ANALYSIS OF OKLAHOMA DAIRY HERD IMPROVEMENT ASSOCIATION RECORDS FOR THE PERIOD 1925 TO 1936

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By

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INTRODUCTION

Dairy herd improvement association work in Oklahoma began with the association year of 1925 and 1926. During this association year, 110 cows were placed on test and under supervision of dairy herd improvement association testers. The number of cows which were supervised in dairy herd improvement association work increased yearly until it reached a total of 1,993 cows in 1929 and 1930, from which it declined until 1934 and 1935, when it had again increased to the total number of 1,025 cows. This number was decreased slightly during the year 1935 and 1936.

In explanation of the variation in the number of cows supervised in dairy herd improvement association work it is assumed that the marked increase in 1929 and 1930 was brought about by good prices for dairy products in comparison with other agricultural commodities during those years and it is also assumed that increased interest in dairy herd improvement work was probably somewhat due to better feed supplies and increased effort on the part of the state supervisors to promote dairy herd improvement work at that time.

The figures which are used to represent the average production for cows in dairy herd improvement association herds in this analysis are based on cow years, that is only on cows which were in the association for the full twelve months. In some cases, therefore, cows were eliminated from the dairy herd improvement summaries because they were not in the association work for the full twelve months.

Dairy herd improvement association supervision during the years 1925 to 1936 has brought a gradual increase in milk production from 4,867 pounds in 1925, to 7,313 pounds in 1935. During the 1929 and 1930 dairy herd improvement association year, there was a decided decline in the production of the average cow in association work. In explanation of this decline it is possible that it may have been brought about by the marked increase in number of cows in association work during the same period, for at this time the number of cows in association work reached a peak of 1,933. This meant that during this period a large number of new herds were added to the dairy herd improvement association records. These new herds which were added at this time apparently were more nearly equal to the average Oklahoma herd. They had not had the benefit of association supervision in the culling and feeding program, which is sponsored in dairy herd improvement association work. For the year 1935 and 1936, there was a slight decrease in average yield and also in number of cows under supervision. This condition is known to be the result of the number of high producing herds changing from dairy herd improvement association work to official testing and the addition, in their place, of new herds which had the tendency to lower the production slightly.

A very important condition, which exists in Oklahoma, is indicated in making a direct comparison of cows under association supervision and the average Oklahoma cow during the same period. While the average association cow was increasing in production during this ten year period, the average cow in Oklahoma was decreasing in annual production from 3,450 pounds of milk to 3,100 pounds and from 146 pounds of butterfat to 131 pounds (30). The exceptional improvement made in dairy herd improvement association supervised herds furnishes the foundation for a more complete and thorough analysis of the production of these cows and an analysis which offers many interesting facts.

REVIEW OF LITERATURE

Crandall and Tailby (6) found in dairy herd improvement associations in New York state that the number of cows under supervision increased more than five times between January 1, 1925, and January 1, 1936. The average butterfat production of these cows increased from 271 pounds in 1925, to 309 pounds in 1935. They also found that the average age of cows in their study and analysis was five years, further, that the highest and most economical production came from cows between the ages of six and nine years. The largest number of cows in herds included in the study was in the three year old group. One hundred ninety-four herds in the 16 New York dairy herd improvement associations showed that the cows in the highest producing group averaged five thousand pounds more milk than those in the lower producing group and at the same time consumed 1,000 pounds more grain per year and returned an average of $89 per year more profit. The cows in the highest producing group received 26.9 pounds of grain per 100 pounds of milk produced; those in the lower producing group received 32.1 pounds of grain for each 100 pounds of milk produced.

McDowell (18) analyzed records of 18,000 cows in cow test association supervision in which the cows were grouped according to butterfat production. Those cows which averaged 100 pounds of butterfat per year returned an average of $10 above feed cost. The group which averaged 200 pounds of butterfat per year showed a profit above feed cost of $42. The group which averaged 300 pounds of butterfat per year showed an average annual profit above feed cost of $74 and those averaging 400 pounds butterfat showed a return of $106 above feed cost. Thus, McDowell (18) found that one cow in the 400 pound group produced more profit above feed cost than 10 cows in the 100 pound group.

Wright (28) in a comparative study made on the farms of 74 Michigan dairymen found that on these farms with an average of 333 pounds of butterfat per cow per year, the cost of milk at the milk house was $1.40 per hundred pounds. The average cost of butterfat per pound was 34.1 cents. He found, further, that a group of cows of lower production averaged 210 pounds of butterfat and that the average cost per pound of butterfat was 39.8 cents.

Crandall and Tailby (6) in a study of records of 21,913 cows found that for each 1,000 pounds increase in milk produced the value of the product produced increased $17.65 with a corresponding increase of $5.37 in total feed cost. This shows that the value of milk produced over the cost of feed consumed increases almost directly with the increase in milk production.

Turner (26) in studying the correlation of decrease in production and feed cost concluded that the average rate of decline due to advanced lactation is such that a cow's production for any month is 93.95 per cent of the previous month's production and that the average rate of decline in rate of feed consumed is such that any month's consumption is 97.98 per cent of the previous month's consumption and that any excess of feed which cows receive has a tendency to bring about uneconomical production and results in increased body fat.

Morrison (21) refers to studies by McDowell who computed averages for several thousand cows classified in groups ranging in milk production from 2,650 pounds to 21,432 pounds. In this comparison 1,383 cows in the lowest producing group averaged 2,650 pounds of milk with an average annual feed cost of $38, or $1.43 per hundred pounds of milk produced. In a second group of 10,440 cows the average production was 10,906 pounds of milk with an average feed cost of $73, or 67 cents per hundred pounds of milk produced. A small group of 26 cows produced an average of approximately 20,000 pounds milk and showed an average feed cost of $275, or 56 cents, per hundred pounds of milk.

In a study of records of the dairy herd improvement association at Elk Horn, Wisconsin, Cramer (5) found that as milk production was increased from 5,000 pounds to 12,000 pounds, the feed cost per hundred pounds of milk was decreased from $2.67 to $1.55, and, further, that herds which produced less than 6,000 pounds of milk per year did not meet all costs involved in production of milk, while those producing above 6,000 pounds of milk made a profit, when milk was marketed at $2.22 per hundred pounds.

Crandall and Tailby (6) showed that in one New York dairy herd improvement association 406 cows averaged 6,486 pounds of milk containing 248 pounds of butterfat and that the grain fed averaged 21.5 pounds for each one hundred pounds of milk produced. The following year cows in this association averaged 7,482 pounds of milk containing 272 pounds butterfat and consumed 25.3 pounds of grain per hundred pounds of milk. The indications are that increased grain feeding raised the total feed cost $5 per cow during the second year, but returns for milk at the same price were $15 higher per cow the second year.

Headley and Venstrom (13) in a comparison of several Nevada herds showed that when the 10 highest producing herds were compared with the 10 lowest producing herds, the 10 high herds averaged 289 pounds of butterfat per cow and show an average gross income of $161.24, an average feed cost of $60.89, or an average return over feed cost of $100.35, while the 10 low producing herds showed an average of 202 pounds of butterfat with an average gross return of $126.19, an average feed cost of $54.94, or an average profit above feed cost of $71.25.

Hodgson (15) in a study of 10,000 dairy herd improvement association records in Wisconsin grouped the cows according to feed cost. He found that for each 50 pound increase in butterfat production there was a corresponding increase of $5.70 in feed cost. He concluded that on this basis if no butterfat was produced the feed cost would still be $26.92, which represents the cost of maintenance and that as production increases the cost of producing a pound of butterfat decreases up to a production of 500 pounds. Cows producing 500 pounds per year produced a unit of butterfat at 24 cents less than those producing 250 pounds butterfat per year.

McIntyre (20) analyzed 79 herds of dairy cattle including 3,844 records in the Jackson county, Missouri, dairy herd improvement association during the period 1923 to 1929. Average production in these 79 herds ranged from 160 pounds to 395 pounds butterfat annually. The average feed cost ranged from $43.75 for cows in the 50 pound fat group to $164.43 for those producing over 550 pounds butterfat annually. Cows in the group averaging 200 pounds butterfat showed a 40.1 per cent greater feed cost than those in the 100 pound group; cows in the 600 pound group showed a 66.7 per cent greater feed cost than those in the 300 pound group, but that the feed cost per pound of fat was less in the higher producing groups. His records show that a definite correlation exists between feed cost and annual butterfat production of cows and, further, that this correlation exists in spite of the variation of the productive ability of the cows, that the cows required a certain amount of feed for maintenance above which the feed cost per 100 pounds butterfat will be practically the same whether the cow is a light or heavy producer. He further concluded that high producing cows are more profitable because the maintenance cost amounts to less per unit of production.

Woodworth, Harris and Rauchenstein (27) made a study of 38 farms in New Hampshire in which they found that for high producing cows the ratio of grain to milk was 1:3.8, for medium producing cows it was 1:4.2, and for low producing cows 1:4.6. They concluded that the effect of poor roughage in herds included in their study was hidden by the variation in grain feeding.

Wright (28) found that yearly feed costs on dairy farms in Michigan were $19.37 higher, or 54 per cent greater for cows averaging 441 pounds of butterfat than for cows which averaged 210 pounds of butterfat. The net returns per cow above all costs averaged $26.80 for the higher producing group while the low producing group showed a loss of $5.62 per cow. The cost of producing a pound of butterfat was 26.8 cents in the high producing group and 39.8 cents in the low producing group.

Over a three year period Headly (14) found that Holstein cows in the state of Nevada receiving no grain averaged 304 pounds of butterfat when fed good alfalfa hay. Those receiving grain in advanced lactation averaged 326 pounds butterfat and those receiving grain continuously 359 pounds butterfat. In comparing the grain fed group with the all hay fed group he found that those receiving grain consumed .49 of a pound less hay for each pound of grain consumed.

In determining the amount of total digestible nutrients required per pound of butterfat produced Headley found that when no grain was fed this requirement was 18.7 pounds and when grain was fed the requirement was 19.5 pounds. His conclusion, however, was that this difference would fall within the limits of experimental error and that it takes just as many pounds of total digestible nutrients per pound of butterfat when it is produced from grain as when it is produced from good quality hay. Digestible nutrients are just as efficient when fed in good alfalfa hay as when fed in grain. He points out that increased yields of butterfat would cost 38 cents per pound when grain is $30 per ton and if a cow's food conversion factor is found to be 20. Grain feeding was not considered justifiable for cows having a food conversion factor higher than 24 with grain costing $30 per ton.

Comparing purebred and grade cows in New York state dairy herd improvement association work for 1934 and 1935, Crandall and Tailby (6) found that the purebred cows exceeded the grades by 1,155 pounds of milk and 29 pounds fat per year, that the feed cost averaged $9 more for the purebred cows but that the return above all feed costs was still $7 more for the purebred cows. They found, further, that the average production for grade cows in this comparison was 102 pounds above the average for the state of New York and concluded that this higher average of the grade cows was due to the better management and better breeding in the herds under dairy herd improvement association supervision.

McDowell (17) studied 29,397 records of purebred cows and 71,745 records of grade cows in dairy herd improvement association work in the United States and found that the value of feed consumed per year for purebreds was 23 per cent above that for the grades, that the purebreds produced 10.6 per cent more milk and 6.7 per cent more butterfat. In comparing the income above feed cost he found that the purebreds excelled the grades by 9.7 per cent.

Morrison (21) in referring to information received from McDowell states that the average production for 63,739 purebreds was 8,443 pounds of milk containing 325 pounds butterfat, while the average for 107,309 grade cows was 7,623 pounds of milk containing 298 pounds butterfat pointing out that in this comparison the purebred cows produced 820 pounds more milk per year and 27 pounds more butterfat.

The effect of the season of freshening on the production of 17,509 cows in New York dairy herd improvement associations was studied by Crandall and Tailby (6) who found that cows freshening in the fall months produced heaviest and also showed greater return above feed cost and that the winter, summer and spring freshening groups followed in the order named.

Wylie in making a study of the season of freshening on Jersey cows found that in comparing records of 2,900 cows the cows freshening in the months of July, October, Novemeber, December, January and February were highest in milk production, while those freshening in April, May, June, August and September were lowest in production of milk. The fat production was highest for those freshening in July, October, November and December; it was lowest for those freshening in April, May and August.

Turner (25) showed that from the standpoint of milk production cows freshening in the fall and winter months equal, or excel, the average while those freshening in the summer months are generally below the average in production.

Cannon and Espe (3) compared records on 131,135 cows to determine whether there was, or was not, a tendency of dairymen to breed their cows for fall and winter freshening. They found no decided difference in the per cent of cows that freshened each month of the year from year to year, and that farmers and dairymen have not been influenced to breed their cows for a fall freshening.

Cannon (4) compared 69,000 records and found that they showed that cows calving in November produced highest yields and that freshening dates from November to June showed a decrease in production in order and that from June to November they showed an increase in production.

McDowell (19) found in studying records of 10,870 cows in Ohio dairy herd improvement association that the months of freshening which resulted in highest production were October, December and November in the order named and that the greatest incomes over feed cost were obtained from cows freshening in December, October and November, respectively. Cows freshening in the fall season showed an average of $76.65 return over feed cost, those freshening in the winter season an average of $75.66, those freshening in the spring season an average of $70.73, and those freshening in the summer season an average of $66.59 return over feed cost.

DISCUSSION AND PROCEDURE

Plan of Study

This study is an analysis of 9,725 records obtained from the annual summaries of the Oklahoma dairy herd improvement association for the years 1925 to 1936 (22). In analyzing these records they have been grouped in various manners for the purpose of offering the most valuable information in this study. They were first grouped according to milk production with 1,000 pounds variations between groups, beginning with a yearly production of 500 pounds or less. A second grouping is on the basis of butterfat production with 50 pound variations between groups beginning with those producing 25 pounds or less per year. A third grouping is on the basis of annual grain costs with $5 variations between groups beginning with ones receiving grain valued at $7 or less. A fourth grouping classifies the purebred cows by ages with one year vatiation between the groups and beginning at the age of two years. A fifth grouping classifies the grade cows by ages with one year variation between groups and beginning at the age of two years. A sixth grouping classifies all cows according to the season of freshening and also the correlation between season of freshening and cost of production.

In each of the various types of analysis the records have been analyzed from the standpoint of the per cent of the total cows included, their average production, average value of the product, average cost of roughage, average grain cost, the average cost of all feed, average value of the product less feed cost and the average cost of producing a unit of milk or butterfat.

Method of Evaluating Product

Due to the fact that the annual summaries of dairy herd improvement associations show a wide variation in the value assigned to the production by various cows it was thought best to use a standard value which would put the analyses on a more practical basis from the standpoint of information useful in presenting the picture of accomplishments of the various types of cows supervised in Oklahoma dairy herd improvement association work. In attempting to arrive at this standard evaluation for products the author has chosen to make such evaluations on the butterfat content of milk produced; since butterfat is considered the unit of evaluation of dairy products in this section, a study was made of the methods in which dairy products produced in Oklahoma are most widely utilized. According to Becker (2) the disposition of milk in Oklahoma for the year 1933 was as follows: 19.2 percent was used as whole milk and cream on the farms where it was produced; 17 per cent was made into butter on the farms; 2.1 per cent was fed to calves and other livestock; 7 per cent was retailed by producers; 10.5 per cent was sold as wholesale, or canned, milk; 44.2 per cent was skimmed and separated and sold in the form of sweet or sour cream. In making further investigations the author found that the percentages shown by Becker (2) for the year 1933 was practically identical with those for other years and that they furnished a fair and accurate indication of how products are marketed in this state. For the types of markets which he indicated the evaluation of a cow's production can most fairly be determined by that proportion which is sold as wholesale milk and that proportion which is separated and sold as butterfat in the form of sweet or sour cream. There is no definite way of placing a correct value on the amount utilized for livestock on the farms. The income received from the proportion which is made into butter on the farms also includes the income for labor involved in making the butter. No definite way can be found to accurately evaluate the 19 per cent which is used as food on the farms where produced. The value of the 7 per cent which is retailed by producers also must include added value for labor and other overhead expenses incurred in retailing milk. It is, therefore, assumed that the most practical evaluation for milk produced and marketed in this state can best be obtained by taking the value received for that 54.7 per cent which is marketed in the form of sweet or sour cream or in the form of wholesale milk.

In order to obtain a fair evaluation for milk marketed in these two forms statistics were taken from receipts and expenditures of a local cooperative creamery (23). During the 11 year period this creamery purchased 433,870.9 pounds butterfat in the form of wholesale milk at a total cost of $193,734.80. These monthly purchases show a weighted average price for butterfat in the form of wholesale milk over the 11 year period of 45.5 cents per pound. During the same period this creamery purchased 991,371.3 pounds of butterfat in the form of sweet and sour cream at a total cost of $249,929.12 at a weighted average price of 25.2 cents per pound of butterfat.

In calculating the average price of butterfat in Oklahoma on this basis the author concluded that an evaluation should also be placed on the skim milk which remained on the farm where sweet or sour cream was marketed. In order to determine the amount of skim milk remaining on the farm it was assumed that the cream which was marketed on the average contained 33 1/3 per cent butterfat. On this basis, for each pound of butterfat marketed 22 pounds of skim milk remained on the farm. To obtain a fair evaluation for this skim milk reference was made to Morrison's (21) study in which he cites that in swine rations when skim milk is compared with corn and tankage 100 pounds of milk will equal approximately 7.3 pounds of tankage plus 10.9 pounds of corn. He further indicates that with tankage at $50 per ton and corn at 70 cents per bushel the value of skim milk will be approximately 32 cents per hundred. The results of several feeding experiments indicate that a fair estimate of the value of skim milk is a price per hundred pounds equivalent to about the value of one-half bushel of corn. To obtain a fair evaluation for corn for this 11 year period reference was made to United States Yearbooks of Agriculture (30) which showed that the average price obtained by the farmers for corn in the state of Oklahoma for the years 1925 to 1936 was 90 cents per bushel during 1925, 56 cents during 1926, 59 cents during 1927, 68 cents during 1928, 79 cents during 1929, 65 cents during 1930, 27 cents during 1931, 18 cents during 1932, 55 cents during 1933, 96 cents during 1934, 70 cents during 1935 and $1.07 during 1936. The weighted average price of corn for the 11 year period is 62.8 cents per bushel. This would place a value of 31.4 cents per hundred pounds of skim milk.

With 10.5 per cent of the production of Oklahoma cows marketed in the form of canned milk at 45.5 cents per pound of butterfat and 44.2 per cent in the form of sweet and sour cream at 25.2 cents per pound of butterfat plus an added value of 31.4 cents per hundred pounds of skim milk remaining on the farm, where butterfat is marketed in the form of sweet or sour cream, the average price of butterfat for the 11 year period was calculated to be 34.6 cents per pound. This value was obtained by the following formula $X = \frac{45.5 \times 10.5 +}{54.7}$

$\frac{(25.2 + 6.9) \times 44.2}{54.7}$.

RESULTS OBTAINED

Relation of Milk Production To Other Factors

Table I, Relation of Milk Production to Other Factors, gives the statistical data for 9,717 cows which were grouped in 1,000 pound groups according to variations in milk production ranging from those in group one, which produced less than 500 pounds of milk per year, to those in the last group, which produced between 18,500 pounds and 19,499 pounds of milk per year. The average production for the entire group of 9,717 cows was 6,495 pounds. It is interesting to note that 74.42 per cent of the entire group of cows were in the production classes falling between 3,500 and 8,500 pounds of milk.

The average value of the production per cow in each group based on the weighted average price of butterfat previously arrived at shows a range varying from $6.22 per year for those cows in the first group to $216.94 for those falling in the last group. The average value of the product for the entire group of cows was $97.23 per year. In calculating the average roughage cost per cow it was found to amount to $7.91 for those in the first group and increased to $31.75 for those in the last group. The average roughage cost for the entire group of cows was $27.43. The average grain cost for the first group of cows amounted to $3.18 per year and for the last group of cows $90. The average grain cost for the entire group amounted to $38.45 per year. The average cost of all feed amounted to $11.09 per cow for those in the lowest producing group and $121.75 for those in the highest producing group, the average feed cost for all cows being $65.88. The column indicating the value of the product less feed cost shows that this item has a range from a minus $4.87 for the lowest producing group of cows to a plus $95.19 for the highest produc-

Table I. Relation of Milk Production To Other Factors.

Classification Pounds Milk	No. of Records	% of Total	Av. Milk Prod.	Av. Test	Av. B.F. Prod.	Av. Price Lb. B.F.	Av. Value Product	Av. Cost Roughage	Av. Cost Grain	Av. Cost All Feed	Av. Value Prod. Less Feed Cost	Av. Feed Cost Per Cwt. Milk
Under 500	22	.22	330	5.5	18	34.6¢	$ 6.22	$ 7.91	$ 3.18	$ 11.09	$ -4.87	$ 3.36
500 - 1499	90	.92	1080	4.8	52	34.6	17.99	11.40	10.58	21.98	-3.99	2.04
1500 - 2499	207	2.13	2101	4.9	103	34.6	35.64	16.81	18.89	35.71	-0.07	1.70
2500 - 3499	557	5.73	3060	4.9	151	34.6	52.25	21.72	24.64	46.36	5.89	1.52
3500 - 4499	1116	11.48	4042	4.9	198	34.6	68.50	22.34	29.76	52.09	16.41	1.29
4500 - 5499	1598	16.44	5021	4.8	242	34.6	83.73	34.71	34.21	58.92	24.81	1.17
5500 - 6499	1746	17.96	5991	4.7	279	34.6	96.53	26.67	38.17	64.84	31.69	1.08
6500 - 7499	1517	15.61	6978	4.5	312	34.6	107.95	28.85	41.49	70.34	37.61	1.01
7500 - 8499	1063	10.93	7945	4.2	337	34.6	116.60	30.87	44.64	75.52	41.08	.95
8500 - 9499	680	6.99	8962	4.0	355	34.6	122.83	33.64	47.72	81.36	41.47	.91
9500 - 10499	442	4.54	9969	3.7	373	34.6	129.06	33.91	47.53	81.45	47.61	.82
10500 - 11499	290	2.98	10940	3.6	394	34.6	136.32	35.86	48.36	84.22	52.10	.77
11500 - 12499	161	1.65	11933	3.5	417	34.6	144.28	36.44	55.91	92.35	51.93	..77
12500 - 13499	91	.93	12956	3.4	442	34.6	152.93	36.19	56.76	92.95	59.98	.72
13500 - 14499	57	.58	13977	3.4	481	34.6	166.42	35.02	59.35	94.37	72.05	.68
14500 - 15499	43	.44	14947	3.3	488	34.6	168.84	34.84	62.65	97.49	71.35	.65
15500 - 16499	18	.18	15925	3.4	535	34.6	185.11	32.61	54.50	87.11	98.00	.55
16500 - 17499	10	.10	16899	3.4	581	34.6	201.02	36.20	61.40	97.60	103.42	.58
17500 - 18499	5	.05	18052	3.3	599	34.6	207.25	41.00	69.60	110.60	96.65	.61
18500 - 19499	4	.04	19634	3.2	627	34.6	216.94	31.75	90.00	121.75	95.19	.62
Average	Total 9717	100%	6495	4.3	281	34.6	97.23	27.43	38.45	65.88	31.35	1.01

ing group of cows. The average value of the product less feed cost for all cows is $31.35. The feed cost per hundred pounds of milk produced by the different groups was highest for that group of cows which received the lowest amount of feed but at the same time produced the least amount of milk. The feed cost per hundred pounds of milk for this group amounted to $3.36, while the lowest feed cost per hundred pounds of milk was 55 cents as found for one of the highest producing groups. The average feed cost per hundred pounds of milk for the entire group of cows was $1.01.

The graphical relationships of the facts presented in Table I are shown in fig. I. Graphs have been drawn to show the relationship between pounds of milk produced and the value of the product, between pounds of milk produced and grain cost, and between pounds of milk produced and roughage cost. The straight line graph in each case shows the functional relation between the pounds of milk produced and the value of the product, the pounds of milk produced and the cost of grain consumed and also this relation between the pounds of milk produced and the cost of roughage consumed. In the first comparison this straight line graph was obtained by using the formula $V = a + bP$, where V equals the value of the product and P equals the pounds of milk produced. The second comparison was obtained by using the formula $G = a + bP$, where G equals the cost of grain consumed and P the pounds of milk produced. The third straight line comparison was obtained by using the formula $R = a + bP$, where R represents the cost of roughage consumed and P the pounds of milk produced, the results being obtained by solving the equation by the Method of Least Squares (7,24).

The fitted straight lines show that for each 1,000 pounds increase

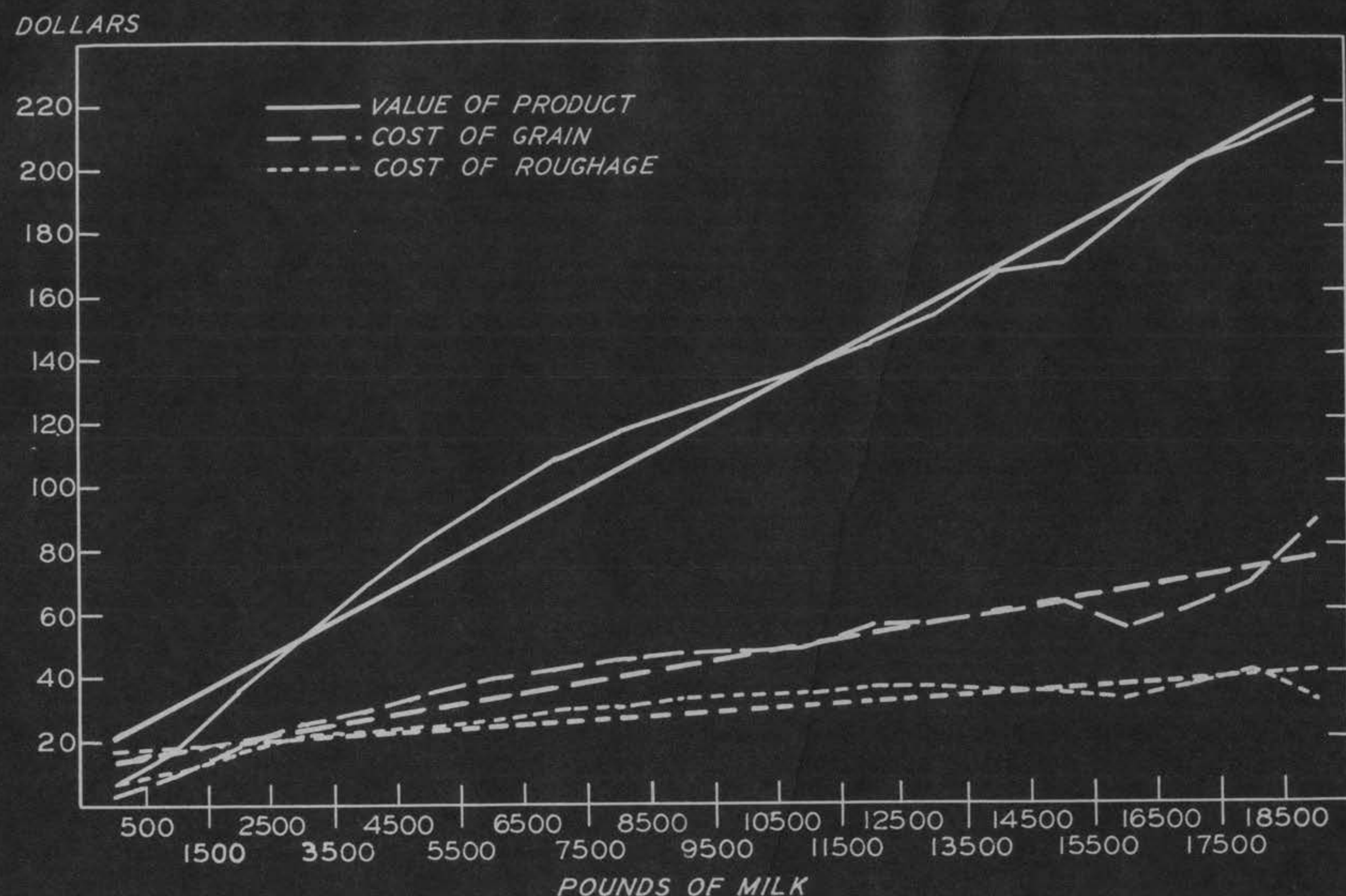

FIG. I
RELATION OF MILK PRODUCTION TO ROUGHAGE COSTS, GRAIN COSTS AND THE VALUE OF PRODUCT PRODUCED

in milk production there was an average increase in the value of the product based on butterfat content of $10.47. For each 1,000 pound increase in milk production the average increase in roughage cost was $1.30 and the increased grain cost was $3.36 giving a total increase in feed cost of $4.66 with an average increase of $10.47 in the value of the milk produced.

Figure II shows that the total feed cost per hundred pounds of milk decreased decidedly as the production increased, varying from a cost of $3.36 per hundred for cows producing less than 500 pounds of milk to the low cost of 55 cents per hundred pounds for those cows in the group producing between 15,500 and 16,500 pounds milk per year. Above these yields there was a slight increase in cost which, no doubt, can be accounted for by the small number of cows included and the apparent lack of economy in feeding. The most rapid decrease of feed cost per hundred pounds of milk occurred in those groups ranging between 500 pounds and 11,500 pounds of milk per year. The change in cost of feed per hundred pounds of milk was very small between any two groups producing above 11,500 pounds of milk.

Relation of Butterfat Production To Other Factors

Table II and figs. III and IV show the relation of butterfat production to other factors. The 9,625 records which could be studied from the butterfat production standpoint were divided into groups of 50 pounds variation in butterfat yield. Production ranged from less than 25 pounds per year for cows in group one to 874 pounds for those cows falling in the highest producing group. Average production for the entire group was 282 pounds per year. Of all the cows included 73.85 per cent are in the groups showing an average production between 175 and 374 pounds per year.

Table II. Relation of Butterfat Production to Other Factors.

Classification Pounds Butterfat	No. of Records	% of Total	Av. Milk Prod.	Av. Test	Av. B.F. Prod.	Av. Price Lb. B.F.	Av. Value Product	Av. Cost Roughage	Av. Cost Grain	Av. Cost All Feed	Av. Value Prod. Less Feed Cost	Av. Feed Cost Per Lb. B.F.
Under 25	28	.28	232	5.2	12	34.6¢	$ 4.15	$ 9.86	$ 2.46	$ 12.32	$ -8.17	$ 1.03
25 - 74	109	1.12	1207	4.5	54	34.6	18.68	13.43	11.61	25.04	-6.36	46.3¢
75 - 124	251	2.58	2478	4.2	104	34.6	35.98	18.88	20.62	39.50	-3.52	37.9¢
125 - 174	740	7.63	3511	4.3	152	34.6	52.59	21.33	25.91	47.24	5.35	31.0¢
175 - 224	1447	14.92	4698	4.3	202	34.6	69.89	24.78	31.96	56.74	13.15	28.0¢
225 - 274	2073	21.38	5781	4.3	250	34.6	86.50	26.79	36.26	63.05	23.45	25.2¢
275 - 324	2105	21.71	6987	4.3	303	34.6	104.83	28.30	36.39	64.69	40.14	21.3¢
325 - 374	1536	15.84	8069	4.3	348	34.6	120.41	30.58	44.65	75.23	45.18	21.6¢
375 - 424	804	8.29	8949	4.4	397	34.6	137.36	31.59	48.89	80.48	56.88	20.3¢
425 - 474	360	3.71	10265	4.3	445	34.6	153.97	32.48	50.32	82.80	71.17	18.6¢
475 - 524	153	1.57	11563	4.3	496	34.6	171.62	34.80	53.95	88.75	82.87	17.8¢
525 - 574	60	.61	13032	4.2	547	34.6	189.26	33.15	63.47	96.62	92.64	17.6¢
575 - 624	15	.15	13993	4.3	596	34.6	206.21	42.27	62.80	105.07	101.14	17.6¢
625 - 674	8	.08	15379	4.2	644	34.6	222.82	29.38	61.50	90.88	131.94	14.1¢
675 - 724	2	.02	13663	5.0	680	34.6	235.28	28.50	45.00	73.50	161.78	10.8¢
725 - 774	3	.03	15864	4.7	743	34.6	257.08	37.00	87.00	124.00	133.08	16.6¢
775 - 824												
825 - 874	1	.01	16082	5.2	833	34.6	288.22	31.00	51.00	82.00	206.22	9.8¢
875 - 924												
925 - 974												
Average	Total 9695	100%	6509	4.3	282	34.6	97.57	27.40	37.50	64.90	32.67	23.0¢

In studying Table II it may be noted that the value of the product based on the calculated price per pound of butterfat shows a range from $4.15 per year for the cows in the lowest producing group to $288.22 for the cows in the highest producing group. The average value of the production per cow per year is $97.57.

Variations in the cost of roughage consumed amounted to $9.86 for the lowest producing group of cows and $31 for the highest producing group, the average roughage cost being $27.40. Grain cost variations show a difference of $2.46 for the grain consumed by the lowest producing group and $51 for the grain consumed by the highest producing group, average grain consumption amounting to $37.50 per cow per year. The total feed cost for the cows varied from $12.32 for the lowest producing group to $82 for the highest producing group, with an average annual feed cost of $64.90 per cow. Feed cost per pound of butterfat produced varies from $1.03 in the lowest producing group which also consumed the smallest amount of feed to a low figure of 9.8 cents per pound of butterfat in the highest producing group. The average feed cost per pound of butterfat produced was 23 cents. The value of the product less the cost of feed consumed varies from a minus $8.17 per cow per year for those in the lowest producing group to a plus $206.22 per year for those in the highest producing group. The average value of product less feed cost for the entire group of cows studied was $32.67 per year.

Figure III shows the functional relation between the butterfat production, the roughage cost, the grain cost and the value of the product produced. The straight line graph showing the relation of the value of the product to the pounds of butterfat produced was

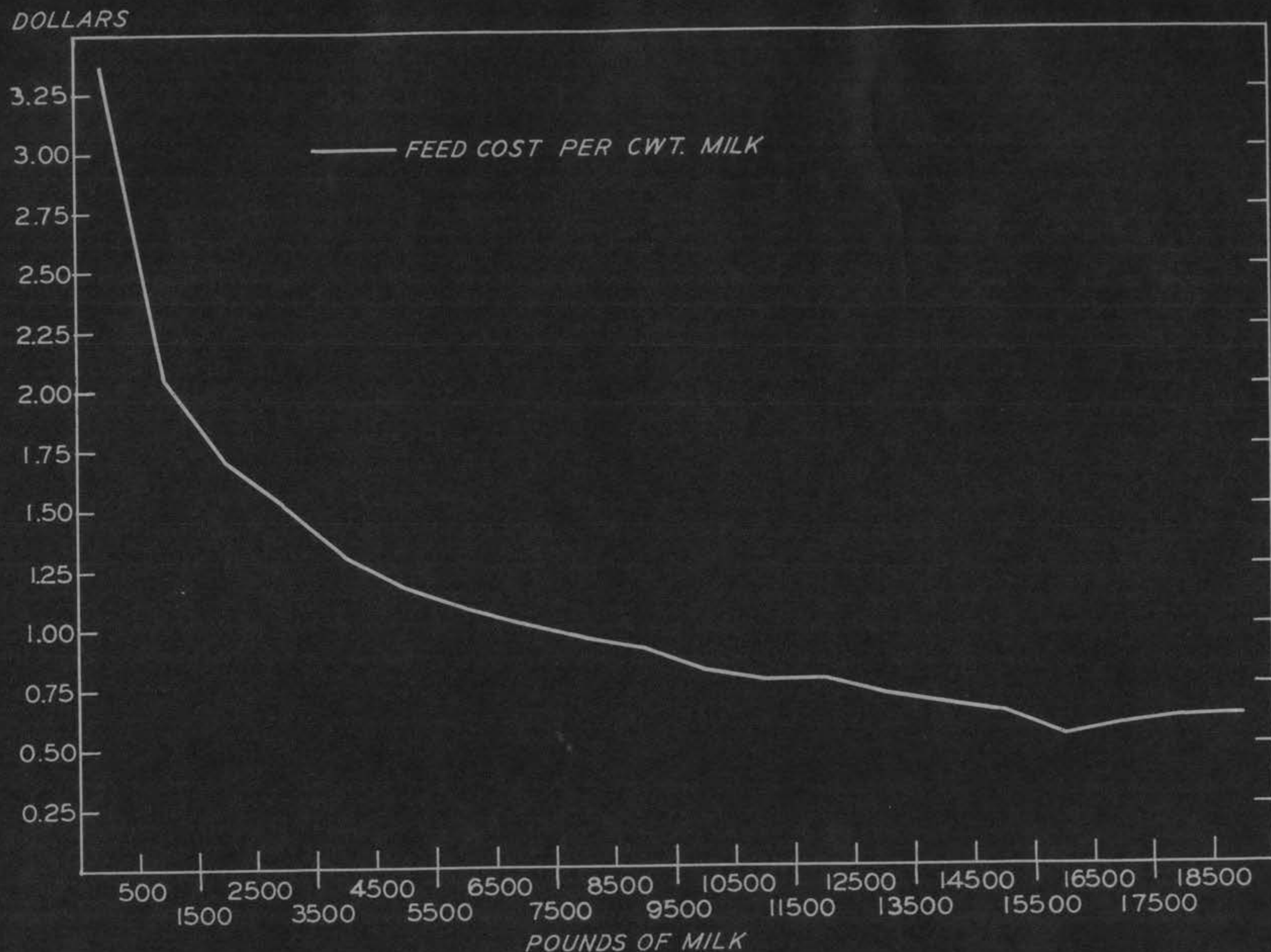

FIG. II
RELATION OF MILK PRODUCTION TO FEED COST PER CWT. OF MILK

calculated from the formula $V = a + bP$ in which V is equal to the value of the product and P to the pounds of butterfat produced. The straight line graph showing the functional relation between cost of grain consumed and pounds of butterfat produced was obtained by using the formula $G = a + bP$ in which G is equivalent to the cost of grain consumed and P represents the pounds of butterfat produced annually. The straight line graph showing the functional relation between cost of roughage and the pounds of butterfat produced was obtained by using the formula $R = a + bP$ in which R represents the roughage cost and P represents the pounds of butterfat produced. All formulas were solved by the Method of Least Squares (7,24).

As is illustrated by fig. III, for every 50 pound increase in production there was a corresponding increase of $16.89 in the value of the product. However, each 50 pound increse in production required only 91 cents increase in the cost of roughage consumed and $4.18 increase in the value of the grain consumed. Thus, every $5.09 increase in feed cost is accompanied by $16.89 increase in value of product. It may be noted, also, that as production increases the increase in roughage cost is relatively small as compared to the increase in grain cost. The graph as a whole indicates that for every 50 pound production of butterfat the increase in value of the product is more than three times greater than the increase in cost of feed consumed.

Figure IV shows the graphical picture of the relation between cost of producing a pound of butterfat and the average production of cows concerned. It will be noted that the feed cost per pound of butterfat drops from $1.03 per pound, where the production is less

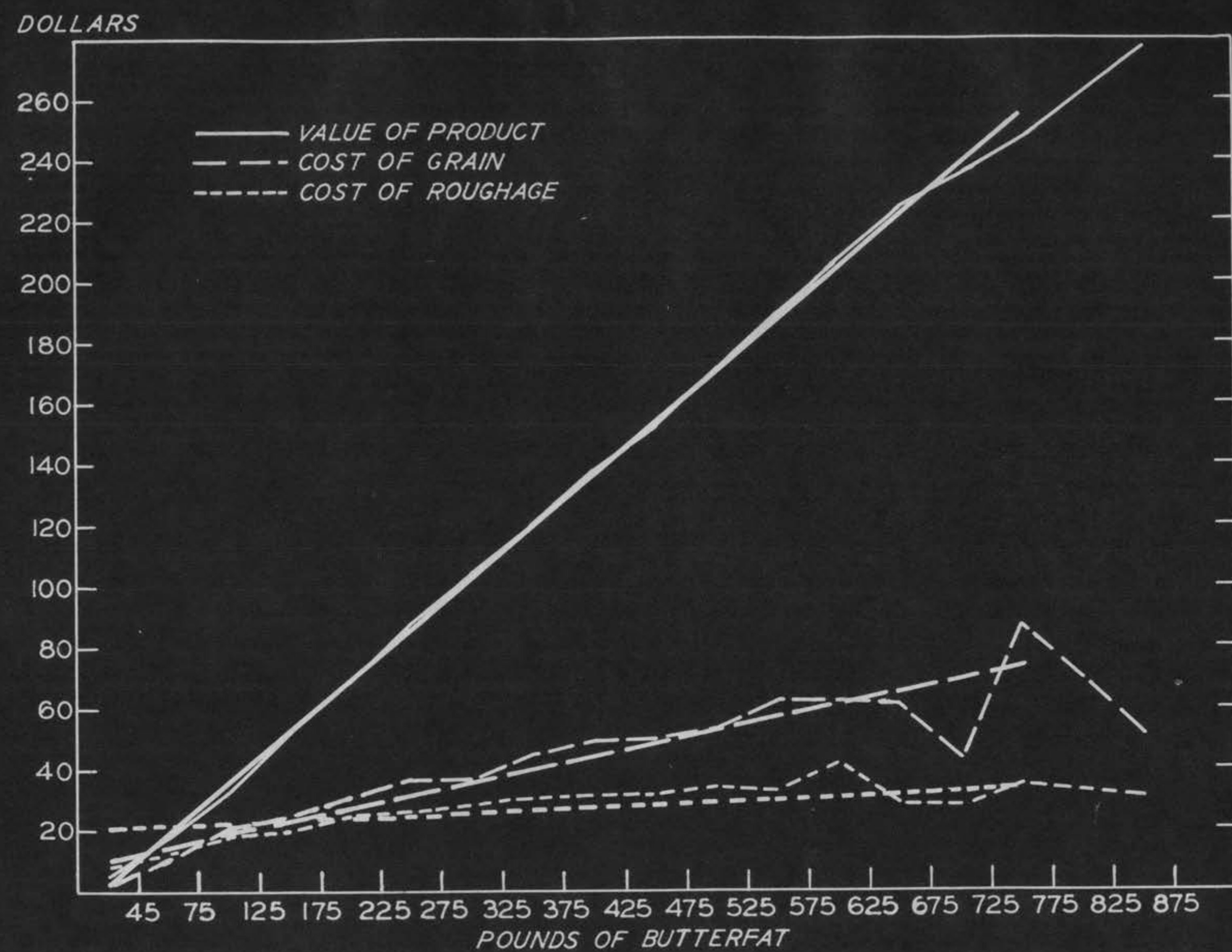

FIG. III
RELATION OF BUTTERFAT PRODUCTION TO ROUGHAGE COSTS, GRAIN COSTS AND THE VALUE OF PRODUCT PRODUCED

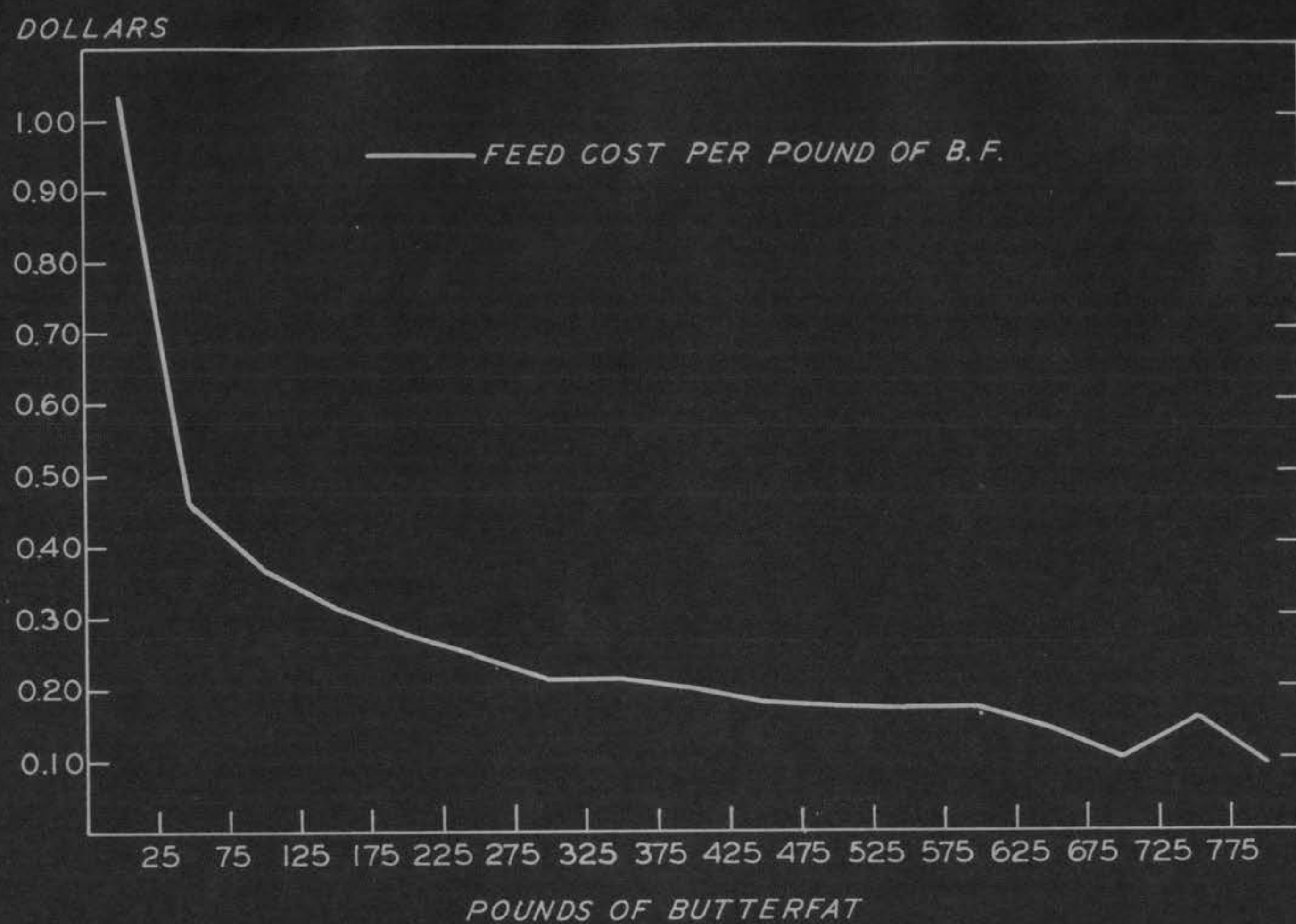

FIG. IV
RELATION OF BUTTERFAT PRODUCTION TO FEED COST PER LB. OF BUTTERFAT

than 25 pounds per year, to 9.8 cents, where the production is as high as 875 pounds per year. The largest variation in the cost of producing a pound of butterfat was found in the groups of cows producing less than 300 pounds of butterfat per year.

Relation of Grain Cost To Other Factors

When the entire group of 9,505 records containing sufficient data was compared by groups according to $5 variations in grain cost, considerable interesting data was obtained as illustrated in Table III and fig. V. In this comparison the groups were arranged to include in the first group all cows with an annual grain cost of less than $7 per head, with $5 variations in each group and with the last group showing a grain cost varying from $148 to $152 per year. Grouped on this basis 44.35 per cent of all the cows were found to fall in the groups receiving between $18 and $37 worth of grain per year.

The production of the cows when classified in this way showed practically a direct correlation with the amount of grain fed. The average value of the product produced varied from $41.87 per year to $256.04 per year. The average value of the product produced for all cows was $97.23 per year. There was no evident decrease in roughage cost where the cost of grain consumed showed an increase, in fact, there was a slight increase in the roughage costs with a corresponding increase in grain cost. The cost of roughage consumed varied from $12.36 to $45, the average amounting to $27.36 per year. The total feed cost per pound of butterfat produced showed a variation of from 14.3 cents to 53.2 cents per pound. No evident relationship was found between the value of the product less feed cost and the amount of grain consumed. This, no doubt, can be accounted for by the

Table III. Relation of Grain Cost to Other Factors.

Classification Grain Cost	No. of Records	% of Total	Av. Milk Prod.	Av. Test	Av. B.F. Prod.	Av. Price Lb. B.F.	Av. Value Product	Av. Cost Roughage	Av. Cost Grain	Av. Cost All Feed	Av. Value Prod. Less Feed Cost	Av. Feed Cost Per Lb. B.F.
$1 - $7	133	1.39	2685	4.5	121	34.6¢	$ 41.87	$ 12.36	$ 5.06	$ 17.42	$ 24.45	14.3¢
$8 - $12	302	3.17	4198	4.5	188	34.6	65.05	17.76	10.66	28.42	36.63	15.1¢
$13 - $17	652	6.85	5257	4.5	234	34.6	80.96	18.90	15.29	34.19	46.77	14.6¢
$18 - $22	1012	10.64	5540	4.5	247	34.6	85.46	21.14	20.16	41.30	44.16	16.7¢
$23 - $27	1117	11.75	5922	4.4	262	34.6	90.65	24.44	25.12	49.56	41.09	18.9¢
$28 - $32	1086	11.42	6020	4.5	270	34.6	93.42	25.58	29.91	55.49	37.93	20.5¢
$33 - $37	1002	10.54	6488	4.4	288	34.6	99.65	28.65	35.02	63.67	35.98	22.1¢
$38 - $42	849	8.93	6856	4.3	296	34.6	102.42	30.35	40.05	70.39	32.03	23.7¢
$43 - $47	680	7.15	7076	4.2	297	34.6	102.76	32.25	45.07	77.32	25.44	26.0¢
$48 - $52	612	6.43	7214	4.2	303	34.6	104.84	32.74	49.95	82.69	22.15	27.2¢
$53 - $57	540	5.68	7326	4.2	308	34.6	106.57	33.13	54.88	88.01	18.56	28.5¢
$58 - $62	398	4.19	7795	4.1	320	34.6	110.72	33.09	59.90	92.99	17.73	29.0¢
$63 - $67	329	3.46	7868	4.2	334	34.6	115.56	32.58	64.91	97.50	18.06	29.1¢
$68 - $72	269	2.83	8038	4.2	339	34.6	117.29	32.22	69.97	102.19	15.10	30.1¢
$73 - $77	144	1.51	7812	4.2	332	34.6	114.87	31.63	75.18	106.81	8.06	32.1¢
$78 - $82	114	1.19	8688	4.2	365	34.6	126.29	32.71	80.11	112.83	13.46	30.9¢
$83 - $87	61	.64	8733	4.2	369	34.6	127.67	32.67	84.80	117.48	10.19	31.8¢
$88 - $92	58	.61	9319	4.0	376	34.6	130.10	32.95	90.26	123.21	6.89	32.7¢
$93 - $97	49	.51	9255	3.9	363	34.6	125.60	33.71	94.67	128.39	-2.79	35.3¢
$98 - $102	41	.43	9663	4.0	387	34.6	133.90	35.66	99.80	135.46	-1.56	35.0¢
$103 - $107	20	.21	10395	3.9	401	34.6	138.75	32.80	105.15	137.95	.80	34.4¢
$108 - $112	13	.13	8795	4.4	388	34.6	134.25	39.08	109.62	148.69	-14.44	38.3¢
$113 - $117	10	.10	12443	3.4	420	34.6	145.32	36.60	114.40	151.00	-5.68	35.9¢
$118 - $122	5	.05	11998	3.3	401	34.6	138.75	42.00	119.20	161.20	-22.45	40.1¢
$123 - $127	4	.04	13618	3.3	451	34.6	156.05	30.25	125.50	155.75	.30	34.5¢
$128 - $132	1	.01	18742	3.9	740	34.6	256.04	45.00	131.00	176.00	80.04	23.7¢
$133 - $137	2	.02	9860	3.4	338	34.6	116.95	45.00	135.00	180.00	-63.05	53.2¢
$138 - $142	1	.01	16090	3.4	545	34.6	188.57	36.00	141.00	177.00	11.57	32.4¢
$143 - $147												
$148 - $152	1	.01	10032	5.7	573	34.6	198.26	37.00	151.00	188.00	10.26	32.8¢
Average	Total 9505	100%	6508	4.3	281	34.6	97.23	27.36	38.33	65.69	31.54	23.37¢

fact that the cows are not grouped in accordance with productive ability and were not likely fed in accordance to production in all cases.

The graphical chart in fig. V shows a functional relation between grain cost and the value of the product, and between grain cost and cost of roughage consumed. In the first comparison, showing the functional relation between grain cost and the value of product, the straight line graph was obtained by the formula $V = a + bG$, V representing the value of the product and G the cost of grain consumed. In the second comparison, showing the functional relationship between cost of roughage consumed and cost of grain consumed, the results were obtained by the formula $R = a + bG$, R representing the cost of roughage consumed and G the cost of grain consumed. All formulas were solved by the Method of Least Squares (7,24).

This chart illustrates the fact that where cows were grouped only on grain cost variations the increase in value of product amounted to only $3.93 for each $5 increase in grain cost. Variations in cost of roughage consumed showed an increase of 78 cents for each $5 increase in cost of grain consumed. These facts indicate that in this grouping the cows were not fed directly in proportion to production and, further, that when grouped in this way cows with a more economical production were grouped along with those which showed a lack of economy in production.

Figure VI shows the functional relation between grain cost and the total feed cost per pound of butterfat produced. The straight line in this illustration was obtained by the formula $F = a + bG$, F representing the total feed cost per pound of butterfat and G the cost of grain consumed. The formulas were solved by the Method of

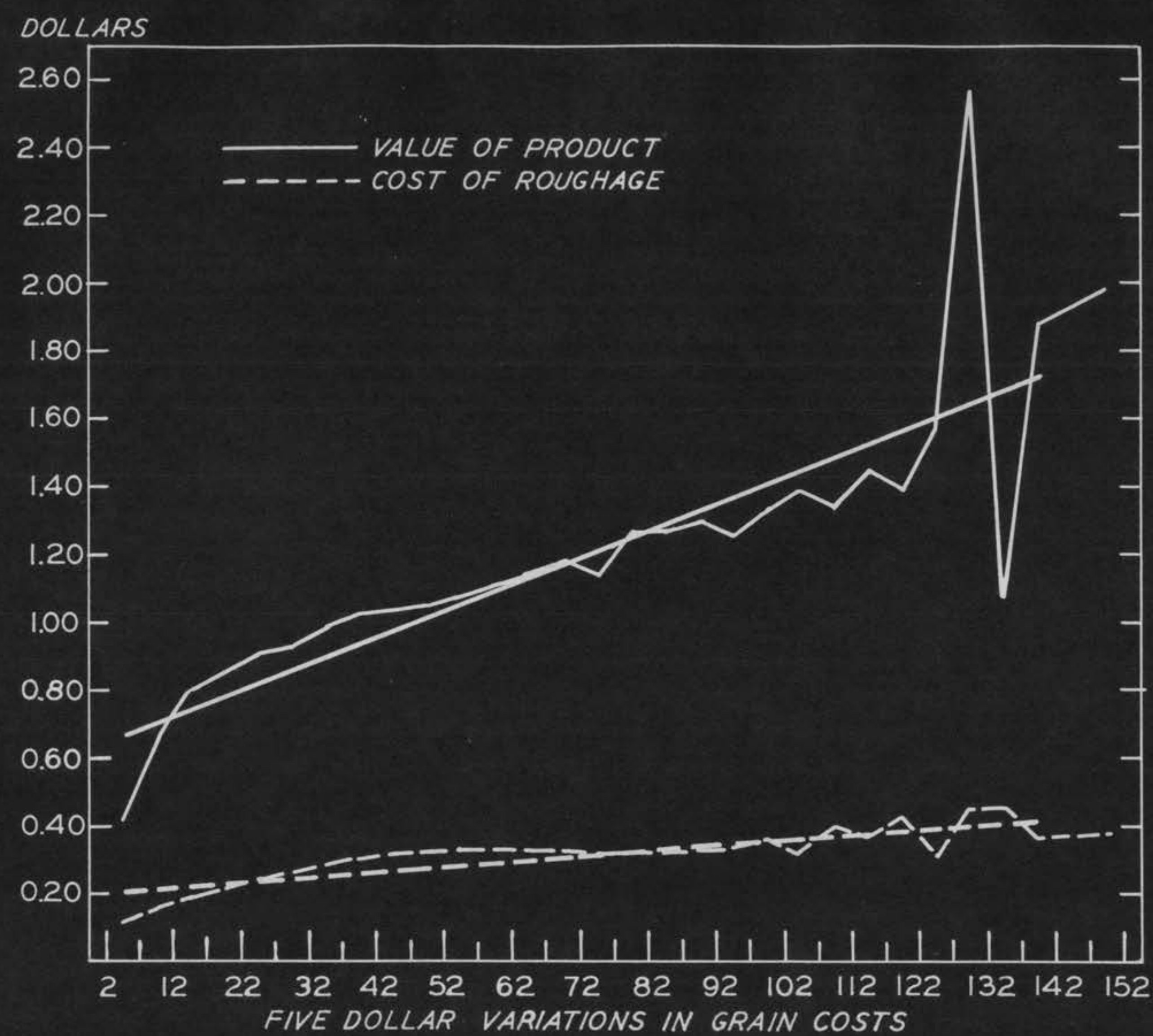

FIG. V
RELATION OF GRAIN COST TO ROUGHAGE COST AND VALUE OF THE PRODUCT

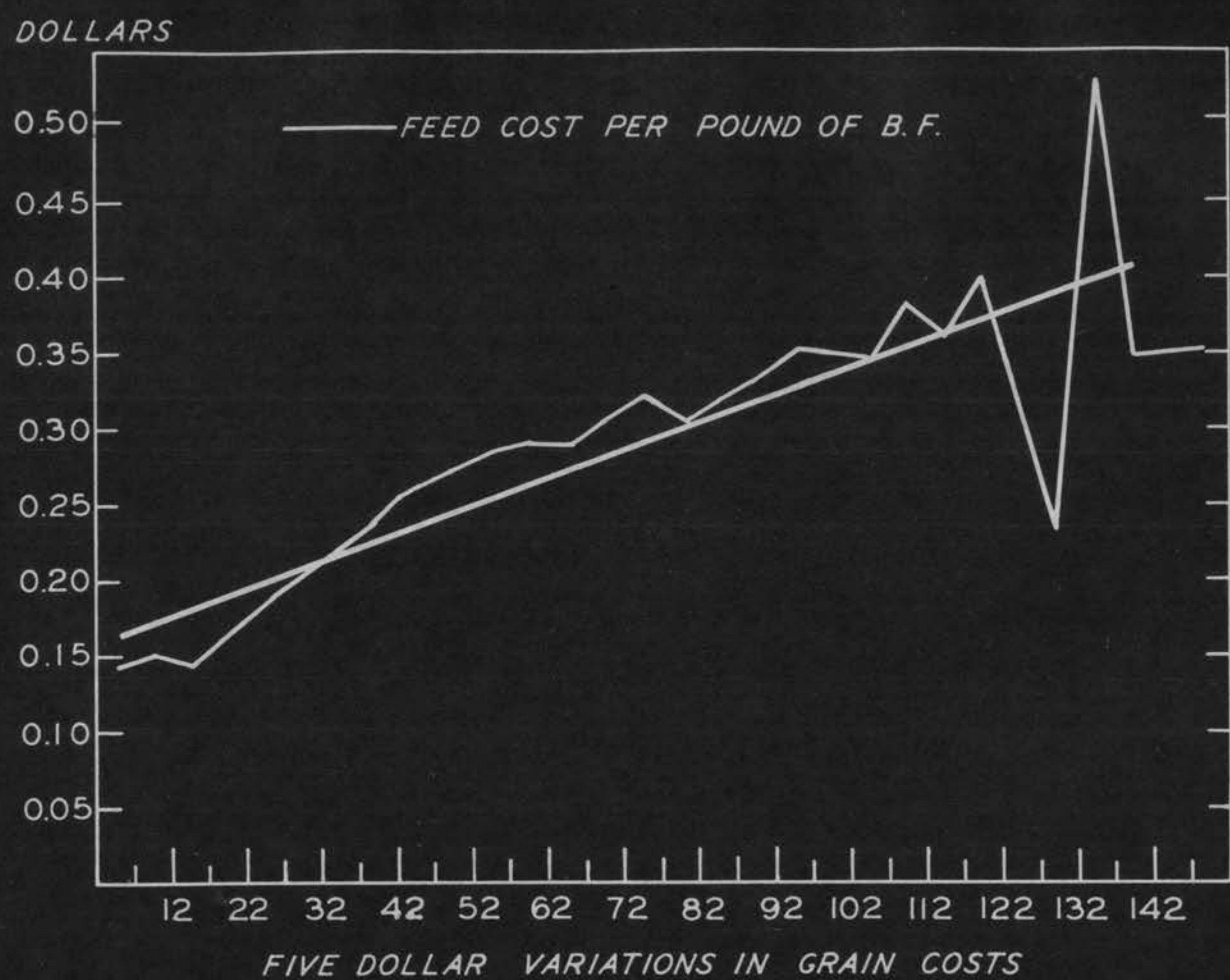

FIG. VI
RELATION OF GRAIN COST TO TOTAL FEED COST
PER LB. OF BUTTERFAT

Least Squares (7,24). From the straight line relation shown in this chart it may be noted that for every $5 increase in grain cost there was a corresponding increase of .9 cents in the cost of feed consumed per pound of butterfat produced.

Purebred Cows Classified By Age

Table IV shows the statistical data obtained by classifying the 1,350 purebred cows by ages in groups varying from the age of two years at freshening to 17 years. It was interesting to note in this comparison that the average age of all purebred cows in production was as low as 5.24 years. Deducting two years for getting the cows into production this would indicate that the average producing lifetime for this group of cows was but little over three years. Of the entire group 71.32 per cent was found to be freshening between the ages of two and six years. As is indicated in Table IV, the average production for the 1,350 purebred cows amounted to 6,907 pounds of milk and 301 pounds butterfat per year. The average value of the product based on the calculated price per pound of butterfat was $104.15, average cost of roughage consumed $30.39, average cost of grain consumed $44.98, average cost of all feed consumed $75.37 and average value of product produced less feed cost $28.78. The average feed cost per pound of butterfat produced was 25 cents.

In comparing the production trends by age fig. VII it was found that there was a tendency toward increased production from the age of two years to eight years, after which there was a slight decrease to the age of 12 years where, no doubt, because of extreme culling and a small number of cows included in the older groups, the production increased decidedly.

Table IV. Purebred Cows Compared by Age.

Classification Age by years	No. of Records	% of Total	Av. Milk Prod.	Av. Test	Av. B.F. Prod.	Av. Price Lb. B.F.	Av. Value Product	Av. Cost Roughage	Av. Cost Grain	Av. Cost All Feed	Av. Value Prod. Less Feed Cost	Av. Feed Cost Per Lb. B.F.
2	153	11.33	5995	4.6	275	34.6¢	$ 95.15	$ 30.03	$ 41.19	$ 71.22	$ 23.93	25.9¢
3	259	19.18	6424	4.5	287	34.6	99.30	29.10	42.00	71.10	28.20	24.8
4	248	18.37	6870	4.4	299	34.6	103.45	30.73	41.81	72.54	30.91	24.3
5	162	12.00	7387	4.3	321	34.6	111.06	31.93	49.59	81.52	29.54	25.4
6	141	10.44	7435	4.4	325	34.6	112.45	28.41	46.70	75.11	37.34	23.1
7	125	9.25	7195	4.3	309	34.6	106.91	31.99	47.62	79.62	27.29	25.8
8	102	7.55	7838	4.2	328	34.6	113.49	31.95	49.75	81.71	31.78	24.9
9	61	4.51	7006	4.3	299	34.6	103.45	31.70	45.03	76.74	26.71	25.7
10	39	2.88	6710	4.4	295	34.6	102.07	30.46	47.85	78.31	23.76	26.5
11	25	1.85	6878	4.0	277	34.6	95.84	29.20	53.20	82.40	13.44	29.7
12	20	1.48	6312	4.0	253	34.6	87.53	24.00	43.45	67.45	20.08	26.7
13	5	.37	8682	4.0	346	34.6	119.72	34.00	53.40	87.40	32.32	25.3
14	8	.59	6265	3.7	231	34.6	79.93	34.25	46.50	80.75	-.82	34.9
15	1	.07	5742	4.2	244	34.6	84.42	28.00	29.00	57.00	27.42	23.3
16												
17	1	.07	9301	6.0	561	34.6	194.11	29.00	47.00	76.00	118.11	13.5
18												
Av. 5.24	Total 1350	100%	6907	4.4	301	34.6	104.15	30.39	44.98	75.37	28.78	25.0

Table V. Grade Cows Compared by Age.

Classification Age by years	No. of Records	% of Total	Av. Milk Prod.	Av. Test	Av. B.F. Prod.	Av. Price Lb. B.F.	Av. Value Product	Av. Cost Roughage	Av. Cost Grain	Av. Cost All Feed	Av. Value Prod. Less Feed Cost	Av. Feed Cost Per Lb. B.F.
2	256	8.58	5469	4.5	247	34.6¢	$ 85.46	$ 28.04	$ 35.80	$ 63.85	$ 21.61	25.8¢
3	463	15.52	5785	4.5	260	34.6	89.96	25.42	37.43	62.85	27.11	24.1
4	453	15.19	5907	4.6	269	34.6	93.07	24.55	38.15	62.69	30.38	23.3
5	460	15.42	6065	4.5	274	34.6	94.80	24.67	39.25	63.92	30.88	23.3
6	428	14.35	6313	4.4	280	34.6	96.88	26.22	39.83	66.05	30.83	23.5
7	355	11.9	6378	4.4	278	34.6	96.18	25.68	39.90	65.58	30.60	23.5
8	285	9.55	6569	4.3	282	34.6	97.57	27.16	41.82	68.99	28.58	24.4
9	124	4.15	6589	4.3	282	34.6	97.57	29.27	41.75	71.02	26.55	25.1
10	85	2.85	6756	4.1	276	34.6	95.50	30.71	41.88	72.59	22.91	26.3
11	36	1.20	6734	4.0	269	34.6	93.07	31.00	38.19	69.19	23.88	25.7
12	24	.80	6049	4.0	244	34.6	84.42	29.92	48.50	78.42	6.00	32.1
13	7	.23	5791	3.9	223	34.6	77.16	22.29	27.14	49.43	27.73	22.1
14	3	.10	7104	3.5	247	34.6	85.46	26.00	41.66	67.66	17.80	27.3
15	2	.10	3953	4.5	176	34.6	60.89	28.50	28.50	57.00	3.89	32.3
16	1	.03	8827	3.9	341	34.6	117.99	20.00	19.00	39.00	78.99	11.4
17												
18												
Av. 5.43	Total 2982	100%	6117	4.4	271	34.6	93.77	26.12	39.11	65.23	28.54	24.1

Grade Cows Classified by Age

Table V shows the statistical data obtained from classifying 2,982 grade cows by age at freshening. In this study it was found that the average age of all cows included was 5.43 years, which, is similar to that of the purebred cows. If two years are deducted for getting these cows into production it indicates that the average producing lifetime was slightly over three years. Of the entire group of grade cows 69.06 per cent were found to be between the ages of two and six years. The average production of milk was 6,117 pounds containing an average of 271 pounds butterfat which indicates that, on the average, the grade cows produce 790 pounds less milk and 30 pounds less butterfat per year than the purebreds. This data quite closely compares with that cited in the Review of Literature (6), (17), (21).

For all grade cows the average value of the product amounted to $93.77 which was $10.38 less than the average for the group of purebred cows. The average roughage consumed showed a cost of $26.12, the average grain consumed cost $39.11, or a total average feed cost of $65.23. The average value of the product over feed cost amounted to $28.54, which is slightly less than that of the purebred cows. The average cost per pound of butterfat produced was 24.1 cents.

Comparison Between Purebred and Grade Cows

The relationship between butterfat production of purebreds and grade cows, fig. VII, when compared by age indicates that the purebred cows were uniformly higher at all ages. The margin of difference between production of purebreds and grades has a tendency to decrease as the age increases, which indicates logical and closer culling on the part of the grade cow owners.

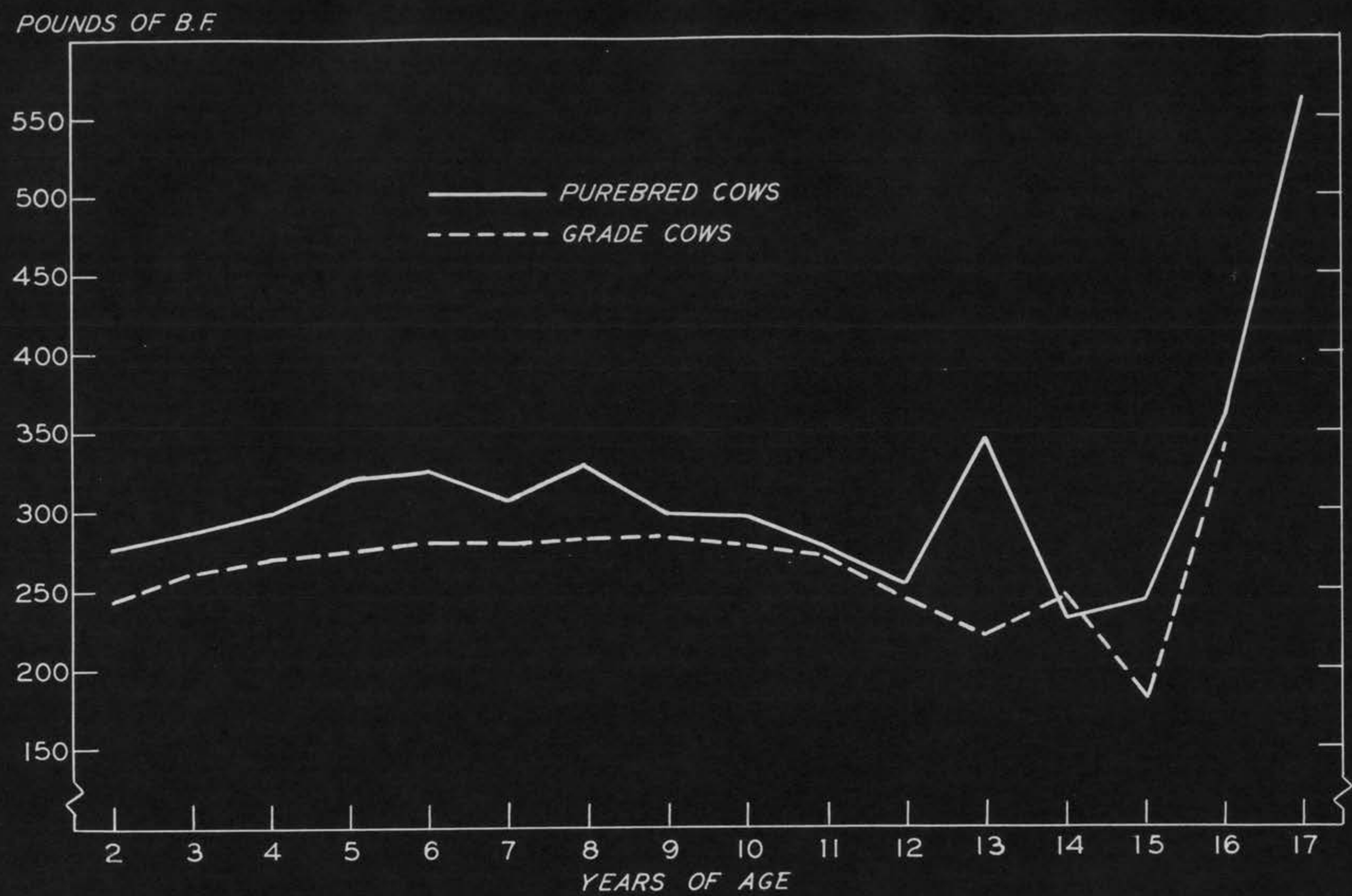

FIG. VII
BUTTERFAT PROUCTION OF PUREBRED AND GRADE COWS COMPARED BY AGE

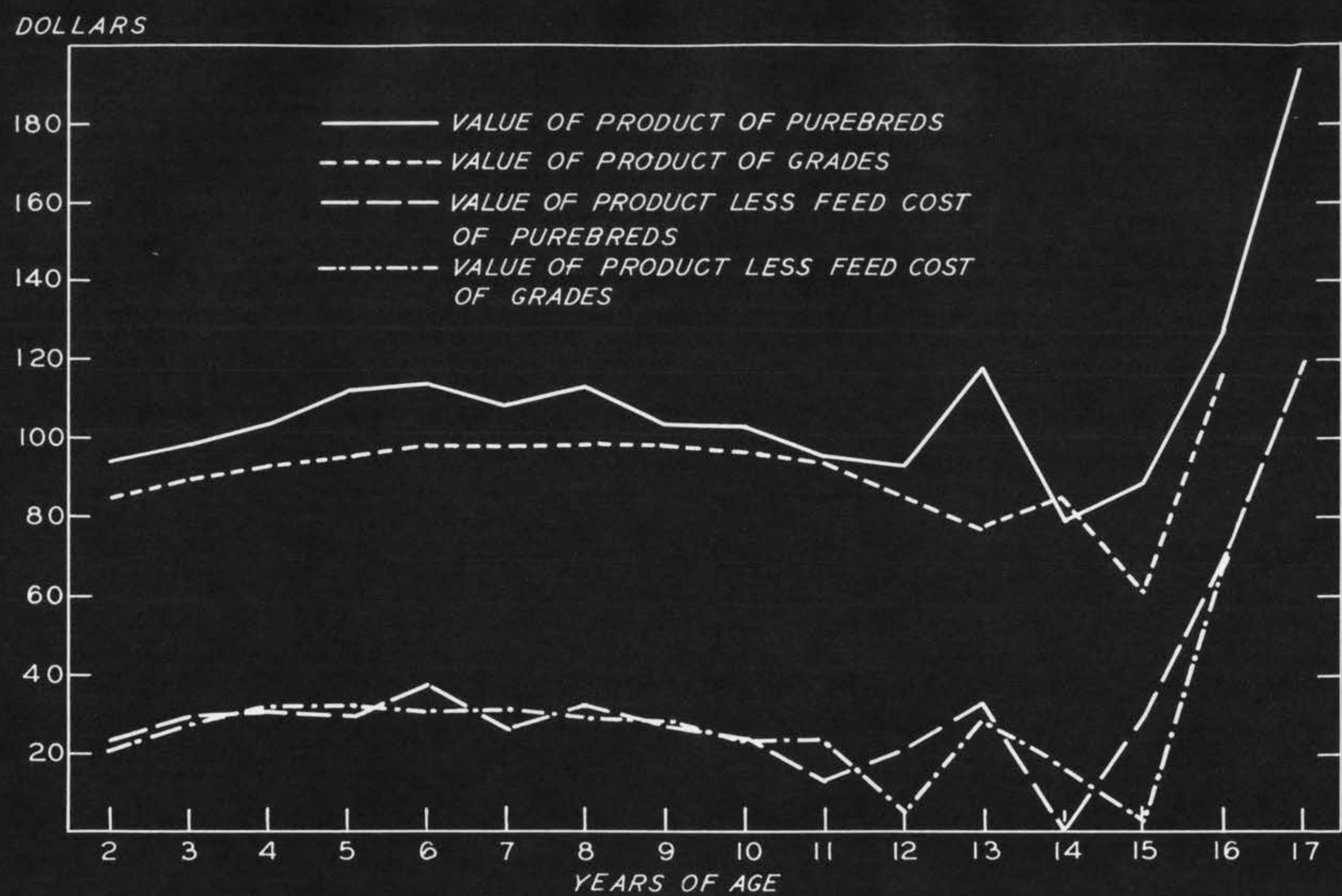

FIG. VIII

TOTAL VALUE OF PRODUCT AND VALUE OF PRODUCT LESS FEED COSTS OF PUREBRED AND GRADE COWS COMPARED BY AGE

The relationship between total value of product and the value of the product less feed cost, fig. VIII, indicates the purebred cows were uniformly higher in production at all ages. However, the lower graph indicates that there was little difference in the value of the product less the cost of feed consumed by the two groups of cows.

Figure IX shows the relation between the feed cost per pound of butterfat produced by the purebred and grade cows when classified by age, and indicates that the difference in feed cost per pound of butterfat is very small. In fact, the difference between feed cost per pound of butterfat for the purebreds and grades may be said to be insignificant at all ages. Data obtained in this comparison compares very favorably with that previously cited in the Review of Literature (17).

The per cent of all purebred and grade cows which were milking at various ages is shown in fig. X. A larger percentage of the purebreds were in production between the ages of two and five years, a larger proportion of the grades from five to nine years. Beyond the age of nine years there was little difference with a slightly higher percentage in favor of the purebred cows. This first difference, no doubt, can be accounted for by the fact that in herds studied in this analysis owners were inclined to buy or raise a larger percentage of purebred cows as heifer calves and bring them into production on their own farm. In the case of grade cows no doubt in many cases they were interested in the commercial production of milk and were willing to pay the necessary price to purchase mature cows rather than to raise grade calves.

Relation of Time of Freshening to Feed Cost and Production

Table VI shows the statistical comparison of production cost and

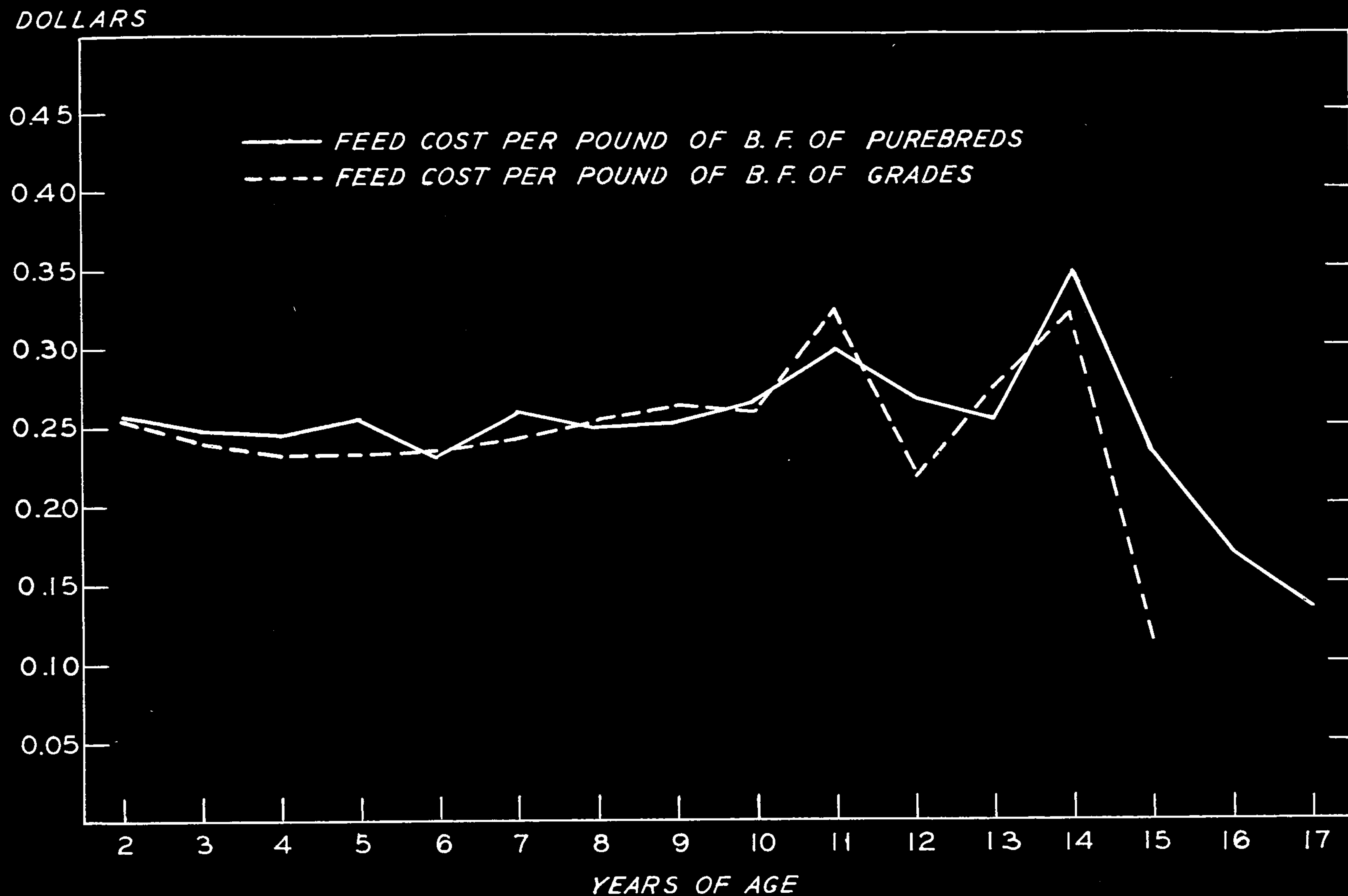

FIG. IX
FEED COST PER LB. OF BUTTERFAT OF PUREBRED AND GRADE COWS BY AGE

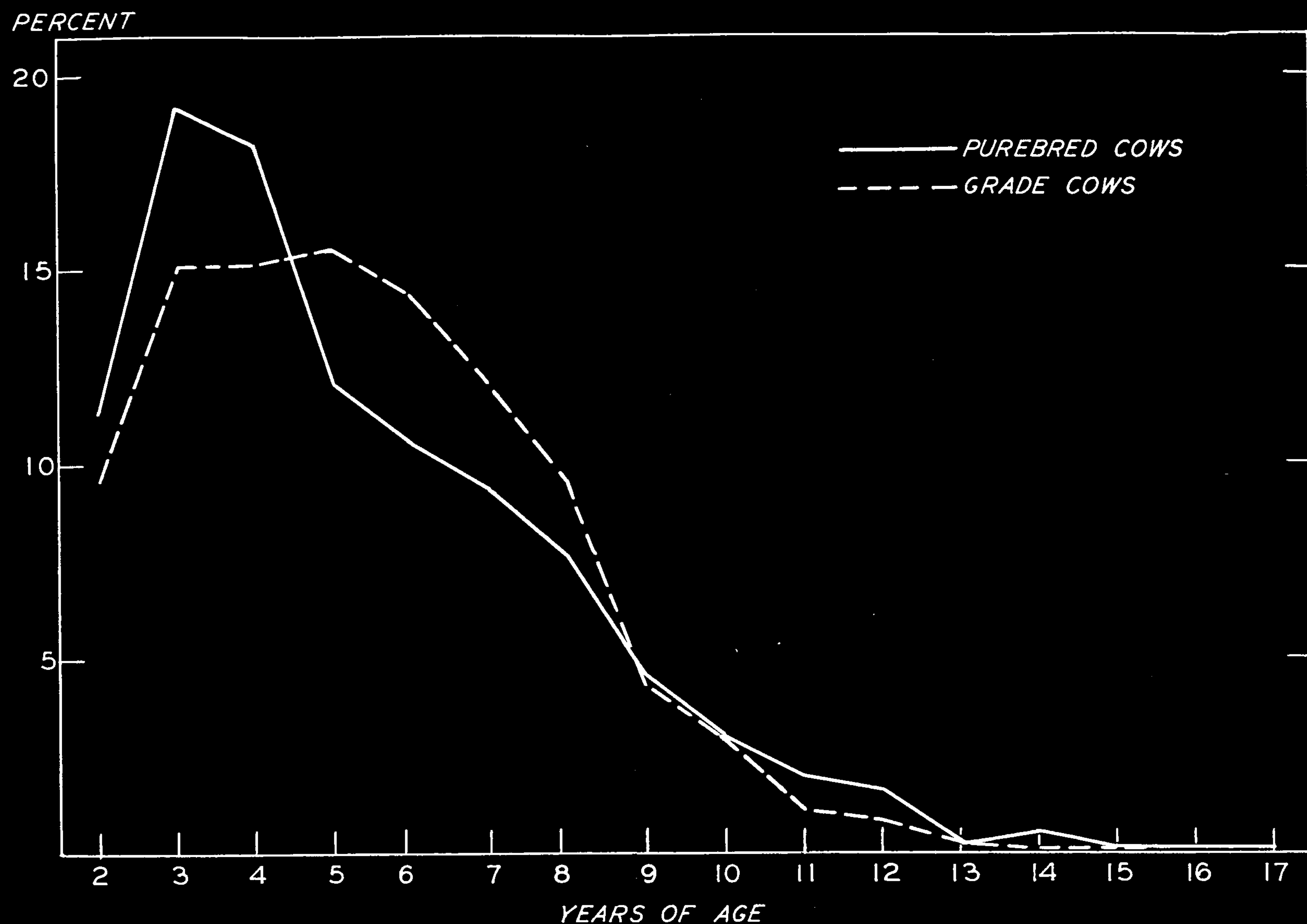

FIG. X

PERCENT OF PUREBRED AND GRADE COWS IN MILK AT VARIOUS AGES other data obtained when the group of 5,870 cows were compared as to the season of freshening. In this comparison it is found that there is a very small variation in the per cent of cows which were freshening in any of the four seasons of the year. The highest percentage freshened in the winter season of December, January and February. The other three seasons ranked in the following order: fall season including September, October and November freshenings; summer season including June, July and August freshenings and the spring season which includes the months of March, April and May. In comparing production it was found that there is a little difference in favor of the cows freshening in the winter season which showed an average production of 294 pounds of butterfat. Those freshening in the spring season showed the lowest production with an average of 282 pounds of butterfat. Cows freshening in the spring months showed the smallest cost for roughage while those freshening in the fall months showed the highest roughage cost. In comparing the cost of grain consumed the spring freshening group was again lowest and the fall freshening group highest. The total cost for fall freshening cows averaged $69.55, for summer freshening $66.46, for winter freshening $66.06 and for spring freshening $62.67. In comparing the cows as to the feed cost per pound of butterfat produced the data indicates that the highest cost was for the group freshening in the summer months of June, July and August, which showed a feed cost of 24.2 cents per pound of butterfat produced. Second were those freshening in the fall months of October, September and November with an average feed cost per pound of butterfat produced amounting to 23.9 cents; third, those freshening in the winter months of December, January and February with an average

Table VI. All Cows Compared By Season of Freshening.

Classification Season of Freshening	No. of Records	% of Total	Av. Milk Prod.	Av. Test	Av. B.F. Prod.	Av. Cost Roughage	Av. Cost Grain	Av. Cost All Feed	Av. Feed Cost Per Lb. B.F.
Dec., Jan., Feb.	1594	27.16	6855	4.3	294	$ 27.21	$ 38.85	$ 66.06	22.4¢
March, April, May	1299	22.13	6453	4.4	282	25.15	37.52	62.67	22.2
June, July, Aug.	1388	23.65	6323	4.3	274	27.36	39.10	66.46	24.2
Sept., Oct., Nov.	1589	27.06	6843	4.2	290	30.04	39.51	69.55	23.9
	Total								
Average	5870	100%	6637	4.3	286	27.56	38.79	66.35	23.2

feed cost of 22.4 cents per pound of butterfat produced. The lowest cost per pound of butterfat produced was found for those cows freshening in the months of March, April and May. This data compares very favorably with the literature which was reviewed and previously cited (3), (4), (6), (19), (25), (29). Purposely no attempt was made in this comparison to evaluate the product produced due to the fact that there was no definite way of determining the seasonal production of the cows in the four groups.

SUMMARY AND CONCLUSIONS

1. The number of cows which have been supervised in dairy herd improvement association work in the state of Oklahoma has gradually increased from 110 cows in 1925 to 1,013 cows in 1936.

2. Average milk production for cows in dairy herd improvement association work in Oklahoma gradually increased from 4,867 pounds in 1925 to 7,313 pounds in 1935. Butterfat production also shows a gradual increase from 243 pounds in 1925 to 300 pounds in 1935.

3. During this same period the average Oklahoma cow dropped in milk production from 3,450 pounds to 3,100 pounds and in butterfat production from 146 pounds to 131 pounds.

4. One important contrast in this analysis is that while the average Oklahoma cow not only failed to increase in production but actually declined the dairy herd improvement cows showed a gradual increase in production.

5. The average calculated value received by Oklahoma farmers for butterfat during the 11 year period 1925 to 1936 was 34.6 cents per pound. Based on the number of cows included in this analysis the average feed cost per pound of butterfat produced was 23 cents. The average feed cost per hundred pounds of milk produced was $1.01.

6. When grouped according to milk production 72.42 per cent of all the cows studied in this analysis showed an average annual production between 3,500 and 8,500 pounds of milk.

7. For each 1,000 pound increase in annual milk production the value of the product increased $10.47 with an increase in feed cost of only $4.66.

8. The feed cost per 100 pounds of milk produced showed a decided

increase as the average production decreased, varying from 55 cents as the lowest feed cost per hundred pounds of milk to $3.66 which represented the highest feed cost per hundred pounds of milk produced.

9. When the cows studied in this analysis were grouped according to butterfat production, 73.85 per cent showed an average annual production between 175 and 375 pounds butterfat.

10. For each 50 pound increase in the annual fat production the value of the product increased $16.89 with a corresponding increase in feed cost of only $5.09.

11. By increasing the average annual production of a cow by 50 pounds butterfat, the increase in the value of the product is more than three times greater than the increase in total feed cost.

12. For each $5 increase in cost of grain consumed the feed cost per pound of butterfat produced showed an increase of .9 cents.

13. When the cows were grouped according to cost of grain consumed, 44.35 per cent of the cows were found to fall in the groups receiving between $18 and $37 worth of grain per year.

14. The value of the product produced varies directly with the increase in grain cost. However, the variation was not in the same proportion.

15. Increase in the cost of grain consumed apparently had no tendency to decrease the annual cost of roughage consumed.

16. Purebred cows included in this study showed an average age of 5.24 years. The grade cows included in this study showed an average age of 5.43 years. This, of course, includes only cows which are in production.

17. The purebred cows averaged 790 pounds more milk and 30

pounds more fat than did the grades. The production of the purebreds was uniformly higher at all ages. However, the average feed cost was slightly higher for the purebreds.

18. Little difference was found in the total feed cost per pound of butterfat produced by purebred and grade cows.

19. Cows freshening in the winter months of December, January and February were highest in butterfat production. Those freshening in the fall months of September, October and November were second in production. Those freshening in the spring months of March, April and May were third. Those freshening in the summer months of June, July and August were lowest in production.

20. In comparing the cows on the basis of feed cost per pound of butterfat produced the lowest cost was found for those cows freshening in the spring season; second, those freshening in the winter season; third, those freshening in the fall season and fourth those cows freshening in the summer season.

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