 4.3 cents per pound and potash 4.8 cents per pound. These figures are based on the tables of Henry & Morrison in "Feeds and Feeding" and on results obtained by the Ohio Station. Due to abnormal conditions (1918), it would be impossible to secure any of these constituents at the above prices.

**Milk and its products.**—In computing the value of product each cow was given credit for the actual amount of milk produced. When a calf consumed all or a part of the milk produced by a cow during a month, the yield of the cow was estimated for that time during which the calf took the milk. In estimating milk, the average daily yield of the cow during the 10 days immediately following the period when the calf consumed the milk was considered the daily yield of

the cow during the period when the milk was consumed by the calf.

If the dairyman did not make the same disposition of all his dairy product the number of pounds of milk, required to produce the amounts of the given products that were sold, was determined.

The number of pounds of butter was reduced to butterfat by multiplying the amount of butter by .857. When the product was sold as butterfat, 16 cents for each 100 pounds of whole milk was added for skimmilk. When the product was sold to a cheese factory, 8 cents for each 100 pounds of whole milk was added for the whey returned.

#### METHODS OF COMPUTING CHARGES

**Feed.**—In all the dairy herds except one the cost of feed was by far the largest single item of expense. In one herd it was more than four times as great as the next single item. Of such importance in dairying is the feed cost that dairymen frequently consider the profit or loss above feed cost the index of the financial condition of their herds. It will be recalled that this is all that was required by the Station when this cooperative work was started.

In Table II are listed the amounts of grain, silage, hay, stover and green feed consumed and the number of days the animals were on pasture. These amounts were yearly averages per cow by herds. If records of a herd were kept for but 1 year, these averages were obtained by dividing the total number of pounds of a given feed by the number of cows in the herd. When records were kept for more than 1 year, the sum of the amounts of any given feed consumed during the years in which records were kept, was divided by the sum of the average number of cows in the herd per year.

**Variation in amounts fed.**—It will be observed that there were great variations in the amounts of feeds supplied to the animals in the various herds. The yearly consumption of grain per cow in herd Number 31 was 2,804.1 pounds, in herd Number 3 each cow received 484.8 pounds. The cows in herd Number 31 received more than five times as much grain per cow in a year as those in herd Number 3. Similar variations existed among the other feeds. In one herd the average amount of silage consumed was 668.2 pounds per year, in another herd each cow received 10,363.4 pounds. Six of the cooperators fed no silage. As one would expect, the cows that received a small amount of grain usually received a larger amount of other feeds.

**Pasture charges.**—The average length of time the above animals were on pasture was 187.2 days, or a trifle more than one-half

of a year. One herd was pastured 71 days longer and another 56 days less than the average. Since pasture, at ordinary prices, furnishes one of the cheapest dairy feeds, a variation of a month more or a month less in the time that the cows are on pasture would have a noticeable influence on the cost of feed.

TABLE II.—AMOUNT OF FEED CONSUMED YEARLY PER COW BY HERDS

Number of herd	Grain	Silage	Hay	Stover	Green feed	Pasture
	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Days</i>
1.....	1,288.36		1,874.30	2,213.80	759.51	222.6
2.....	1,254.70			5,130.40		172.4
3.....	484.85		191.48	3,129.02	2,276.40	199.3
4.....	1,323.51	7,565.80		705.26		206.1
5.....	1,119.52		1,592.85	2,355.55	97.14	230.3
6.....	1,494.60	8,302.41	1,353.46	399.42		182.3
7.....	653.73	4,144.67	1,477.90	123.40	815.16	198.1
8.....	2,236.50	7,015.80	2,619.30		528.40	169.8
9.....	1,853.70	4,432.40	1,856.50			223.3
10.....	1,572.40	6,269.80	2,317.20		724.10	166.7
11.....	831.81	4,600.90	1,696.01	1,119.28	666.95	224.8
12.....	1,441.14	6,380.86	1,920.23	268.63		192.0
13.....	2,178.96	668.18	2,448.60	1,580.92	3,289.23	196.6
14.....	2,152.22		4,159.16	1,035.52	390.21	145.5
15.....	2,267.43	3,891.41	2,515.62	919.00	716.67	179.1
16.....	1,637.11	4,009.64	94.34	1,200.60	379.52	141.7
17.....	2,075.07	10,363.42	659.00			166.0
18.....	2,719.31	9,278.99	1,726.51		50.50	189.0
19.....	1,278.85	5,633.50	1,167.65	1,063.06	969.82	182.4
20.....	1,323.00	6,337.19	1,340.05	440.13		177.3
21.....	975.19	4,236.80		2,906.61		258.4
22.....	1,762.18		3,063.81	199.43	155.11	184.8
23.....	1,512.20	5,087.1	1,623.46	1,038.60	1,150.92	169.5
24.....	2,306.19	6,567.90	1,459.30	1,406.93	239.04	178.2
25.....	870.30	8,858.44	1,538.57	828.78	55.81	131.3
26.....	653.13	8,045.70	2,307.03	380.99	83.47	179.7
27.....	1,342.37	5,717.39	130.43	1,249.56		194.8
28.....	1,826.90	4,831.92	1,520.08	2,195.96	109.37	195.1
29.....	1,113.47	6,516.62	493.96	2,028.70	219.03	151.2
30.....	949.50	6,405.00	720.20	155.00	342.20	202.2
31.....	2,804.08	3,839.69	1,506.24	432.99		177.2
32.....	1,135.75	7,636.51	2,486.15	621.15	1,324.87	211.9
33.....	2,189.82	7,412.00	392.22		644.44	177.3
Average.....	1,534.48	4,970.66	1,462.17	1,064.50	484.48	187.18

**Feeds purchased.**—Six of the cooperators purchased all of the grain supplied to their herds. One of these cooperators had 125 acres in his farm and kept 5.7 cows; another had 225 acres and kept 14.4 cows and a third had 154 acres and kept 12.1 cows. On the other hand one man kept 14.3 cows on 73 acres and produced all of his grain and another kept 27 cows on 157 acres without purchasing any feeds. Sixty-two percent of the grain supplied to the herds of these cooperators was purchased. It seems that among the cooperators, there was but very little relation between the number of acres of land per cow on the farm and the percentage of grain purchased. There was not much roughage purchased. Only one man purchased any silage. Four men purchased small amounts of hay, and two men, some stover. Only 0.7 percent of all the roughage consumed was purchased.

The dairyman has an opportunity to save a great deal by raising his own feeds. It is probably not often that the actual cost of production of any feed is as great as the price that would be obtained for it on the farm. If in computing the cost of feed, in the following table, the cost of production had been used, it probably would have reduced the amount charged against feeds. Whether it is right to charge feeds to the dairy at the cost of production or at market prices, depends upon whether it is considered that all operations on the farm are a part of the dairy industry and are subordinate to it or whether the dairy is considered separate from the other farm operations. When the dairy is considered as a separate enterprise, the feeds must be charged to the dairy at market prices less cost of marketing. In this work all feeds were considered at market prices less cost of marketing. This was done because the object of this work was to show dairying conditions alone, and not how they might be influenced by factors apart from the dairy.

Table III shows the cost of each kind of feed together with the total feed cost per cow. Because each dairyman stated the price per 100 pounds or per pound of each feed consumed, the cost of feed per cow does not make as fair a basis as the amounts of the feeds, in making a comparison of the various herds. Market conditions vary in different communities and some managers are able to purchase feeds more economically than others, and some to sell at better prices than others.

**Variations in feed prices.**—The price per 100 pounds of grain as reported by the cooperators varied from \$0.88 to \$1.65. The average price of grain for all the herds was \$1.32 per 100 pounds. The average price per ton of silage was \$3.72; for hay, \$13.30; for stover, \$5.08; green feed was \$3.92 per ton, and \$1.29 was the monthly charge for pasture. Thirty-nine and eight-tenths percent of the entire feed cost was spent for grain, 18.1 percent for silage, 19.1 percent for hay, 5.3 percent for stover, 1.9 percent for green feed and 15.8 percent for pasture.

As in the case of individual feeds, there were great variations among the cooperators in the total cost of feed per cow. According to the records, one man's feed cost was only \$30.67 per year for each cow, another had a feed cost of \$73.16 per cow. In one-third of these 33 herds the average yearly feed cost was \$66.57 per cow; for another one-third it was \$51.45; and for the other one-third it was \$39.64. (The reader should bear in mind that these were the feed costs during the period 1910-1915.) Fifty percent of the grain was purchased in those herds with a feed cost of \$39.64, 61 percent of it was purchased with a feed cost of \$66.57.

TABLE III.—YEARLY FEED AND BEDDING COST PER COW

Number of herd	Grain	Silage	Hay	Stover	Green feed	Pasture	Bedding	Total cost
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
1	13.75	.....	11.13	4.55	1.73	10.02	.88	42.06
2	17.60	.....	.....	11.28	.....	10.07	2.25	41.20
3	4.51	.....	1.41	10.24	4.71	10.35	2.14	33.35
4	18.26	18.91	.....	2.21	.....	8.34	.....	47.92
5	11.81	.....	7.09	3.53	.53	7.10	.61	30.67
6	19.49	16.60	7.90	.70	.....	6.48	1.27	52.44
7	8.90	8.29	10.81	1.84	.07	8.78	.92	39.61
8	24.71	15.88	22.33	.....	.79	7.50	1.95	73.16
9	23.93	7.45	12.75	.....	.....	5.97	1.62	51.72
10	26.05	9.40	16.22	.....	2.17	5.43	1.42	60.69
11	12.03	10.25	11.43	1.68	1.52	10.13	.97	48.01
12	22.99	11.99	13.70	.49	.....	8.06	2.05	59.28
13	31.19	1.52	15.92	4.50	7.32	10.11	1.44	72.00
14	23.75	.....	23.00	4.14	1.18	5.73	2.09	64.89
15	33.27	6.11	16.09	3.96	.87	6.00	1.76	68.06
16	22.38	7.82	.94	2.20	.77	6.98	2.15	43.24
17	27.11	20.73	6.17	.....	.....	7.50	.33	61.84
18	37.49	13.92	14.15	.....	.76	4.43	2.13	72.88
19	19.11	11.06	6.84	2.42	1.63	5.89	1.12	48.07
20	16.91	9.42	9.85	.78	.....	4.81	.75	42.52
21	8.63	10.59	.....	5.04	.....	11.20	1.59	37.05
22	22.48	.....	21.45	3.99	.16	5.44	2.01	55.53
23	21.44	7.06	9.24	2.81	2.09	9.87	1.56	54.07
24	33.35	9.90	9.49	3.39	.25	8.27	1.09	65.74
25	10.86	13.60	6.42	1.50	.17	4.55	1.56	41.66
26	9.90	19.78	15.56	.76	.34	7.56	.32	54.22
27	18.51	11.43	.91	2.70	.....	10.01	1.69	45.25
28	22.50	7.91	9.38	9.16	.22	15.11	4.45	68.73
29	11.74	9.77	3.59	3.04	.22	10.66	1.62	40.64
30	13.10	15.46	5.28	.31	.68	8.88	.28	43.99
31	34.79	7.68	11.45	.87	.....	6.65	3.52	64.96
32	15.98	10.88	15.04	1.30	2.17	10.76	1.24	57.37
33	27.11	11.85	2.26	.....	1.07	6.89	2.11	51.29
Average..	20.33	9.25	9.72	2.71	.95	8.05	1.54	52.55

Note—It should be kept in mind that these prices cover the period from 1910 to 1915.

In those cases where the cooperator kept records for more than 1 year, the variation in the feed cost per cow from year to year was not as great as the variations among the different herds. There were, however, some rather marked variations. One man with a herd of 15 cows had a feed cost during the second year of more than \$24 per cow more than during the first year. In another herd of 10 cows the feed cost during the second year was more than \$19 per cow less than during the first year. A glance at the profits per cow during these years shows that the one cooperator was justified by the return in increasing his feed cost and the other in decreasing his. During the first year of keeping records, the feed cost of herd Number 24 was \$51.72 and the profit per cow was \$12.32; during the second year the feed cost was \$75.65 and the profit was \$51.30, making an increase of \$23.93 in the feed cost and an increase of \$38.95 in the profit. In herd Number 28 during the first year the cost of feed was \$81.85 and the profit per cow was \$23.52; during the second year the cost of feed was \$62.81 and the profit per cow



was \$41.95, making a decrease of \$19.04 in the cost of feed per cow and an increase of \$18.43 in profit.

**Labor.**—Where general farming is practised in connection with the dairy, as it was on all of these farms, the labor question does not present the difficulties that it does on specialized dairy farms. No extra help was hired, especially for dairy work, by any of these dairymen. The men who did the work in the fields assisted with the milking. Some of the cooperators managed their farms and dairies without any outside help, either they or their families attending to all of the work. Table IV shows the hours of man and of horse labor and the labor cost per cow for each herd. Man labor was valued at 15 cents per hour, and horse labor at 8.2 cents per hour.

TABLE IV.—LABOR COST PER COW BY HERDS

Number of herd	Man labor		Horse labor		Total cost
	Hours	Cost at 15 cents per hour	Hours	Cost at 8.2 cents per hour	
		<i>Dollar</i>		<i>Dollars</i>	<i>Dollars</i>
1.....	215.8	32.37	58.78	4.82	37.19
2.....	245.3	36.80	109.39	8.97	45.77
3.....	108.7	16.30	8.78	.72	17.02
4.....	117.4	17.61	7.20	.59	18.20
5.....	153.7	23.06	2.93	.24	23.30
6.....	164.0	24.60	7.68	.63	25.23
7.....	141.1	21.17	38.66	3.17	24.34
8.....	205.9	30.89	37.34	3.06	33.95
9.....	156.3	23.43	6.95	.57	24.00
10.....	155.7	23.36	21.58	1.77	25.13
11.....	178.3	26.74	13.54	1.11	27.85
12.....	210.6	31.59	18.90	1.55	33.14
13.....	187.1	28.07	41.47	3.40	31.47
14.....	163.7	24.55	19.63	1.61	26.16
15.....	194.4	29.16	35.73	2.93	32.09
16.....	217.6	32.64	96.83	7.94	40.58
17.....	193.5	29.02	19.51	1.60	30.62
18.....	173.3	25.99	31.83	2.61	28.60
19.....	188.6	28.29	5.98	.49	28.78
20.....	124.0	18.60	17.56	1.44	20.04
21.....	127.3	19.10	35.25	2.89	21.99
22.....	128.5	19.28	28.04	2.30	21.58
23.....	149.3	22.39	.06	.01	22.40
24.....	159.3	23.90	25.00	2.05	25.95
25.....	139.8	20.97	7.29	.60	21.57
26.....	193.4	29.01	23.78	1.95	30.96
27.....	146.5	21.98	2.81	.23	22.21
28.....	181.4	27.21	27.44	2.25	29.46
29.....	160.0	24.00	67.70	5.55	29.55
30.....	161.3	24.20	12.20	1.00	25.20
31.....	88.3	13.25	32.69	2.68	15.93
32.....	92.0	13.80	21.21	1.74	15.54
33.....	150.3	22.54	.....	.....	22.54
Average.....	162.8	24.42	26.78	2.20	26.62

There were great variations among the cooperators in the amount of labor per cow. In herd Number 31 only 88.3 man hours were spent on each cow during the entire year. This would be a

trifle less than 15 minutes per day for each cow. In herd Number 2 each cow received 245.3 hours per year, or a little more than 40 minutes per day. The average yearly number of man hours per cow was 162.8, or almost 27 minutes per cow daily. Where an equal quality of milk is produced and the same disposition is made of the product, the labor cost should not vary greatly among different herds. Variations in the amounts of labor expended may be due to the disposition of the product, the convenience of buildings and equipment and to the care and attention given to sanitary conditions.

The cost of horse labor per cow is not a very large item. On these farms it ranged from nothing to \$8.97 per cow. The average cost was \$2.20 per cow. The cost of horse labor constituted about 8 percent of the entire labor charge.

#### DETERMINING OTHER CHARGES

**Land and buildings charge.**—As the land and buildings charge for cows is the sum of the interest, insurance, taxes, repairs and depreciation on buildings and the interest and taxes on land, one can readily see that there will be great variations in this charge among the cooperators. The man who has a large investment per cow in buildings will have a heavy land and buildings charge, and the man who has a small investment in buildings will have a light charge. Economy considered, the dairyman should have no greater investment in buildings than will provide for the comfort and health of his animals, for the sanitary condition of his product, and for the convenience of himself.

Among these cooperators the land and buildings charge varied from \$0.94 to \$16.26 per cow. It is quite probable that the cows with a land and buildings charge of \$0.94 would have been more profitable if they had been housed more comfortably, while on the other hand it is quite likely that the cows with a charge of \$16.26 would have produced fully as well if the buildings had been less expensive. The average land and buildings charge per cow was \$5.68.

**Equipment charge.**—It is rather difficult to determine just how much equipment is necessary to most efficiently handle a dairy. One might be able to do without some article which another would consider absolutely necessary. Also, in the matter of cost, cheap equipment might be satisfactory for some dairymen while others would demand more expensive articles. The disposition of product has much to do with the amount of equipment needed. The average

equipment charge when product was sold as whole milk, was \$1.84; when sold as cream it was \$3.24, and as butter it was \$1.85 per cow. The average per cow for all herds was \$2.11.

**Service fees.**—The initial cost of the bull and the number of cows served are the two principal factors in determining the service fee per cow. Aside from interest, insurance, taxes and depreciation it cost practically as much to keep a scrub as a purebred bull.

In some cases the appreciation of the bull and the credit for outside service were greater than the total expense of the bull. When such was the case, as in herds Number 17 and Number 29, the cows were credited with the extra bull service.

The service fees in these 33 herds ranged from an actual credit to an expense of \$12.51 per cow. In herd Number 26 at the beginning of 1 year the herd bull was valued at \$300. During that year the cattle became diseased and it was necessary to sell the bull for \$99. This was a direct loss of \$201. Including the other cost of the bull this made a total charge of \$279.93 for service fees. As there were 12.1 cows in the herd that year, each cow was charged with a service fee of \$22.63. The other year that records were kept of this herd the service fee was only \$2.38 per cow, making an average of \$12.51 per cow for the 2 years. The average service fee per cow for all of the herds was \$1.72.

**Interest, insurance and taxes on cows.**—As a uniform rate, 6.3 percent was used throughout; this charge varied directly with the inventory value of the cows. The lowest charge was \$2.29 and the highest \$11.65 per cow. The average charge for all of the herds cooperating was \$4.39.

**Depreciation and appreciation.**—Due to the fact that the investment in cows was small, the average depreciation on cows for these herds was not large. A poor or scrub cow is usually worth as much for beef as a purebred animal and frequently there is not much difference between the beef value and the dairy value of a poor-producing cow. There is, however, a great difference between the beef value and the dairy value of a good cow.

In 14 of the 33 herds cooperating there were increases in the value of the cows at the end of the year. These increases ranged from \$0.11 to \$12.51 per cow. In several herds this increase was due to the fact that there were a few purebred cows and a purebred bull in the herd and that the scrub cows were being replaced by purebred heifers. In two herds there was no appreciation or depreciation. It was considered that the cows were worth as much when the year ended as when it began. This is possible when records

are kept for a short time only. It is possible for a dairyman to have a herd of young cows which are worth as much or more at the end than they were at the beginning of the year. If records were kept for several years, however, the depreciation would become quite large and would tend to bring the average depreciation about the same as for the man who had a herd composed of both young and old cows. Occasionally, dairymen keep their depreciation at a minimum by selling their cows just before they begin to depreciate because of their age. When this is done the seller escapes the depreciation, but the buyer has it to carry. In 17 herds there were decreases in the value of the cows; these decreases ranged from \$0.11 to \$47.06 per cow. The high depreciation charge in herd Number 26 was due to disease. The average depreciation for the 33 herds was \$2.47 per cow.

**Miscellaneous charge.**—The miscellaneous charge includes supplies, veterinary service, hauling and freight, etc. These charges were entered at their actual cost. The average charge for supplies was 45 cents; for veterinary service 21 cents; and for hauling and freight was \$2.23 per cow.

TABLE V.—OTHER COSTS PER COW BY HERDS

Number of herd	Land and building charge	Equipment charge	Service fees	Interest, insurance and taxes	Depreciation and appreciation	Miscellaneous charge
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
1.....	11.85	2.30	5.64	5.49	+12.51	.....
2.....	4.69	3.94	2.40	4.05	+ 5.72	.39
3.....	2.05	2.04	2.84	3.00	- 1.33	.52
4.....	4.62	1.58	.18	2.68	.....	.19
5.....	1.24	1.09	1.54	3.49	-11.11	.....
6.....	4.87	1.41	.87	2.75	+ 2.19	5.00
7.....	.94	1.90	1.79	2.29	+ .55	.02
8.....	12.65	1.85	2.22	4.65	- 4.08	11.98
9.....	4.28	1.35	+4.55	4.01	.....	5.44
10.....	7.71	8.24	3.40	5.00	-15.86	1.08
11.....	3.06	1.91	1.20	3.37	- 2.01	.11
12.....	3.37	2.37	1.85	3.75	+ 6.14	2.75
13.....	12.61	1.35	5.50	8.01	- .11	2.63
14.....	12.04	1.33	1.39	2.36	- 2.80	.06
15.....	5.77	1.47	.75	4.48	+ .74	.04
16.....	2.08	1.87	1.87	4.13	-13.13	.18
17.....	7.14	5.81	.....	5.71	- 1.11	4.02
18.....	3.91	1.83	3.14	6.02	- 9.80	20.68
19.....	6.18	1.55	.08	3.74	+ 3.58	3.41
20.....	5.12	.67	1.79	4.29	- 1.96	17.82
21.....	5.11	1.38	.93	2.99	+ 6.25	.10
22.....	4.46	1.73	2.72	2.65	+ .28	1.02
23.....	3.16	3.96	+ .26	3.89	+ .48	1.16
24.....	4.20	1.79	2.54	6.65	+ 5.10	1.08
25.....	2.37	1.09	2.12	7.27	- 3.58	1.11
26.....	16.26	3.44	12.51	11.65	-47.06	.76
27.....	2.91	2.00	.87	3.44	+ .11	3.99
28.....	7.93	2.27	1.04	3.02	+ 4.07	.89
29.....	2.12	1.41	+2.59	3.06	- 4.32	.23
30.....	5.87	.17	1.99	3.92	+ 6.28	.....
31.....	4.45	1.32	1.57	4.98	- 5.95	10.28
32.....	6.24	3.03	+1.08	5.03	- 6.74	1.70
33.....	6.35	.24	.37	3.09	- 4.90	.53
Average.....	5.68	2.11	1.72	4.39	- 2.47	3.01

**Total cost.**—Table VI gives the total cost per cow and the percentage of the total cost that was expended for feed, labor and other items of cost. The appreciation and the credit for outside service was subtracted from the total cost in each case.

TABLE VI.—RELATION OF FEED, LABOR AND OTHER COSTS

Number of herd	Total cost	Percentage of cost expended in		
		Feed	Labor	Other costs
	<i>Dollars</i>	<i>Percent</i>	<i>Percent</i>	<i>Percent</i>
1.....	92.02	46	40	14
2.....	96.72	43	47	10
3.....	62.15	54	27	19
4.....	75.37	64	24	12
5.....	72.44	42	32	26
6.....	90.38	58	28	14
7.....	70.34	56	35	9
8.....	144.54	51	23	26
9.....	86.25	60	28	12
10.....	127.11	48	20	32
11.....	87.52	55	32	13
12.....	100.37	59	33	8
13.....	133.68	54	23	23
14.....	111.03	58	23	19
15.....	111.92	61	29	10
16.....	107.08	40	38	22
17.....	116.25	53	26	21
18.....	146.86	50	19	31
19.....	88.23	54	33	13
20.....	94.21	45	21	34
21.....	63.30	58	35	7
22.....	89.41	62	24	14
23.....	87.90	62	25	13
24.....	102.85	64	25	11
25.....	80.77	51	27	22
26.....	176.86	31	17	52
27.....	80.56	56	28	16
28.....	109.27	63	27	10
29.....	78.74	52	37	11
30.....	74.86	59	34	7
31.....	109.44	59	15	26
32.....	94.57	61	16	23
33.....	89.31	58	25	17
Average.....	98.55	54	28	18

From the variations existing in the separate items of expense one would expect to find considerable variation in the total cost. The total cost ranged from \$62.15 per cow in herd Number 3 to \$176.86 per cow in herd Number 26. The total cost in herd Number 26 was almost three times as great as in herd Number 3. The average total cost of one-third of these herds was \$126.73, of another one-third \$93.27, and of the remaining herds \$75.66 per cow. The average cost per cow for all the herds was \$98.55.

In 26 of these herds between 50 percent and 65 percent of the total cost was spent for feed, and in 18 herds between 20 percent and 30 percent of the cost was used for labor. In seven herds more than 60 percent of the total cost was expended for feed. In one herd the feed cost was only 31 percent of the total cost. In herd

Number 2, 47 percent of the cost was used for labor. In this herd the labor cost was higher than the feed cost. In another herd the labor cost was only 15 percent of the total. The other cost ranged from 7 percent to 52 percent of the total. In several herds the other costs were higher than the labor costs, and in one herd, due to the abnormal depreciation charge, they were higher than the combined feed and labor costs. Considering the 33 herds, 54 percent of the total cost was spent for feed, 28 percent for labor and 18 percent for other costs.

**Summary of costs.**—In work of this kind, all items of cost should be expressed, as far as possible, in terms of quantities rather than in dollars and cents. The market price of feed and the rate per hour at which labor can be hired vary greatly from time to time. Figures based on dollars and cents are of value for a short time only, because of the frequent changes in the purchasing power of a dollar. Cost accounts in terms of quantities, on the other hand, do not lose their value, for they can be converted into money values at any time by multiplying them by current prices.

It is not difficult to express in terms of quantities the two large items of expense in the cost of producing milk. The other costs, exclusive of feed and labor, cannot be expressed in quantities. Since the interest, insurance, taxes and depreciation vary directly and the other items to a large extent with the value of the cow, one can obtain close estimates of these expenses by expressing them in percentages of the value of the cow.

That it is possible to express the costs other than feed and labor, in terms of their relation to the value per cow, with some degree of accuracy is shown by the close agreement between the figures obtained in this investigation and those reported in Bulletin 501, of the U. S. Department of Agriculture.

TABLE VII.—RELATION OF COSTS OTHER THAN FEED AND LABOR TO INVENTORY VALUE OF COW

	Ohio		U. S. Bul. No 501	
	Charges	Value of cow	Charges	Value of cow
	<i>Dollars</i>	<i>Percent</i>	<i>Dollars</i>	<i>Percent</i>
Value of cow.....	69.70	.....	68.55	.....
Land and building charge.....	5.68	8.1	5.74	8.4
Equipment charge.....	2.11	3.0	2.14	3.1
Interest, insurance and taxes.....	4.39	6.3	*3.43	*5.0
Service fees.....	1.72	2.5	2.44	3.6
Depreciation.....	2.47	3.5	2.41	3.5
Miscellaneous.....	3.01	4.3	2.05	3.0
Total.....	.....	27.7	.....	26.6

\*Interest only.

The costs other than feed and labor average according to our figures 27.7 percent and according to the U. S. Department's figures 26.6 percent of the value of the cow. If insurance and taxes, 1.3 percent, had been added to the U. S. D. A. figures, as they were to our own, there would be a difference of only 0.2 percent.

Table VIII gives the average amounts of each kind of feed consumed and the number of hours of labor expended in the care of the dairy and the other costs expressed in percentages of the value of the cow. This table is a summary of some of the preceding tables. Under the heading, "Old prices," the amounts are calculated at the prices reported by the cooperator. Under the heading, "Present prices," they are calculated at approximately present prices (1918).

TABLE VIII.—AVERAGE YEARLY EXPENSE PER COW

	Old prices	Present prices
Feed consumed—	<i>Dollars</i>	<i>Dollars</i>
1,534 pounds of grain.....	20.33	38.35
4,971 pounds of silage.....	9.25	24.86
1,462 pounds of hay.....	9.72	13.16
1,064 pounds of stover.....	2.71	4.26
484 pounds of green feed.....	.95	2.42
187 days on pasture.....	8.05	18.70
770 pounds of straw for bedding.....	1.54	3.85
162.8 hours of man labor.....	24.42	40.70
26.8 hours of horse labor.....	2.20	4.02
Land and building charge (8.1 percent of value of cow).....	5.68	8.0
Equipment charge (3.0 percent of value of cow).....	2.11	3.00
Interest, insurance and taxes (6.3 percent of value of cow).....	4.39	6.30
Service fees (2.5 percent of value of cow).....	1.72	2.50
Depreciation (3.5 percent of value of cow).....	2.47	3.50
Miscellaneous (4.3 percent of value of cow).....	3.01	4.30

When one has the feed and the labor expressed in quantities and the other items of expense in percentages of the investment value per cow, the approximate expense of keeping a cow can be brought up to date at any time regardless of the changes in market prices.

#### DETERMINING CREDITS

**Calves.**—Since the cows were charged with a service fee it is necessary to credit them with the birth values of their calves. In this work the cooperator placed a value on each calf when it was 3 days old. This value was credited to the cows. A calf at that age may vary in value, depending on the breeding, locality, market conditions, etc., from nothing to \$100 or more. In herd Number 29 the average value of each calf was \$0.91, while in herd Number 25 the average value was \$41.02. The average birth value of all the calves in the thirty-three herds was \$7.56.

**Manure.**—As previously stated, the value of manure was based on the fertilizing constituents of the feed. The value of manure

depends upon the character of the feeds consumed. Feeds which are rich in nitrogen, phosphoric acid and potash make good manure, while those which are deficient in these constituents make poor manure. The manurial values of individual feeds vary greatly. According to the calculations used in this bulletin, corn would have a manurial value of \$4.68 per ton, oats of \$5.83 per ton, oilmeal of \$16.63 per ton, cottonseed meal of \$18.77 per ton, clover hay of \$6.52 per ton and corn silage \$1.28 per ton.

Table IX gives the amounts and the values per cow of the fertilizing constituents recovered in the manure.

TABLE IX.—FERTILIZING CONSTITUENTS RECOVERED IN MANURE

Herd number	Nitrogen		Phosphoric acid		Potash		Total value
	Amount	Value	Amount	Value	Amount	Value	
1.....	82.04	<i>Dollars</i> 10.02	30.88	<i>Dollars</i> 1.06	69.76	<i>Dollars</i> 2.66	<i>Dollars</i> 13.74
2.....	83.51	10.20	50.11	1.73	74.21	2.84	14.77
3.....	68.74	8.40	30.07	1.04	57.16	2.18	11.62
4.....	77.62	9.48	41.54	1.43	56.18	2.15	13.06
5.....	79.55	9.72	30.82	1.06	71.52	2.73	13.51
6.....	95.63	11.69	43.13	1.49	70.93	2.71	15.89
7.....	70.22	8.58	33.16	1.14	64.08	2.45	12.17
8.....	160.80	19.65	51.87	1.79	93.76	3.58	25.02
9.....	109.40	13.37	46.25	1.60	85.33	3.26	18.23
10.....	100.57	12.29	39.45	1.36	71.58	2.73	16.38
11.....	91.94	11.24	35.89	1.24	86.66	3.31	15.79
12.....	101.48	12.40	41.81	1.44	79.36	3.03	16.87
13.....	138.56	16.93	49.47	1.71	106.41	4.06	22.70
14.....	147.96	18.08	55.87	1.93	121.22	4.63	24.64
15.....	94.33	11.53	54.85	1.89	79.41	3.03	16.45
16.....	149.37	18.25	65.11	2.25	101.05	3.86	24.36
17.....	87.97	10.75	55.93	1.93	62.97	2.40	15.08
18.....	174.67	21.34	65.23	2.25	100.55	3.84	27.43
19.....	100.86	12.32	41.15	1.42	75.42	2.88	16.62
20.....	90.72	11.09	36.26	1.25	70.33	2.69	15.03
21.....	61.33	7.50	28.79	.99	62.50	2.39	10.88
22.....	105.09	12.84	32.17	1.11	65.50	2.50	16.45
23.....	115.01	14.05	46.66	1.61	84.15	3.22	18.88
24.....	134.79	16.47	57.87	2.00	97.04	3.71	22.18
25.....	91.19	11.14	41.28	1.42	86.19	3.29	15.85
26.....	93.29	11.40	35.32	1.22	90.62	3.46	16.08
27.....	84.57	10.33	30.43	1.05	51.37	1.96	13.34
28.....	120.36	14.71	45.82	1.58	93.64	3.58	19.87
29.....	87.07	10.64	31.15	1.08	68.68	2.62	14.34
30.....	69.15	8.45	31.79	1.10	58.26	2.22	11.77
31.....	121.39	14.83	49.07	1.69	70.27	2.68	19.20
32.....	135.19	16.52	48.35	1.67	100.46	3.84	22.03
33.....	103.49	12.65	37.57	1.30	60.50	2.31	16.26
Average.....	103.87	12.69	42.88	1.48	78.40	2.99	17.17

**Determining manurial value.**—The column showing the amounts of nitrogen recovered in the manure, enables one to determine something of the quality of the feeds consumed, since the total nitrogen consumed multiplied by 6.25 gives the crude protein consumed. There were considerable variations in the amounts of nitrogen supplied to these cows in their feeds. In herd Number 18 the average amount of nitrogen in the feed of each cow was 232.8 pounds, while in herd Number 21 each cow received only 81.73 pounds. The average amount per cow for all herds was 138.5 pounds.



By comparing Table IX with Table II it will be observed that it was not always the herds which received the largest quantities of feed that gave the largest returns from manure. In herd Number 16, for instance, each cow received 1,637 pounds of grain, 4,009 pounds of silage, 94 pounds of hay, 1,200 pounds of stover and 379 pounds of green feed, and in herd Number 33 each cow received 2,190 pounds of grain, 7,412 pounds of silage, 392 pounds of hay and 644 pounds of green feed. Each cow in herd Number 33 received more than 500 pounds more grain and almost 300 pounds more roughage than those in herd Number 16. Yet there were 45.88 pounds more nitrogen, 27.54 pounds more phosphoric acid and 40.55 pounds more potash in the feed supplied to each cow in herd Number 16 than there were in the feed supplied to herd Number 33. Calculating the money value, as above, of fertilizing constituents of the feeds supplied to herds Number 16 and Number 33, we find that the value of the manure in herd Number 16 was \$30.28 per cow, while that in herd Number 33 was only \$20.33. The average value of manure per cow for all herds was \$17.17. When purchasing feeds, dairymen would do well to consider the fertilizing constituents, as well as the feeding value.

Table X gives the yearly production of milk and butterfat of the highest and the lowest producers and the average production of all cows in each herd. It was impossible to get the amounts of fat produced by four of the herds reported. These four herds were, therefore, eliminated in getting the average production of fat. The number of cows in each herd and the breed represented can be learned from Table I.

#### DETERMINING THE COST OF MILK PRODUCTION

The average production per cow of the thirty-three herds was 5,884 pounds of milk and 255.4 pounds of fat. The average production of the best cow in each herd was 7,878.5 pounds of milk and 333.33 pounds of fat, while the average of the poorest cow in each herd was 4,108.2 pounds of milk and 183.1 pounds of fat. There were some very good herds cooperating with the Station. One herd of 19.8 cows averaged 9,400.2 pounds of milk per cow; another herd of 14.8 cows had an average production of 6,322 pounds of milk and 337.13 pounds of fat. That these cows were considerably better than the average cow of the state is quite evident. The average amount of milk produced in Ohio in 1909 was about 3,500 pounds per cow, according to the U. S. Census for 1910, while the average of the lowest producer in each herd where records were kept was more than 4,100 pounds.

TABLE X.—PRODUCTION PER COW PER YEAR BY HERDS

Herd number	Milk			Butterfat		
	Highest	Lowest	Average	Highest	Lowest	Average
	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
1.....	6,570.1	4,433.8	5,645.20	291.20	198.09	246.98
2.....	8,459.9	5,314.5	6,243.70	316.40	224.34	254.46
3.....	6,510.5	3,006.0	4,485.20	286.50	138.54	207.47
4.....	6,250.6	4,425.9	4,945.50	254.30	163.51	192.32
5.....	6,469.4	4,416.8	5,751.10	261.90	168.86	231.13
6.....	6,598.7	2,552.0	5,451.20	342.20	141.79	265.18
7.....	5,947.0	2,478.7	3,761.96	250.60	112.54	165.35
8.....	9,386.6	5,225.0	6,643.97	413.40	227.23	322.36
9.....	8,926.9	4,652.9	6,950.58	280.70	162.06	232.70
10.....	6,631.0	4,528.3	5,100.26	348.00	240.02	282.18
11.....	7,386.0	3,430.5	5,245.44	360.00	193.15	264.49
12.....	8,669.2	4,513.2	6,223.04	447.33	243.29	328.69
13.....	7,522.8	4,242.4	5,464.27	397.22	225.52	298.13
14.....	5,818.7	2,809.1	4,329.58	250.46	129.45	195.27
15.....	8,285.2	3,721.6	6,348.29	338.04	149.09	260.65
16.....	5,782.4	3,096.4	4,457.47	299.34	188.97	227.36
17.....	9,449.4	4,387.6	6,797.48	.....	.....	.....
18.....	10,852.9	5,036.7	9,400.19	.....	.....	.....
19.....	7,657.3	3,252.6	5,509.51	387.95	201.12	307.05
20.....	8,942.6	4,553.6	6,586.68	300.91	159.46	231.93
21.....	7,737.5	3,540.0	5,102.40	268.26	154.09	190.70
22.....	10,030.2	5,693.8	7,226.10	323.77	193.06	256.49
23.....	6,743.2	3,090.6	5,910.35	361.46	156.34	291.57
24.....	8,375.0	4,250.0	6,322.47	461.68	205.93	337.13
25.....	8,412.9	4,090.2	6,151.60	280.16	135.65	209.06
26.....	8,059.4	4,117.8	5,909.45	301.08	136.38	194.87
27.....	6,847.3	3,468.7	5,108.72	284.27	186.89	248.10
28.....	10,910.4	4,708.0	6,444.12	463.39	248.99	326.22
29.....	7,843.1	5,339.9	5,975.66	338.23	227.83	277.82
30.....	5,870.1	4,267.1	5,113.90	317.25	194.95	284.54
31.....	8,759.2	4,826.7	6,568.10	.....	.....	.....
32.....	9,481.7	3,368.7	6,665.83	.....	.....	.....
33.....	8,803.9	4,730.0	6,033.80	440.61	202.99	274.95
Average.....	7,878.52	4,108.15	5,884.03	330.33	183.1	255.35

Variations in yields per cow.—The variations in the yields of milk of individual cows in a herd often has more influence on the cost of production than any other factor. In two of these thirty-three herds there was a difference in the production of more than 6,000 pounds of milk between the best and poorest cows; in two other herds there was a difference of more than 5,000 pounds, and in twelve other herds there was a difference of more than 4,000 pounds of milk. In these sixteen herds the average yearly production of the poorest cow in each herd was 4,267 pounds of milk, while the average yearly production of the best cow in each of these herds was 8,907 pounds. The production of the best cows was more than twice as much as that of the poorest.

The income from milk includes the milk products which were sold as well as those which were used on the farm. The entire amount of milk produced was calculated at the price received for that which was sold. (See Table XI.)

TABLE XI.—CREDITS PER COW PER YEAR BY HERDS

Herd	Milk	Calves	Manure	Total
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
1.....	116.96	12.67	13.76	143.39
2.....	132.25	3.74	14.77	150.76
3.....	64.93	2.06	11.62	78.61
4.....	66.82	1.84	13.06	81.72
5.....	77.20	3.81	13.52	94.53
6.....	99.86	2.40	15.88	118.14
7.....	75.68	1.55	12.17	89.40
8.....	136.63	18.16	25.02	179.81
9.....	85.15	3.41	18.22	106.78
10.....	86.45	1.38	16.38	104.21
11.....	87.73	5.78	15.78	109.29
12.....	124.42	4.34	16.87	145.63
13.....	128.72	9.24	22.70	160.66
14.....	76.13	1.92	24.64	102.69
15.....	126.65	2.54	16.45	145.64
16.....	79.48	2.89	24.36	106.73
17.....	78.10	15.00	15.08	108.18
18.....	166.46	12.45	27.44	206.35
19.....	95.59	1.90	16.63	114.12
20.....	113.28	7.68	15.02	135.98
21.....	71.84	1.04	10.88	83.76
22.....	86.01	3.04	16.45	105.50
23.....	94.48	3.48	18.88	116.84
24.....	121.78	21.21	22.17	165.16
25.....	76.39	41.02	15.86	133.27
26.....	80.07	39.01	16.08	135.16
27.....	77.17	2.17	13.35	92.69
28.....	134.42	4.06	19.87	158.35
29.....	126.08	.91	14.34	141.33
30.....	103.79	4.94	11.77	120.50
31.....	114.00	3.47	19.21	136.68
32.....	86.40	8.94	22.03	117.37
33.....	85.78	1.33	16.25	103.36
Total.....	3,276.70	249.38	566.51	4,092.59
Average.....	99.29	7.56	17.17	124.02

Because of the variations among the dairies in the receipts per unit of product, the income per cow from milk as shown in Table XI does not give a fair basis for comparing the various herds. In herd Number 17 the average price at which whole milk was sold was only \$1.15 per 100 pounds, while in herd Number 13 the average price was \$2.36 per 100 pounds. The average price of milk for the 33 herds was \$1.69 per 100 pounds.

Table XII shows the total income including the value of manure and of calves, the total expense and the profit or loss per cow by herds.

Twenty-eight of these herds returned a profit, according to Table XII. These profits ranged from \$6.36 to \$62.58 per cow. In five herds the expense was greater than the income. The loss ranged from 35 cents to \$41.70 per cow. The average gain, obtained by subtracting the sum of the loss from the sum of the profit and dividing the difference by the entire number of herds, for the 33 herds was \$25.46 per cow.

TABLE XII.—STATEMENT OF ANNUAL PROFIT OR LOSS  
PER COW BY HERDS

Herd number	Total income	Total expense	Profit	Loss
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
1.....	143.39	92.02	51.37	.....
2.....	150.76	96.72	54.04	.....
3.....	78.61	62.15	16.46	.....
4.....	81.72	75.37	6.35	.....
5.....	94.53	72.44	22.09	.....
6.....	118.14	90.38	27.76	.....
7.....	89.40	70.34	19.06	.....
8.....	179.81	144.54	35.27	.....
9.....	106.78	86.25	20.53	.....
10.....	104.21	127.11	.....	22.90
11.....	109.29	87.52	21.77	.....
12.....	145.63	100.37	45.26	.....
13.....	160.66	133.68	26.98	.....
14.....	102.69	111.03	.....	8.34
15.....	145.64	111.92	33.72	.....
16.....	106.73	107.08	.....	— .35
17.....	108.18	116.25	.....	8.07
18.....	206.35	146.86	59.49	.....
19.....	114.12	88.23	25.89	.....
20.....	135.98	94.21	41.77	.....
21.....	83.76	63.30	20.46	.....
22.....	105.50	89.41	16.09	.....
23.....	116.84	87.90	28.94	.....
24.....	165.16	102.85	62.31	.....
25.....	133.27	80.77	52.50	.....
26.....	135.16	176.86	.....	41.70
27.....	92.69	80.56	12.13	.....
28.....	158.35	109.27	49.08	.....
29.....	141.33	78.74	62.59	.....
30.....	120.50	74.86	45.64	.....
31.....	136.68	109.44	27.24	.....
32.....	117.37	94.57	22.80	.....
33.....	103.36	89.31	14.05	.....
Total.....	4,092.59	3,252.31	840.28	.....
Average.....	124.02	98.55	25.46	.....

Table XIII shows the net cost per 100 pounds of milk for each herd. The net cost per cow is the total cost less the birth value of calves and the value of manure. The cost per 100 pounds of milk was obtained by dividing the net cost per cow by the number of 100 pounds of milk produced per cow.

**Causes of variation in cost price.**—The cost per 100 pounds of milk ranged from 39 cents to \$2.14. The reason for the extremely low cost, 39 cents, for herd Number 25, is that the total expense per cow was rather low and that the birth value of calves per cow was very high, on several calves a birth value of \$150 was placed. After subtracting the value of calves and manure from the total expense there were left only \$23.90 as the net cost per cow. The average cost of producing milk in these 33 herds was \$1.26 per 100 pounds.

If 10 percent of the total cost had been charged for managerial ability and only one-half of the value of manure credited (as some claim should be done) to the cows the cost of milk would have been \$1.57 per 100 pounds.

In connection with producing milk there is another item of expense which is frequently overlooked. It is necessary for the

dairyman either to purchase young cows or else raise his own dairy heifers in order that he may replace his old cows. Most dairymen who desire to improve their herds prefer to raise their own heifers. By so doing they can select the heifers from their best producing cows and keep their herds freer from contagious diseases. On the other hand, the price that could be obtained for a dairy heifer on the market is usually not sufficient to pay the cost of raising. The practice of buying young cows could not be made general, however, because the supply would soon be exhausted.

TABLE XIII.—NET COST OF PRODUCING MILK\*

Herd number	Milk	Net cost per cow	Cost of milk per 100 pounds
	<i>Pounds</i>	<i>Dollars</i>	<i>Dollars</i>
1.....	5,645.21	65.68	1.163
2.....	6,243.67	78.22	1.253
3.....	4,485.16	48.47	1.080
4.....	4,945.54	60.47	1.223
5.....	5,751.10	55.12	1.058
6.....	5,451.20	72.10	1.323
7.....	3,761.96	56.62	1.505
8.....	6,943.97	101.36	1.460
9.....	6,950.58	64.61	1.030
10.....	5,100.26	109.35	2.144
11.....	5,245.44	65.96	1.257
12.....	6,223.04	79.16	1.272
13.....	5,464.27	101.74	1.861
14.....	4,329.58	84.47	1.950
15.....	6,348.29	92.93	1.464
16.....	4,457.47	79.83	1.791
17.....	6,797.48	86.16	1.267
18.....	9,400.19	106.98	1.133
19.....	5,509.51	69.71	1.265
20.....	6,586.68	71.51	1.086
21.....	5,102.40	51.39	1.007
22.....	7,226.10	69.92	.967
23.....	5,910.35	65.55	1.109
24.....	6,322.47	59.46	.940
25.....	6,151.60	23.90	.388
26.....	5,509.45	121.77	2.060
27.....	5,108.72	65.05	1.273
28.....	6,444.12	85.34	1.324
29.....	5,975.66	63.50	1.063
30.....	5,113.90	53.14	1.137
31.....	6,568.10	86.77	1.321
32.....	6,665.83	63.60	.954
33.....	6,033.80	71.72	1.189
Total.....	194,173.10	2,436.56	.....
Average.....	5,884.03	73.83	1.255

\*In these computations the dairyman was considered a common laborer. No credit was given for ability required to manage his business, which charge should be about 35 to 40 percent of the other labor cost.

Table XIV has been prepared to show the effect on the cost of producing milk when the loss or the gain on young stock has been considered. The column headed "Net cost per cow including the loss or the gain on young stock" was obtained by adding the loss or subtracting the gain on young stock from the net cost per cow.

Thirty-two of these thirty-three dairymen raised their heifers. In 25 herds there were losses on young stock, ranging from 12 cents to \$16.46 for each cow in the herd. In 7 herds there were gains on young stock, ranging from 15 cents to \$10.71 per cow. The average

cost per 100 pounds of milk including the gain or the loss on young stock was \$1.30. Excluding young stock the cost was \$1.26. The loss on young stock added 4 cents per 100 pounds to the cost of producing milk.

TABLE XIV.—NET COST OF PRODUCING MILK, INCLUDING LOSS ON YOUNG STOCK

Herd number	Milk	Gain or loss on young stock	Net cost per cow including young stock	Cost of milk per cwt. including young stock
	<i>Pounds</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
1.....	5,645.21	- 6.42	72.10	1.28
2.....	6,243.67	+ 4.59	73.63	1.18
3.....	4,485.16	- 4.23	52.70	1.18
4.....	4,945.54	-11.08	71.55	1.45
5.....	5,751.10	+ 5.15	49.97	1.37
6.....	5,451.20	- 1.05	73.15	1.34
7.....	3,761.96	- 2.84	59.46	1.58
8.....	6,943.97	-16.46	117.82	1.70
9.....	7,950.58	- 1.84	66.45	1.96
10.....	5,100.26	- 4.64	113.99	2.24
11.....	5,245.44	- 4.64	70.60	1.35
12.....	6,223.04	+ 2.11	77.05	1.24
13.....	5,464.27	+ 1.21	100.53	1.84
14.....	4,329.58	- 4.41	88.88	2.05
15.....	6,348.29	- 5.54	93.47	1.47
16.....	4,457.48	-12.49	92.32	2.07
17.....	6,797.48	- 1.12	86.28	1.27
18.....	9,400.19	- 4.06	111.04	1.18
19.....	5,509.51	- 2.53	72.29	1.31
20.....	6,586.68	- 2.23	71.76	1.09
21.....	5,102.40	- 2.28	53.67	1.05
22.....	7,226.10	- 5.02	74.94	1.04
23.....	5,910.35	+ 2.49	63.06	1.07
24.....	6,322.47	-10.71	48.75	.71
25.....	6,451.60	+ .15	23.75	.39
26.....	5,909.45	- 1.15	121.92	2.06
27.....	5,108.72	- 7.47	72.52	1.42
28.....	6,444.12	- 7.44	92.78	1.44
29.....	5,975.66	- .05	63.55	1.06
30.....	5,113.90	- .42	58.56	1.14
31.....	6,568.10	-14.64	101.41	1.54
32.....	6,665.83	- 4.68	68.28	1.02
33.....	6,033.80	.....	71.72	1.19
Total ..	194,173.10	-93.39	2,529.95	.....
Average.....	5,884.03	- 2.83	76.66	1.30

#### APPLYING RESULTS WITH CHANGES IN PRICES

These costs, however, would not apply at all at the present time (July, 1918). Prices of feeds and the cost of labor have almost doubled from 1915 to July, 1918. The investment in animals, buildings and equipment is also much higher than formerly. By calculating the items of expense, as was done in Table VIII, at current prices one could show approximately what would be the average cost of producing milk in herds similar to these, at any time.

The average cost of keeping a cow for 1 year would be \$178.02 instead of \$98.55, according to Table VIII, which was the cost when these records were taken. Subtracting the birth value of calves and the value of manure from this total cost, \$178.02, as was done in

Table XII to secure the net cost per cow, we find that it would have cost these dairymen approximately \$2.61 per 100 pounds to produce milk and if 10 percent of the total cost had been added for management, the average cost would have been about \$2.96. This does not take into consideration the seasonal variations in the cost.

#### SUMMARY AND CONCLUSION

1. Because the cost of producing milk varies greatly, the only accurate way to determine the cost of production is to keep complete records of all operations connected with the dairy.

2. In these herds 54 percent of the total cost was spent for feed, 28 percent for labor and 18 percent for all other costs.

3. The average cost of keeping a cow in these herds for 1 year was \$98.55. Including the loss on young stock, the cost was \$101.38.

4. The average annual income from milk and its products was \$99.29. The total income including birth value of calves and value of manure was \$124.02 per cow.

5. After deducting credits other than milk from the total expense, the net cost per cow was \$76.66. In July, 1918, it would have been approximately \$178.02.

6. The average yearly production per cow was 5,884 pounds of milk containing 255 pounds of fat. This is much higher than the average production in Ohio, therefore, the costs here given are lower than the actual average costs.

7. The net cost of producing milk at the time these records were collected was \$1.30 per 100 pounds. The purebred animals greatly reduced the net cost of milk, because their calves were valued more highly than those of grade cows. To obtain the net cost per cow the value of manure and the birth value of calves were subtracted from the total expense. In one herd, due to the high value of calves, \$41.02 per cow, the net cost of milk was only \$0.39 per 100 pounds. Note the advantage of purebred stock.

8. Using prices of feed, labor and supplies in July, 1918, the cost of producing milk would have been approximately \$2.61 per 100 pounds, and if 10 percent of the total cost had been added for management, the average cost would have been about \$2.96.

9. In fixing a price for milk, it would be unjust to use the average cost of production, as this would cause about one-half of the dairymen to operate at a loss and no line of business could long endure such conditions. If 20 percent of the dairymen who furnished the foregoing data had been eliminated because of inefficiency, a price could not justly have been set at a lower figure than \$1.58 or, under July, 1918, prices, approximately \$3.58. If seasonal variations were computed according to Warren's suggestion, such a price would range from about \$2.50 to \$4.30 per 100 pounds.

IN COOPERATION WITH  
 O. A. E. S. and U. S. Dept. of Agr.  
 in Farm Management Investigations.

# MILK RECORD

Of \_\_\_\_\_ Farm for Month of \_\_\_\_\_, 19

\_\_\_\_\_ County. \_\_\_\_\_ P. O. \_\_\_\_\_, Owner. \_\_\_\_\_, Manager.

COWS.																					
DATE.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	A. M.	P. M.	
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(536)

APPENDIX









Ohio Agricultural Experiment Station  
Department of Dairy Husbandry

**COMPLETE DAIRY RECORD**

Keep this sheet tacked in prominent place and record all items

Date	Dairy Labor										Used in Family				M		
	Daily Work*		Mfg.†			Marketing		Other Dairy Work					Milk	Cream		Butter	Skim Milk
	Cows	Y.Stk	Man	Man	Horse	Man	Horse	Hauling Feed, Buying & Selling, Care sick cows, &c.			Amt.	Value	Lbs.	Lbs.		Lbs.	Lbs.
Man Hrs.	Man Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Hrs.	Kind					Lbs.	Lbs.	Lbs.	Lbs.	L	
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29																	
30																	
31																	
Totals																	

\*Remarks. Rate per hour man labor Horse labor

\* Includes all dairy work done regularly every day, such as feeding, milking, care of cattle, separating milk, washing utensils, cleaning & making butter, etc. † Refer to feed record for amounts and values which are accounted for only on feed record.

