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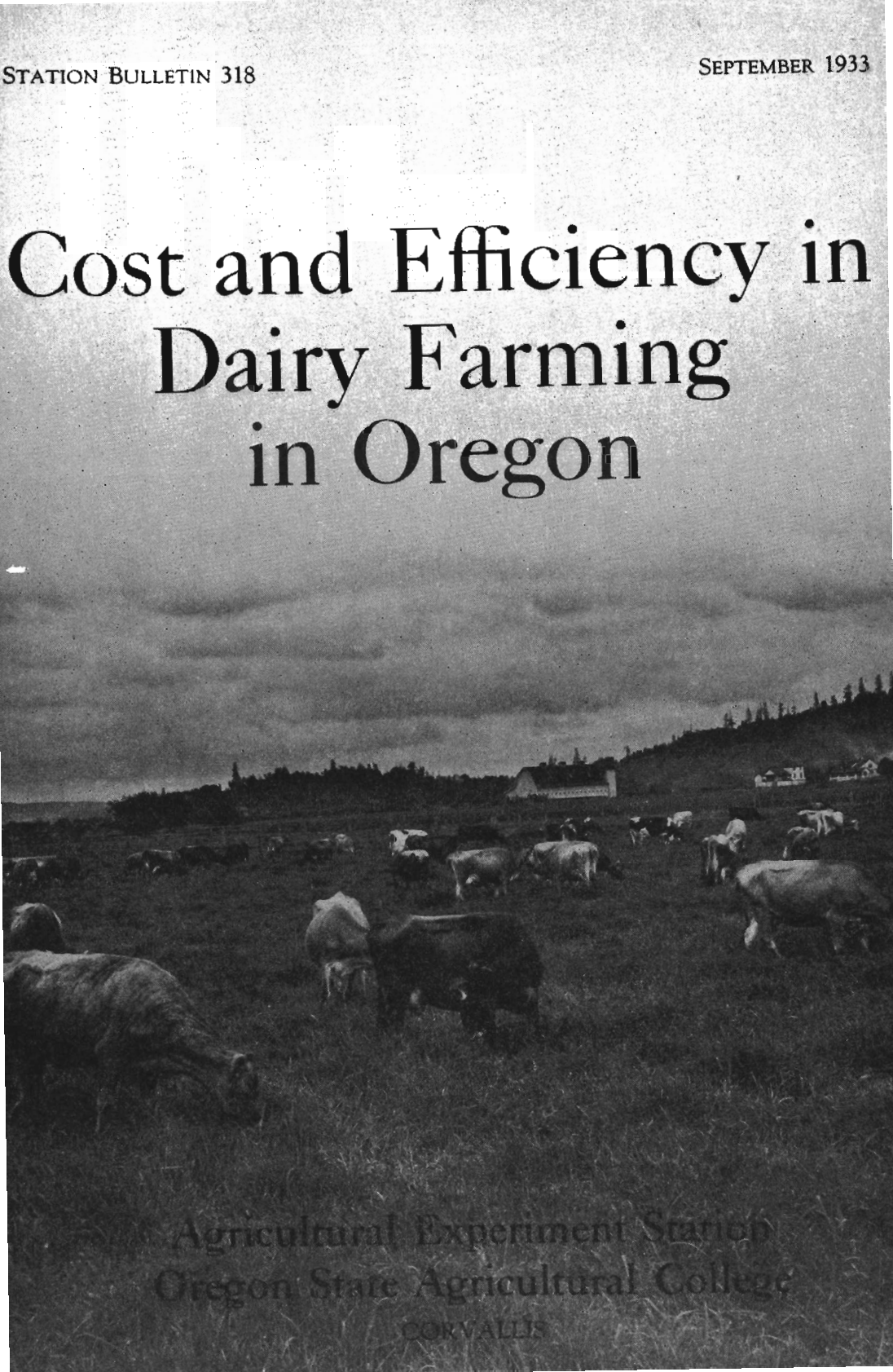
Cost and Efficiency in Dairy Farming in Oregon



Agricultural Experiment Station
Oregon State Agricultural College
CORVALLIS

REDUCING COSTS IN DAIRYING

DAIRYING is the most important agricultural enterprise in Oregon, producing nearly one-fifth of the total value of agricultural products. Even with the low prices of 1932, the value of the milk produced on Oregon farms amounted to nearly sixteen million dollars.*

This four-year study, based on 1,733 annual farm-cost records, covering 29,619 cow-years, and the production of 21,063,315 gallons of milk, shows that costs of production are nearly fifty per cent higher on one half of the dairy farms than on the other half. The study brings out a number of the factors that make for lower costs of production, the most important of which are (1) better cows, (2) more and better pastures, (3) better feeding practices, (4) an economic size of herd, (5) efficient use of labor.

An average reduction in the cost of producing milk in Oregon of a small fraction of a cent per pound of butterfat would pay for this investigation many times over every year. It is hoped that many dairymen will obtain suggestions that will enable them to reduce their costs by substantial amounts.

*Estimate of United States Department of Agriculture.

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SUMMARY

Average costs and selling prices

The average cost of producing milk and butter-fat in the state of Oregon as a whole, was found to be 50 cents per pound of butter-fat for the year ending April 1, 1930; 40 cents for the year ending April 1, 1931; and 36 cents for the year ending April 1, 1932. These figures are averages of all of the records taken in each year, and represent an aggregate of all types of dairy production such as churning cream, cheese factory milk, market milk, etc. The average selling prices per pound of butter-fat in each of the three years were 50 cents, 41 cents, and 31 cents, respectively.

The average percentage distribution of the principal cost items was as follows: feed, 52 per cent; labor, 27 per cent; interest and depreciation on cows, 8 per cent; use of buildings and equipment, 7 per cent; other items, 6 per cent. The cost was approximately 50 per cent immediate cash expenditure and 50 per cent non-cash items such as farm-grown feed; unpaid labor of the dairyman and his family; depreciation of stock, buildings, and equipment; and interest on the value of stock, buildings, and equipment.

REGIONAL COSTS. For the year ending April 1, 1932, the average cost per pound of butter-fat was 39 cents in the Willamette Valley, 35 cents in the Coast regions, and 33 cents in the Irrigated regions. Similar differences in cost were found in the two preceding years. The differences in cost between the regions are caused by differences in type of production and in feed and pasture conditions. The Willamette Valley is characterized by the largest proportion of market milk production, shortage of pasture and heavy grain feeding; the Coast regions, by excellent pastures, long pasture season, and less winter feeding; and the Irrigated regions, by the use of irrigated pastures and alfalfa hay as the principal forms of feed.

COSTS BY TYPE OF PRODUCTION. Costs for the principal types of dairying were obtained for a fourth year, the year ending April 1, 1933, and averaged 39 cents per pound of butter-fat for market milk in the Willamette Valley; 33 cents for churning cream in the Willamette Valley; 30 cents for cheese milk in the Coast regions, and 24 cents for churning cream in the Irrigated regions. Similar differences were found in each of the other years of the study.

COST OF SEPARATING MILK. The average cost of separating milk, for the year ending April 1, 1932, was found to be 14 cents per 100 pounds of skim milk. The separator loss of butter-fat and average price differential between churning cream and manufacturing milk brought the total cost of 100 pounds of skim milk up to 26 cents.

QUANTITY COSTS. Costs in pounds of hay, succulent feeds, grain, days of pasture, and hours of labor are given for the principal dairy regions and types of dairying. These quantity costs amount to about four-fifths of the total cost of production.

SUMMARY—*Continued*

Cost formulas

Cost formulas based on the quantity-cost data obtained in this study and the United States Department of Agriculture farm prices for Oregon for oats, all loose hay, and monthly farm wages without board, are given for each of the principal dairy regions and for types of production. Using these formulas for each of the years covered by this study gives costs which vary from the determined costs by an average of only 3 per cent, and in no case differ by as much as 9 per cent.

Variation in cost

There was wide variation in cost between farms. In the year ending April 1, 1932, 7 per cent of the farms had costs under 25 cents per pound of butter-fat, while 5 per cent had costs exceeding 55 cents.

Factors affecting cost

1. YIELD PER COW. Yield of milk and butter-fat per cow was found to be the most outstanding factor affecting the cost of production. Market-milk farms with cows producing less than 225 pounds of butter-fat annually had an average cost of 52 cents per pound of butter-fat as contrasted with 34 cents for farms with cows producing more than 375 pounds of butter-fat; and similar relationships were found for other types of production. Probably the greatest opportunity for Oregon dairymen to reduce their costs of production and increase their profits is by building up the production of their herds through (1) the use of better bulls, (2) raising better heifers, and (3) testing their cows to determine which are the low producers that should be culled out.

2. PASTURE. Lower costs of production were found on the farms with more pasture. Many Oregon dairymen, particularly in the Willamette Valley, can reduce their costs by developing more and better pastures. Where it can be grown, irrigated Ladino clover is probably the most promising pasture crop for farms.

3. GRAIN. Heavier grain feeding to high-producing cows was found to be necessary and profitable, but the data also show that many dairymen are feeding too much grain to low-producing cows, thereby unnecessarily increasing their costs. Recommendations for grain feeding based on the milk production of the cow are given.

4. HAY. Feeding good hay and other roughage up to the capacity of the cow was found to be the most economical practice. The local price of hay, or cost of producing it, is shown to be an important factor in cost, hay amounting to more than 20 per cent of the total cost.

5. SIZE OF HERD. Larger herds had definite advantages in efficiency of operation and lower cost of production, and with normal prices they returned much larger profits. The data show, however, that they have a risk of larger loss when prices are unfavorable.

SUMMARY—*Continued*

6. VALUES OF COWS. Values of the cows did not vary in proportion to their production of milk and butter-fat. A chart is presented showing theoretical values for cows with varying yields of butter-fat, based on the corresponding variation in cost of production.

7. PURE-BRED STOCK. Only 7 per cent of the herds were all pure-bred cows, and only 23 per cent were part pure-bred. The pure-bred herds, on the average, showed no advantage in cost of production, many giving no higher production than the average grade herd, indicating that registry papers are not a guarantee of high production.

8. LABOR EFFICIENCY. Difference in the efficiency with which labor was used gave a variation in cost of producing market milk from 35 cents per pound of butter-fat for the group of farms using the least labor per cow to 51 cents for the group using the most labor.

9. BUILDINGS AND EQUIPMENT. Detailed data are given on the value of buildings and dairy equipment, and on the equipment and arrangement of dairy barns. Features of dairy buildings and equipment, including "loafing sheds" for cows and "liquid tanks," are illustrated by photographs.

10. BUTTER-FAT TEST. With higher butter-fat tests the yield of milk per cow decreased, and the cost per 100 pounds of milk increased; but the yield of butter-fat increased, and the cost per pound of butter-fat decreased.

11. SEASON OF FRESHENING. Fall freshening was the predominating and apparently the most profitable practice in all parts of the state except the Coast regions, where crop and pasture conditions give an advantage to spring freshening.

12. CULLING AND DEATH LOSS. The average death loss of cows was 2½ per cent of the average number of cows annually; 19 per cent were sold annually, about two-thirds of them for beef and one-third as milk cows. The average death loss and the number sold for beef indicates an average production life for milk cows of between six and seven years. Bloat, calving, and accidents were the most frequent causes of deaths. Abnormal culling or death loss was responsible for high costs of production on many individual farms.

The Oregon dairy farm business

A complete farm organization record of the entire farm business was obtained in the first year of the study on 537 of the farms. The average total farm investment was $22,864 per farm. Land and buildings amounted to 82 per cent of the total capital; and dairy stock, the next largest item, to 10 per cent. Detailed statements of the kinds of crops and livestock enterprises are given. The average labor income per farm was $455 for the state as a whole; $134 in the Willamette Valley; $820 in the Coast regions; and $835 in the Irrigated regions. Important factors affecting the financial returns per farm were (1) yield of butter-fat per cow; (2) size of business; and (3) labor efficiency.

Cost and Efficiency in Dairy Farming in Oregon*

By

H. E. SELBY, A. S. BURRIER, and P. M. BRANDT

DESCRIPTION OF THE STUDY

THIS study of the farm cost of producing milk and butter-fat in Oregon was undertaken in 1929 and covers the four-year period ending April 1, 1933. The study has been carried on in the twenty-two leading counties in dairy production in Oregon.

Purpose. The major objectives of the study were:

(1) To determine the average costs of producing milk and butter-fat for the state as a whole and for different regions, conditions, and types of dairying.

(2) To determine factors that affect the cost of production; and how the individual dairyman can control these factors to reduce his cost and thus increase his profits.

Methods used. The study has been carried on by the survey method. With the assistance of county agents and others familiar with local conditions an impartial selection was made from the dairymen in each county, the object being to get a representative cross-section of the dairy enterprise, avoiding too large a proportion of either the better or poorer farms, herds, or farmers. The cost data were obtained from these dairymen in personal interviews by representatives of the Oregon Agricultural Experiment Station. The figures obtained are based largely on careful, detailed estimates made by the dairyman, but books and records were used whenever available.

The cost figures in this bulletin are for the milking cows only, not including young stock.† They cover the cost of production of the milk or cream on the farm, ready to be sent to market, and do not include hauling or other marketing costs.

Acknowledgments: The authors thank the many farmers, county agents, creamerymen, dairymen, and others, whose willing cooperation has made this study possible. Special credit is due numerous individuals, particularly to H. D. Scudder, head of the department of farm management, Roger W. Morse, extension dairy specialist, I. R. Jones, associate dairy husbandman, and E. L. Potter, head of the division of agricultural economics, for helpful suggestions and assistance; to G. W. Kuhlman of the farm management department, R. S. Besse, formerly of that department, Roger W. Morse and I. R. Jones of the dairy husbandry department, and Joseph Belanger, Gordon Laughlin, Barnard Joy, A. R. Madsen, N. L. Peck, and E. J. Neiderfrank, graduate students in farm management, for assistance in the field work; to Helen Russell, Florence Brost, Katherine Smith, and Harriett Brandt, for assistance in the tabulation of the data; and to N. L. Peck for assistance in preparation of the charts.

†Costs of raising dairy heifers will be presented in a separate bulletin; cost of raising veal calves are given in Appendix D; and cost of keeping bulls are presented in Bulletin 312, Oregon Agricultural Experiment Station, *Cost of Keeping Dairy Herd Sires and Suggestions on their Selection and Management.*

For further details as to the methods used and explanation of the various cost items see Appendix A.

Scope of the study. A total of 574 farms cooperated in the study, and from these 1,733 annual farm records were obtained in the four years. These records cover 29,619 cow-years, and the production of 21,063,315 gallons of milk containing 8,009,880 pounds of butter-fat.

For the first three years the study was on a state-wide basis covering the principal dairy regions and types of dairying, data being obtained from the twenty-two leading counties in dairying. In the fourth year, only the four leading types of dairying were covered, data being obtained from twelve counties.

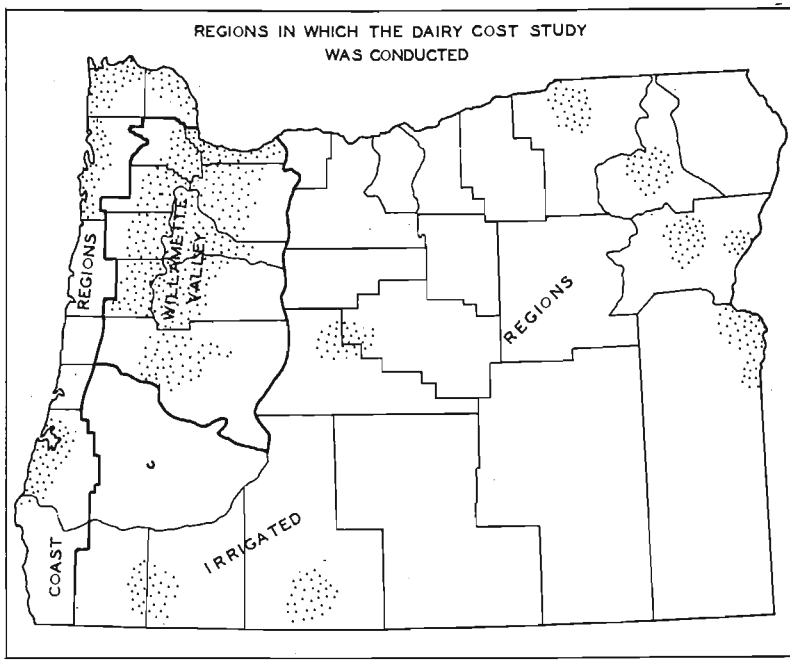

Figure 1. Regions in which the dairy cost study was conducted.

TABLE I. NUMBER OF RECORDS TAKEN, BY REGIONS AND YEARS

Year ending April 1	Willamette Valley	Coast regions	Irrigated regions	All regions
1930	301	100	150	551
1931	276	101	137	514
1932	250	89	125	464
1933	106	43	54	203
TOTAL	933	333	466	1,732

The study covers herds of six or more cows and all types of dairy-farms except those engaged primarily in the business of breeding and selling pure-bred dairy cattle, or the distribution of fluid milk. The farms included in the study produce about 5 per cent of the total dairy production in Oregon.

Regions studied. The areas in which the study was carried on are shown in Figure 1. From the standpoint of conditions for dairying, Oregon may be divided into the three main regions shown on the map: (1) the Willamette Valley, (2) the Coast regions, and (3) the Irrigated regions. Comparison of these regions as to types of dairying and conditions for dairying will appear throughout the data and discussion in this bulletin.

The numbers of records that were taken in each region in each year are shown in Table I. The counties included in each region are as follows:

WILLAMETTE VALLEY:	Benton, Clackamas, Lane, Linn, Marion, Multnomah, Polk, Washington, and Yamhill
COAST REGIONS:	Clatsop, Columbia, Coos, and Tillamook
IRRIGATED REGIONS:	Baker, Crook, Deschutes, Jackson, Josephine, Klamath, Malheur, Umatilla, and Union

Period covered. The four-year period ending April 1, 1933, which this study covers was a period of rapidly falling prices and changing conditions. The effect of this is evident in the data that will be presented

Because of the changing prices many of the cost items for the different years are not comparable when expressed in dollars and cents. It will be seen, however, that much of the cost of producing milk and butter-fat can be expressed in physical quantities such as pounds of feed and hours of labor, which are much more constant from year to year.

The drawback of not having comparable money costs from year to year is perhaps more than offset by the picture that the data present of the effect of the changing prices and conditions of this period on dairy costs of production and on the management of the dairy enterprise.

Size and type of farms and dairy herds. Most of the descriptive data pertaining to the farms and herds will be introduced in connection with the various tabulations that follow. To give the reader a general idea of the size and type of the farms and herds, Table II shows the average total acreage and crop acreage per farm in each region, the average number of milk cows, the classification of the herds as to breeds of cattle, and the number of grade, part pure-bred, and pure-bred herds.

Of the farms included in the survey in the Willamette Valley, roughly speaking, one third produced Grade B market milk, the market for which is chiefly the city of Portland, but also Salem, Eugene, Corvallis, and the other Valley towns. One third of the farms produced churning cream; and the remaining third, condensery, creamery and cheese factory milk, and market cream. The chief type of production in the Coast regions was cheese milk—about two-thirds of the total; and in the Irrigated regions about four-fifths was churning cream.

In both the Willamette Valley and the Irrigated regions about half of the total farm receipts were from the dairy enterprise. The other half were from a number of other enterprises, no one of which averaged as much as 10 per cent of the total receipts. In the Willamette Valley, poultry and wheat and in the Irrigated regions poultry, alfalfa hay, and hogs were the leading supplementary enterprises. The individual farms varied, of course, from highly specialized to highly diversified types, with a wide variety of important supplementary enterprises. Detailed information as to the kinds of enterprises is given in Table XXVIII.

TABLE II. DATA REGARDING SIZE AND TYPE OF FARMS AND HERDS
Year ending April 1, 1932

Items	Willamette Valley	Coast regions	Irrigated regions	All regions
Total acres per farm	156	157	177	162
Acres of crops per farm	81	31	58	65
Milk cows per farm	14	31	16	18
Percentage of herds predominantely	%	%	%	%
Jersey	48	38	55	48
Holstein	10	11	18	13
Guernsey	9	13	4	8
Other breeds	3	.....	3	2
Mixed	30	38	20	29
TOTAL	100	100	100	100
Percentage of herds	%	%	%	%
All grade cows	64	80	77	70
Part pure-bred cows	26	18	20	23
All pure-bred cows	10	2	3	7
TOTAL	100	100	100	100

In the Coast regions, dairying is much more specialized, an average of 87 per cent of the total receipts being from the dairy enterprise. Hogs and poultry were the leading supplementary enterprises.

Review of other economic dairy studies. There have been more economic and cost of production studies of dairying than of any other farm enterprise. In Appendix E is given a brief summary of a review of 53 state and government publications presenting results of economic studies of dairying in twenty-four states during the period 1905 to 1930, this review having been made at the outset of this study. Tabulations of data from these publications and a bibliography of them are also given.

COSTS AND PROFITS IN PRODUCING MILK AND BUTTER FAT IN OREGON

Average costs of production for the state as a whole for each year of the three-year period ending April 1, 1932, and the average price received per pound of butter-fat, are shown in Figure 2 and Table III. The average percentage distribution of the principal cost items is shown in Figure 3, and a more detailed cost statement is given in Table XXXIV.

As was stated previously, these costs are for the milking-cow herd only, not including young stock, and cover the cost of production of the

milk or cream on the farm, ready to be sent to market, exclusive of hauling or other marketing costs.

These figures show that costs of production have been decreasing with the falling prices of feed and labor during the period of this study, although the decrease has not been as great as the drop in selling prices of milk and butter-fat.

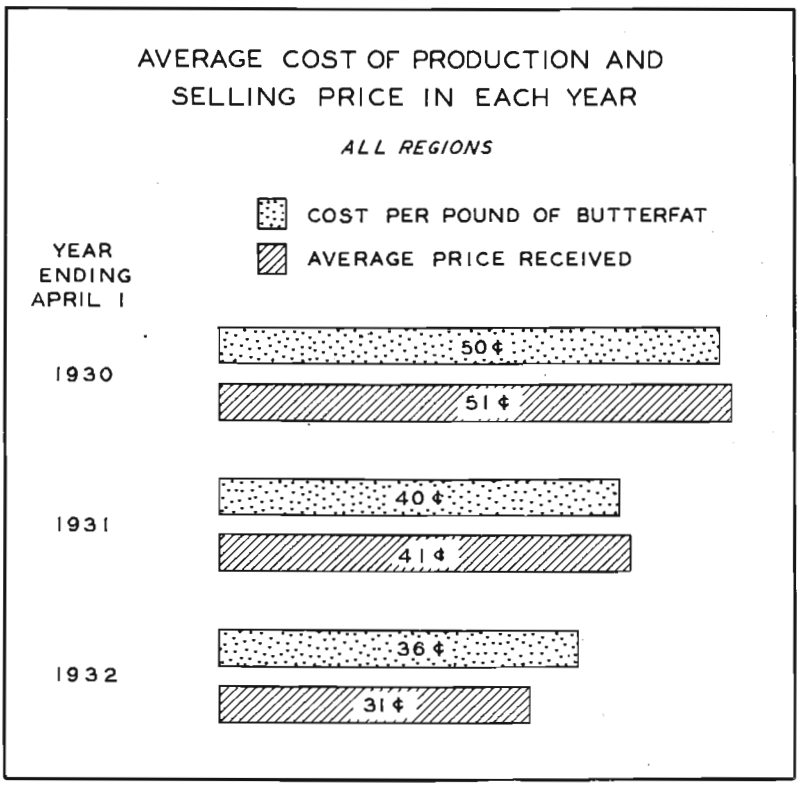

Figure 2. Average cost of production and selling price in each year.

It should be kept in mind that these average figures represent a great many individual farms which vary above and below the average. Consideration should be given to the range and variation in the several items, which will be shown later, as well as to the average costs.

CASH AND NON-CASH COST

It should also be kept in mind that the cost figures in this bulletin represent the *total* cost of production, not the *cash* cost which many people think of as cost. Only about half of the total cost is immediate cash expenditure, as is shown in Figure 4 and Table IV. The total cost includes

not only all cash expense but also non-cash items such as home-grown feeds; unpaid labor of the dairyman and his family; depreciation of buildings, stock, and equipment; and interest on the value of buildings, stock and equipment. On the average, 94 per cent of the hay, 99 per cent of the succulent feeds, and 41 per cent of the grain fed were farm grown.

TABLE III. AVERAGE COST OF PRODUCING MILK AND BUTTER-FAT IN OREGON, 1930-1932
All Regions

Items	Year ending April 1		
	1930	1931	1932
Number of farms	551	514	464
Cows per farm	16	17	18
Pounds of milk per cow annually	6,140	6,342	6,088
Butter-fat test (per cent)	4.4	4.4	4.4
Pounds butter-fat per cow annually	270	279	270
Annual cost per cow			
Hay	$35	$25	$23
Succulents	11	11	9
Grain	27	18	14
Pasture	10	10	9
TOTAL FEED	$83	$64	$55
Labor	40	35	29
Use of buildings	7	6	6
Use of equipment	3	2	2
Sire	3	3	2
Depreciation of cows	6	5	5
Interest on cows	5	5	4
Miscellaneous	6	6	5
TOTAL GROSS COST	$153	$126	$108
Credit for calves	5	4	2
Credit for manure	7	6	5
Credit for skim milk	6	5	4
TOTAL NET COST PER COW	$135	$111	$ 97
COST PER 100 POUNDS OF MILK	2.19	1.75	1.60
COST PER POUND OF BUTTER-FAT	.50	.40	.36
Average price received per pound butter-fat.	$ 0.51	$ 0.41	$ 0.31

Cost studies of feed crops have shown that about half of their cost is non-cash, and hence the home-grown feed has been entered as half cash and half non-cash. Also approximately half of the sire maintenance is cash cost for items similar to the cash cost for the cows. About three-fifths of the depreciation charge on the cows is cash cost for stock purchased and the cash costs in raising replacements. No charge is shown for interest on land since the use of the land for raising feed crops is covered by the value at which the feed has been charged to the cows.

The producer should realize, however, that much of the non-cash cost indirectly represents cash expenditure. Depreciation must be met sooner or later by cash expenditure for replacements. On many farms, even part of the interest is actual cash expenditure in the form of interest on borrowed money.

A return equal to the total net cost of production as determined in this study gives the dairyman prevailing market prices for the feed consumed

by the cows, wages at prevailing rates for all work on the cows by himself and his family, depreciation on stock and equipment, and 5 per cent interest on the capital investment involved in the dairy enterprise.

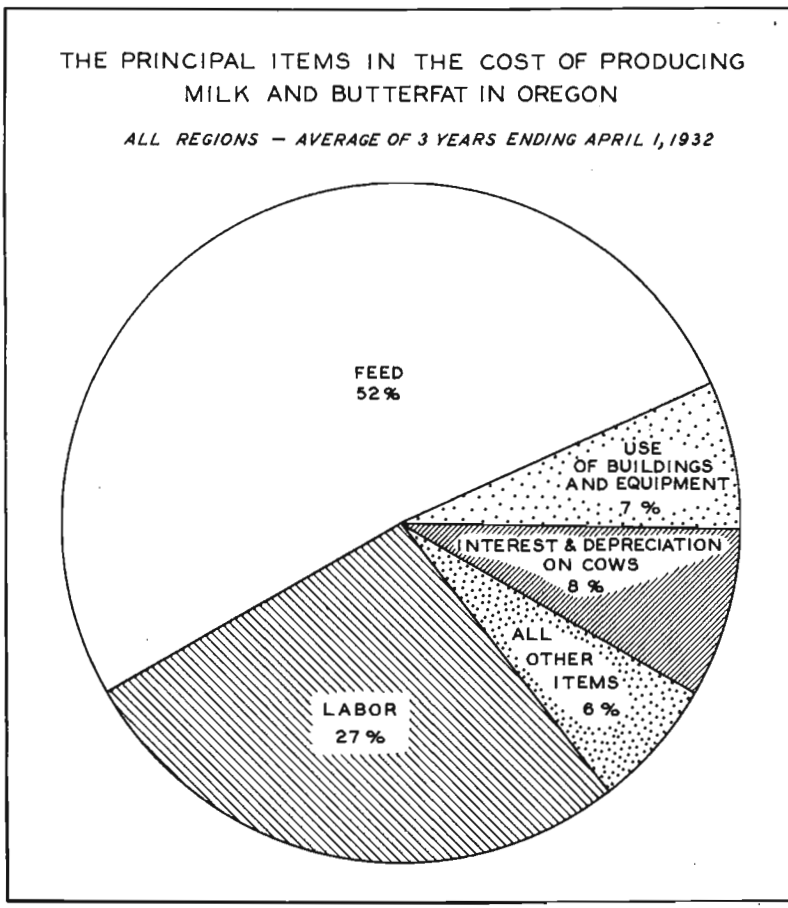

Figure 3. The principal items in the cost of producing milk and butter fat in Oregon.

COMPARATIVE COSTS IN THE DIFFERENT REGIONS

A comparison of the costs in the different regions for the year ending April 1, 1932, is given in Table V. It will be seen that the average total cost was highest in the Willamette Valley and lowest in the Irrigated regions. A similar relationship was found in each of the other years of the study. The marked advantage of the Coast and Irrigated regions in lower costs of production is largely offset, however, by difference in the average prices received.

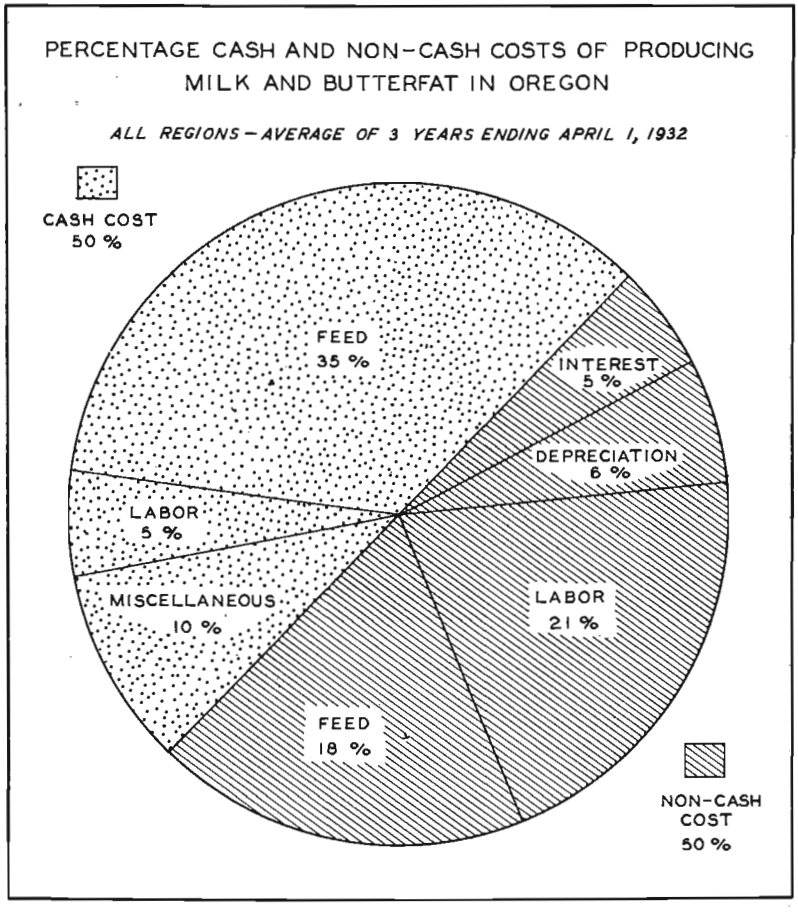

Figure 4. Percentage cash and non-cash costs of producing milk and butter-fat in Oregon.

The higher costs in the Willamette Valley are caused by a lack of pasture, lower quality of hay and consequent heavier grain feeding; and also by a larger proportion of market milk production with additional expense to meet Grade B milk requirements. The lower costs in the Coast regions are made possible by the larger amount of pasture available, with less necessity for grain feeding; and in the Irrigated regions, irrigated pastures, heavier feeding and lower market price of alfalfa hay, and light grain feeding, give the lowest cost of all.

USE OF MILK PRODUCED

About 5 per cent of the total production of milk was used in the farm homes as milk and cream or churned into butter, about 5 per cent was fed to calves, and 90 per cent was sold in various forms (TableVI).

The distribution of the home use to milk, cream, and butter indicates only the form in which it was taken from the dairy to the house, since part of the milk might subsequently be skimmed for cream for table use or churning, part of the cream used might be churned, and for many families reporting only cream used, the cream was diluted with skim milk to give

TABLE IV. CASH AND NON-CASH COST OF MILK AND BUTTER-FAT
All regions, Year ending April 1, 1932

Items	Annual cost per cow		
	Total cost	Cash	Non-cash
Purchased feed			
Hay	$2.46	$2.46	.....
Succulents	.09	.09	.....
Grain	8.43	8.43	.....
Pasture	.42	.42	.....
Farm-grown feed			
Hay	21.02	10.51	$10.51
Succulents	8.49	4.24	4.25
Grain	5.37	2.69	2.68
Pasture	8.68	4.34	4.34
TOTAL FEED	$54.96	$33.18	$21.78
Operator's labor	$16.68	.....	$16.68
Family labor	6.95	.....	6.95
Hired labor	5.03	$5.03	.....
TOTAL LABOR	$28.66	$5.03	$23.63
Sire maintenance	$2.12	$1.06	$1.06
Bedding	.51	.25	.26
Salt and minerals	.44	.44	.....
Veterinary and medicines	.32	.32	.....
Turberculosis and abortion testing	.21	.21	.....
Milk testing	.29	.29	.....
Gas and oil	.48	.48	.....
Electricity	.84	.84	.....
Fire insurance	.40	.40	.....
Taxes	1.04	1.04	.....
Use of auto	.08	.08	.....
Building repairs	.28	.28	.....
Equipment repairs	.45	.45	.....
Other miscellaneous	.85	.85	.....
TOTAL MISCELLANEOUS	$8.31	6.99	1.32
Depreciation of buildings	$2.77	.....	$2.77
Depreciation of equipment	1.34	.....	1.34
Depreciation of herd sire	.08	$ .07	.01
Depreciation of cows	5.17	3.10	2.07
TOTAL DEPRECIATION	$9.36	$3.17	$6.19
Interest on buildings	$2.94	.....	$2.94
Interest on equipment	.53	.....	.53
Interest on herd sires	.20	.....	.20
Interest on cows	3.81	.....	3.81
TOTAL INTEREST	$7.48	.....	$7.48
TOTAL GROSS COST	$108.77	$48.37	$60.40
Credit for calves	2.29	.....	2.29
Credit for manure	4.71	.....	4.71
Credit for skim milk	4.08	.....	4.08
TOTAL NET COST PER COW	$97.69	$48.37	$49.32
COST PER 100 POUNDS OF MILK	1.60	.79	.81
COST PER POUND OF BUTTER-FAT	.36	.18	.18

milk for drinking. Buying butter or exchanging butter-fat for it at the creamery was a more common practice than churning on the farm.

A few farms included in the study retailed part or all of their product. Such sales have been included as market milk and cream, and also the

TABLE V. AVERAGE COST OF PRODUCING MILK AND BUTTER-FAT IN OREGON, BY REGIONS

Year ending April 1, 1932

Items	Willamette Valley	Coast regions	Irrigated regions	All regions
Number of farms	250	89	125	464
Cows per farm	14	31	16	18
Pounds of milk per cow annually	6,419	6,064	5,558	6,088
Butter-fat test (per cent)	4.4	4.4	4.5	4.4
Pounds butter-fat per cow annually	284	268	248	270
Annual cost per cow				
Hay	$22	$20	$30	$23
Succulents	12	9	2	9
Grain	23	8	6	14
Pasture	5	14	9	9
TOTAL FEED	$62	$51	$47	$53
Labor	32	25	28	29
Use of buildings	8	5	4	6
Use of equipment	2	2	2	2
Sire	3	2	2	2
Depreciation of cows	6	4	5	5
Interest on cows (5 per cent)	4	4	4	4
Miscellaneous	7	5	4	5
TOTAL GROSS COST	$124	98	$96	$108
Credit for calves	3	1	2	2
Credit for manure	6	4	4	5
Credit for skim milk	4	.....	8	4
TOTAL NET COST PER COW	$111	$93	$82	$97
COST PER 100 POUNDS OF MILK	1.72	1.53	1.48	1.60
COST PER POUND OF BUTTER-FAT	.39	.35	.33	.36
Average price received per pound butter-fat	$0.34	$0.30	$0.27	$0.31

TABLE VI. PERCENTAGE OF TOTAL PRODUCTION OF MILK USED IN THE HOME, FED TO CALVES, AND SOLD IN VARIOUS FORMS

Year ending April 1, 1932

Use of milk	Willamette Valley	Coast regions	Irrigated regions	All regions
	%	%	%	%
Home use in the form of				
Milk	3.8	2.3	2.5	3.0
Cream	1.6	.4	2.8	1.5
Butter	.6	.1	1.3	.6
Fed to calves	5.1	4.7	6.2	5.2
Sold in the form of				
Churning cream	23.6	2.9	66.8	26.6
Market milk	45.2	18.0	18.0	30.1
Market cream	5.5	.....	.1	2.4
Creamery milk	4.1	8.8	1.6	5.1
Condensery milk	8.8	.....	.....	3.9
Cheese milk	1.7	62.8	.7	21.6
TOTAL	100.0	100.0	100.0	100.0

small amounts of milk and cream that many farms sold to neighbors or local customers.

COST AND SELLING PRICES FOR DIFFERENT TYPES OF DAIRYING

The average cost and selling prices for the important types of dairying in Oregon for each year are shown in Figure 5, while in Table VII is given a summary of costs for the four principal types for the last year of the study. Costs of market milk for farms in the Portland milk shed only are given in Appendix C.

Only those farms in which nearly the entire production for the year was of the type indicated have been included in these tabulations. The market milk production is chiefly Grade B milk, although the smaller towns, and in the first year of the study most of the towns, had not yet adopted standard milk ordinances and requirements.

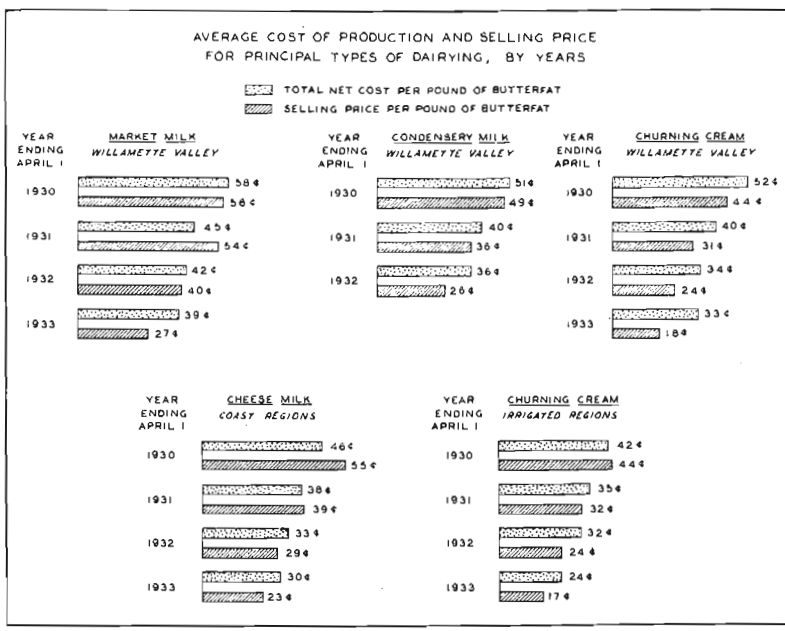

Figure 5. Average cost of production and selling price for principal types of dairying, by years. Additional data for these groups of farms are given in Table XXXV.

Figure 5 indicates that the production of churning cream in the Willamette Valley has been consistently less profitable than the other types of dairying. Most of the production of churning cream in the Willamette Valley is a supplementary enterprise or sideline in the farm organization, and utilizes labor and considerable unmarketable feed for which there might otherwise be no economic use. In order to get something for such labor and feed, and thus increase their total farm income, farmers continue to produce churning cream as a sideline, even though, as indicated by these figures, it fails to pay full market value for all the labor and feed used.

The irregular relationship between the market-milk costs and selling prices was caused by unsettled local marketing conditions.

Choice between these main types of dairy production is limited for most dairy farms by their location and available markets, and for many

TABLE VII. AVERAGE COST OF PRODUCING MILK AND BUTTER-FAT IN OREGON BY PRINCIPAL TYPES OF DAIRYING

Year ending April 1, 1933

Items	Market milk (Willamette Valley)	Churning cream (Willamette Valley)	Cheese milk (Coast regions)	Churning cream (Irrigated regions)
Number of farms	54	35	41	52
Cows per farm	15	12	33	18
Pounds of milk per cow annually	6,389	4,995	5,663	4,841
Butter-fat test (per cent)	4.2	4.7	4.6	4.6
Pounds butter-fat per cow annually	270	237	258	224
Annual cost per cow				
Hay	$23	$20	$17	$16
Succulents	11	9	6	1
Grain	17	14	5	2
Pasture	4	5	15	9
TOTAL FEED	$55	$48	$43	$28
Labor	29	27	19	22
Use of buildings	9	6	5	3
Use of equipment	3	2	2	2
Sire	2	2	2	2
Depreciation of cows	5	5	3	5
Interest on cows	3	3	3	3
Miscellaneous	7	4	4	3
TOTAL GROSS COST	$113	$97	$81	$68
Credit for calves	2	2	1	1
Credit for manure	7	5	3	3
Credit for skim milk	.....	10	.....	9
TOTAL NET COST PER COW	$104	$80	$77	$55
COST PER 100 POUNDS OF MILK	1.63	1.59	1.36	1.13
COST PER POUND OF BUTTER-FAT	.39	.33	.30	.24
Average price received per pound butter-fat	$0.27	$0.18	$0.23	$0.17

farms only one type is possible. In the Willamette Valley, however, many farms have a choice between the churning cream and the condensery milk, and for some locations the market milk is a third possibility. Also, in addition to these main types, in the Willamette Valley considerable whole milk is sold to creameries for manufacturing purposes, considerable market cream is produced, chiefly for the city of Portland, and there are a few cheese factories; in the Coast regions there is a limited amount of churning cream, market milk and creamery milk production; and in the Irrigated regions there is market milk, creamery milk, and in some places cheese factory milk production; all of which offer some choice of type of production.

Cost of separating milk and value of skim milk. In deciding whether to sell the product of the dairy herd as cream or whole milk, the separating of the milk and the use of the skim milk on the farm are important considerations.

The average cost of separating milk on 211 farms was 14 cents per 100 pounds of skim milk, made up of the items shown in Table VIII. In addition to the separating cost, the separator loss of butter-fat and the price differential between cream and milk should also be considered in determining how much it costs to keep the skim milk on the farm.

Seventy-nine samples of skim milk were obtained from a number of farms and tested for butter-fat. The average test was .065 per cent butter-fat. At 27 cents per pound of butter-fat, the average for grade C milk in the year ending April 1, 1932, this amounted to 2 cents per 100 pounds of skim milk.

TABLE VIII. COST OF SEPARATING MILK AND COMPUTED TOTAL COST OF SKIM MILK

Willamette Valley and Irrigated Regions
Year ending April 1, 1932
211 farms—14 cows per farm

Items	Amount
Annual cost per farm	
Labor separating milk (193 hours)	$42
Labor washing separator (123 hours)	24
Interest on value of separator (5 per cent)	3
Depreciation of separator	9
Repairs and miscellaneous	1
TOTAL SEPARATING COST PER FARM	$79
Pounds of skim milk per farm	57,200
Cost per 100 pounds of skim milk	
Separating cost	14¢
Separator loss of butter-fat	2
Price differential	10
TOTAL COST OF SKIM MILK	26¢

The average price differential between churning cream and grade C milk was 2 cents per pound of butter-fat, which amounts to 10 cents per 100 pounds of skim milk from milk testing 4.4 per cent.* This is the average difference in net prices on the farm, and hence eliminates a consideration of difference in hauling cost between cream and milk. This item of price differential does not apply, of course, to dairymen in localities where no market for milk is available.

Combining the separating cost of 14 cents, the butter-fat loss of 2 cents, and the price differential of 10 cents, gives the total of 26 cents per 100 pounds of skim milk as shown in Table VIII. The costs of separating have probably declined somewhat since the year of this tabulation.

Eighty-three per cent of the separating cost was for labor, and of this, 57 per cent was done by the dairyman himself, 39 per cent by other members of the family, and only 4 per cent by hired labor. It is obvious, therefore, that most of the cost of separating is not actual cash outlay. The operator's labor was charged at wages averaging 22 cents per hour and the unpaid family labor at 19 cents. Many farmers, of course, might figure

* It is assumed that with each pound of butter-fat removed in separating there are two pounds of other liquid so that 100 pounds of 4.4 milk when separated would give only 86.8 pounds of skim milk.

that the time spent in separating milk would otherwise be wasted, and be willing to do the separating for a return of less than these wages.

There was considerable variation in the separating cost on different farms. The most important factor affecting this was the size of the herd, the relation of which to separating cost is shown in Figure 6. Much of the work involved in separating milk is no greater for a large than for a small herd, and consequently the separating cost per 100 pounds of skim milk is much less for larger herds.

Whether the skim milk is worth the cost indicated by these figures will vary on different farms. Feeding experiments indicate that, when fed to fattening hogs, skim milk is worth perhaps one-fourth to one-fifth the price of 100 pounds of grain. With the farm grain prices prevailing at the close of this study—mostly less than a cent a pound—it would seem on the average, to be more profitable to sell whole milk than to separate it in order to have the skim milk for hog feeding. For feeding calves, chickens, and growing pigs, however, skim milk has a considerable higher

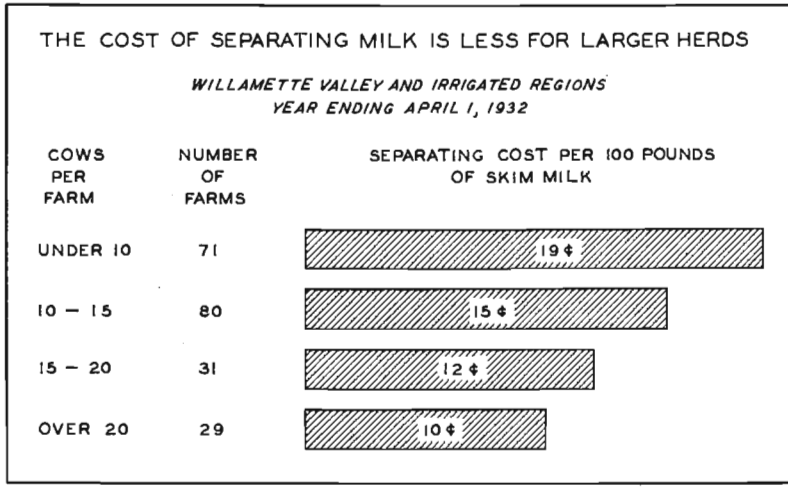

Figure 6. The cost of separating milk is less for larger herds.

value, and in most cases doubtless is well worth the cost indicated, or even more.

Hauling charges. As has been pointed out, the costs in this bulletin are costs of the product on the farm, ready to be shipped to market, and the prices received are likewise the net price on the farm. An additional cost for hauling or shipping the product to market is necessary in practically all cases. Much of this hauling is done commercially, either by the buyer of the product or independent haulers, although many dairymen haul their own product (Table IX).

A definite custom charge is nearly always made where the buyer hauls whole milk, the charge being deducted from the gross value of the milk. In hauling churning cream, however, frequently no definite charge is made, the buyer absorbing the hauling cost in the price paid. Many creameries,

however, make a difference of a cent or two between prices for "route" and "door" patrons.

TABLE IX. PERCENTAGE OF FARMS WITH INDICATED PRACTICE IN HAULING PRODUCT TO MARKET
Year ending April 1, 1932

Hauling practice	Market milk (Willamette Valley)	Churning cream (Willamette Valley)	Cheese milk (Coast regions)	Churning cream (Irrigated regions)
	%	%	%	%
Commercial hauling, custom charge	80	15	29	49
Commercial hauling, no charge	.....	58	.....	36
Part or all own hauling	20	27	71	15
TOTAL	100	100	100	100

In the first year of the study, most of the charges for hauling churning cream varied from one cent to two cents per pound of butter-fat; by the last year nearly all had been reduced to one cent or less. The average hauling cost for market milk in the Willamette Valley was 20 cents per hundred pounds of milk the first year and had declined only to 19 cents by the end of the study. Hauling of condensery milk varied from 15 to 20 cents per hundred pounds and averaged 17 cents in all three years in which data were obtained for this type of production. The average cost of hauling cheese milk in the Coast regions declined from 9 cents in the first year to 6½ cents in the last year, the lower cost as compared with whole milk in the Willamette Valley being due to shorter distances to local cheese factories.

For farmers who did their own hauling, the cost was based on the automobile or truck expense involved and the labor required. In general, such costs were less than custom hauling rates. Often, however, this was made possible only by combining the milk or cream hauling with other items such as going to town on other business, or taking children to school, and pro-rating part of the expense to these other items.

COST IN QUANTITIES OF FEED AND LABOR

Although prices of feed and wages for labor vary from time to time there is much less change in the quantities that are used. The average

TABLE X. AVERAGE AMOUNTS OF FEED AND LABOR PER COW ANNUALLY
By regions—average of three years ending April 1, 1932
By types of production—average of four years ending April 1, 1933

Region or type of production	Hay	Succulents	Grain	Pasture	Labor
	Pounds	*Pounds*	*Pounds*	*Days*	*Hours*
Willamette Valley	4,947	6,719	2,060	106	147
Coast regions	3,531	5,051	811	203	108
Irrigated regions	7,015	1,240	630	164	129
ALL REGIONS	4,984	4,818	1,293	148	130
Market milk, Willamette Valley	5,172	7,443	2,112	92	148
Churning cream, Willamette Valley	5,024	5,529	1,647	123	154
Cheese milk, Coast regions	3,376	4,520	550	216	96
Churning cream, irrigated regions	6,548	1,195	484	171	126

amounts of the different classes of feed, the number of days of pasture, and the number of hours of labor for each region, together with the principal types of dairying are given in Table X. As has been shown, the cost of feed and labor represented by these quantities amounts to nearly four-fifths of the total cost of production. By applying current prices to these amounts of feed and labor the cost of production may be approximated for any price level, as will be discussed further in the next section.

The only quantity cost in which there was significant change as a result of the changing price levels during the period of this study was the amount of grain fed. The changes in amount of grain per cow from year to year are shown in Table XI.

TABLE XI. ANNUAL AMOUNTS OF GRAIN PER COW FOR PRINCIPAL TYPES OF DAIRYING
1930-1933

Type of production	Year ending April 1			
	1930	1931	1932	1933
	Pounds	*Pounds*	*Pounds*	*Pounds*
Market milk, Willamette Valley	2,183	2,152	2,377	1,737
Churning cream, Willamette Valley	1,850	1,743	1,584	1,412
Cheese milk, Coast regions	753	607	418	422
Churning cream, Irrigated regions	640	578	496	223

AVERAGE PRICES

Average prices and wages obtained in the study are given in Table XII. Details of what these prices represent and how they were obtained are given in Appendix A. Succulent feeds were charged at a uniform price of $5.00 the first year, $4.00 the second, $3.50 the third and $3.00 the fourth year.

TABLE XII. AVERAGE PRICES OF FEED AND PASTURE, AND WAGES OF LABOR, BY REGIONS AND YEARS

For the year ending April 1	Hay per ton	Grain per ton	Pasture per head per month	Wages per hour		
				Operator's labor	Family labor	Hired labor
Willamette Valley						
1930	$13.68	$37.20	$1.56	30.9¢	23.8¢	31.7¢
1931	9.51	26.80	1.62	28.8	23.9	27.2
1932	9.00	22.40	1.38	22.8	19.5	22.8
1933	8.00	19.00	1.36	19.6	16.5	16.2
Coast regions						
1930	15.64	41.40	2.29	33.1	25.2	31.9
1931	12.40	32.20	2.37	30.5	23.7	30.3
1932	11.34	25.60	2.17	25.8	20.3	24.4
1933	10.17	23.20	2.21	20.8	19.2	21.5
Irrigated regions						
1930	12.70	37.80	1.96	31.1	23.8	28.8
1931	9.36	27.60	1.81	29.3	22.9	27.6
1932	8.90	22.60	1.63	22.8	19.7	21.6
1933	5.26	18.20	1.47	19.6	17.2	17.8
All regions						
1930	13.78	38.20	2.00	31.5	24.2	31.3
1931	10.17	28.00	2.00	29.4	23.6	28.4
1932	9.51	23.00	1.79	23.5	19.7	23.2
1933	7.67	19.80	1.79	19.9	17.3	18.6

FORMULAS FOR COMPUTING THE COST OF PRODUCING MILK AND BUTTER-FAT

A number of formulas for computing the cost of producing milk have been published,* based on quantity cost data obtained in studies similar to this in other areas. A difficulty in using these formulas, or the quantity costs as given above, to estimate current costs of production, is finding a set of prices to use, particularly a set of prices comparable to those in the study upon which the cost formula is based. For example, applying Portland market quotation prices of hay and grain to the quantity costs obtained in this study would give quite a different cost than the farm values of hay and grain given by the dairyman.

An attempt to get around this difficulty has been made by computing cost formulas based on continuing series of prices: namely, the U. S. Department of Agriculture farm prices for Oregon.† The prices used are the farm price of all loose hay, the farm price of oats, and the monthly wages of farm labor without board (published quarterly). These prices for the four years of this study, and the comparable prices obtained in the study, are shown in Figure 7.

Formulas for computing the cost per pound of butter-fat, based on these prices, for each region and the principal types of production, are given in Table XIII. In these formulas the coefficient of A is the average of the cost of hay and succulent feeds per pound of butter-fat in each year divided by the average U. S. Department of Agriculture price of hay for the year; the coefficient of B is the average of the cost of grain per

TABLE XIII. FORMULAS FOR COMPUTING THE COST OF PRODUCING MILK AND BUTTER-FAT IN OREGON

Region or type of production	Formula for cost in cents per pound butter-fat*
Willamette Valley	1.31 A + 25.0 B + .214 C + 6.9
Coast regions	1.13 A + 11.7 B + .174 C + 12.0
Irrigated regions	1.37 A + 8.5 B + .205 C + 5.7
All regions	1.26 A + 16.7 B + .198 C + 8.3
Market milk, Willamette Valley	1.43 A + 25.5 B + .224 C + 8.8
Churning cream, Willamette Valley	1.38 A + 20.8 B + .247 C + 3.8
Cheese milk, Coast regions	1.11 A + 8.2 B + .166 C + 12.6
Churning cream, Irrigated regions	1.26 A + 6.5 B + .216 C + 5.2

*A=U. S. Dept. of Agric. farm price per ton of all loose hay for Oregon.
B=U. S. Dept. of Agric. farm price per bushel of oats, for Oregon.
C=U. S. Dept. of Agric. monthly farm wages without board, for Oregon.

Illustration of use of formulas: For the year ending April 1, 1933, the average U. S. Dept. of Agric. price per ton of all loose hay in Oregon (A) was $7.53; the average price of oats per bushel (B) was $0.31; and the average monthly farm wage without board (C) was $40.31. The cost for churning cream in the Irrigated Regions would be computed by the formula for that type of production as follows:

1.26 A = 1.26 × 7.53 = 9.5
6.5 B = 6.5 × .31 = 2.0
.216 C = .216 × 40.31 = 8.7
5.2

Estimated cost per pound of butter-fat ..... 25.4¢

*A summary of formulas for cost of milk production is given in Henry and Morrison, *Feeds and Feeding*, page 413.

†These price series are published in *Crops and Markets*, issued monthly by the United States Department of Agriculture.

pound of butter-fat divided by the average U. S. Department of Agriculture price of oats; the coefficient of C is the average of the cost of labor per pound of butter-fat divided by the average U. S. Department of Agri-

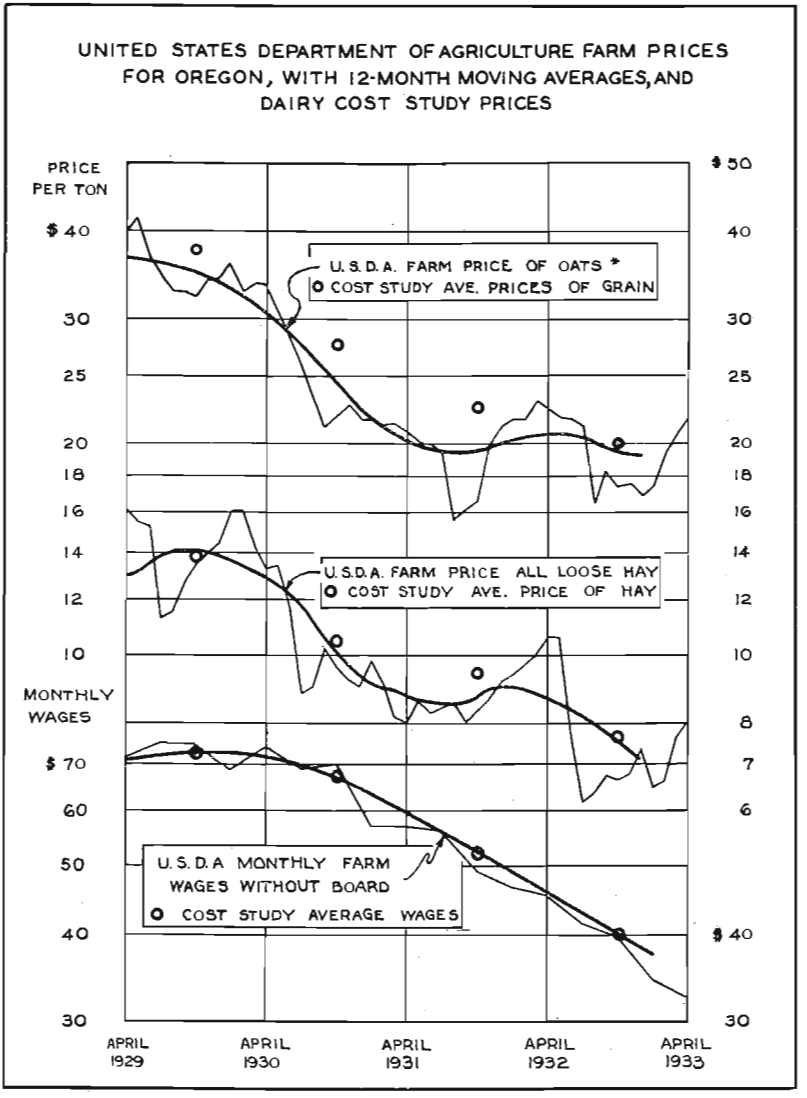

Figure 7. A logarithmic or ratio scale has been used in this chart to give a better comparison of the curves at different price levels. The cost-study prices of grain cover mixed dairy feeds, oil meals, etc., in addition to farm grains and hence would be expected to be higher than the U. S. Department of Agriculture price of oats.

* Converted from price per bushel to price per ton on basis of 32 pounds per bushel.

culture wage of farm labor; and the constant term is the average of the difference in each year between the total net cost per pound of butter-fat and the cost of hay, succulent feeds, grain, and labor.

Applying these formulas to the average of the U. S. Department of Agriculture prices for each year of the study gives costs which differ from the determined costs by an average of only 3 per cent, and in all cases differ by less than 9 per cent.

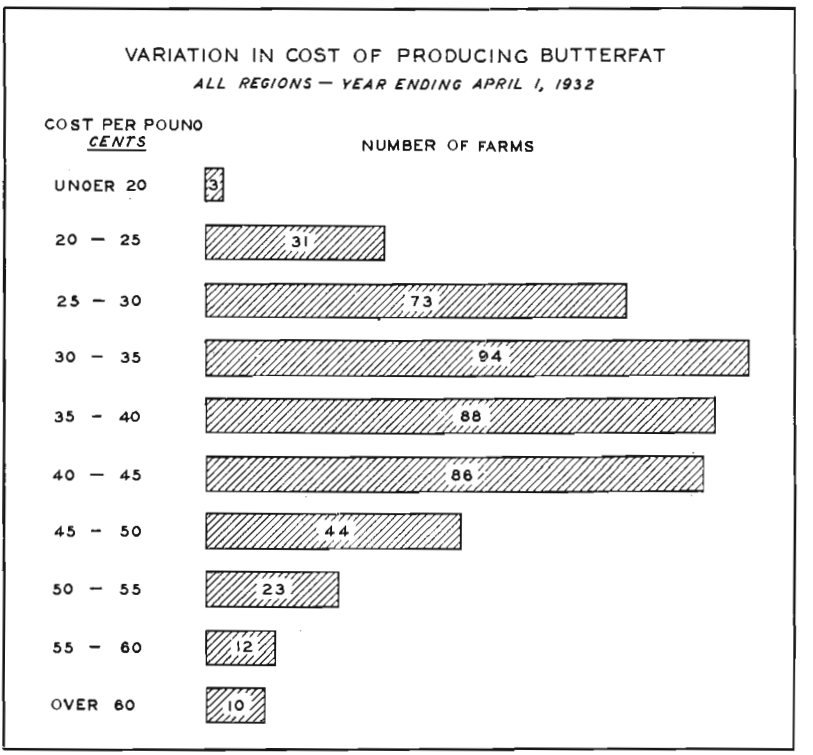

Figure 8. Variation in cost of producing butter-fat.

VARIATION IN COST BETWEEN DIFFERENT FARMS

There was wide variation between individual farms in their costs of producing milk and butter-fat. Examples of this are given in Figure 8, which shows the distribution of all of the farms as to cost per pound of butter-fat in the year ending April 1, 1932, and in Figure 9, which is an array of the individual costs of production for the four chief types of dairying; and in Table XXXVI, which gives similar figures for each region. In the state as a whole in the year ending April 1, 1932, 7 per cent of the farms had costs under 25 cents per pound of butter-fat, while at the other extreme 5 per cent had costs exceeding 55 cents per pound.

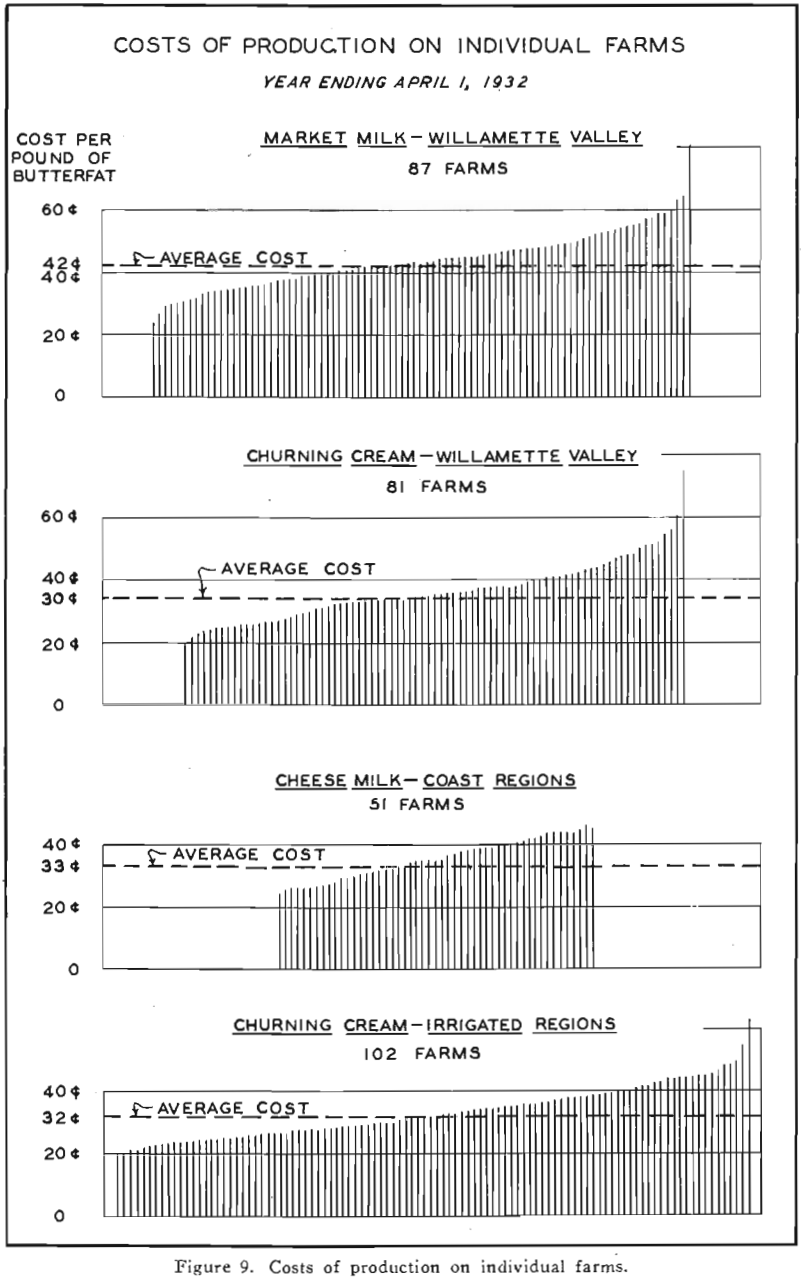

Figure 9. Costs of production on individual farms.

Determining the factors that account for this wide variation in costs, and what the individual dairyman can do to change these factors so as to reduce his costs of production and thus increase his profits, was a major object of this study. A number of these factors and their relationship to cost of production are discussed in the following pages.

FACTORS AFFECTING THE COST OF PRODUCING MILK AND BUTTER-FAT

YIELD PER COW

The relation of yield of milk or butter-fat per cow to the cost of production is shown in Figure 10 and Table XIV for market milk in the Willamette Valley, and in Table XXXVII for cheese milk in the Coast regions and churning cream in the Irrigated regions.

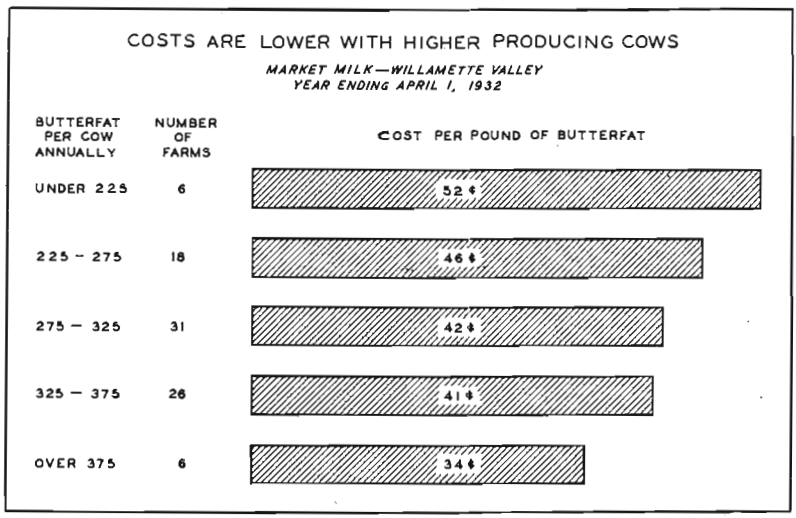

Figure 10. Additional data for these groups of farms are given in Table XIV.

Yield per cow is the outstanding factor affecting the cost of producing milk and butter-fat. This is in accordance with the findings in practically all cost studies of dairying; and yield is likewise found to be a dominant factor in nearly all similar studies of other farm enterprises.

Tables XIV and XXXVII show that with higher yields of butter-fat the feed, labor, and total costs per cow increase, but the costs per pound of butter-fat decrease. This is simply because these costs do not increase proportionally to the increased yield of the cow. In the discussion of feeding practices it will be shown that higher producing cows consume much less nutrients per pound of butter-fat, because of the large fixed nutrient requirement for maintenance of the cow. This is partly offset by the necessity of feeding a larger proportion of higher priced nutrients in

the form of grain, but even so the cost per pound of butter-fat decreases. More labor per cow is required for higher producing cows because of the additional feeding and handling of the additional milk, but the labor per unit of product decreases. A similar relation is found for other items not shown in the tables.

TABLE XIV. RELATION OF YIELD OF BUTTER-FAT PER COW TO COSTS OF PRODUCING MARKET MILK

Market-milk farms, Willamette Valley

Year ending April 1, 1932*

Items	Pounds of butter-fat per cow annually				
	Under 225	225–275	275–325	325–375	Over 375
Number of farms	6	18	31	26	6
Cows per farm	18	18	14	20	13
Pounds of milk per cow annually	5,367	6,019	6,759	7,964	8,793
Butter-fat test (per cent)	4.0	4.2	4.4	4.3	4.6
Pounds butter-fat per cow annually	213	255	298	345	401
Cost per cow annually					
Feed	$51	$62	$67	$81	$71
Labor	30	33	35	34	41
Total net cost	110	117	124	141	135
Cost per pound of butter-fat					
Feed	24¢	24¢	22¢	23¢	18¢
Labor	14	13	12	10	10
Total net cost	52	46	42	41	34

*Most of the tabulations showing relationship of various factors to cost are given only for the year ending April 1, 1932, the last year, with the full extent of the survey, but in all cases similar relationships were found in the other years of the study.

Increasing the yield per cow. The yield per cow of milk and butter-fat is dependent primarily on the inherited milk producing ability of the cow. The yield of a cow can be reduced by improper feeding and handling, but there is no way of increasing it beyond the yielding ability that is bred into her.

The only way in which a dairyman can increase the yield of his herd, therefore, if he is properly feeding and handling it, is to get better cows. The cheapest and most practical way of doing this is by the use of good bulls to increase the yielding ability of heifers raised for replacements. Data obtained in this study on the cost of keeping herd sires, which are presented in a separate bulletin, show that average costs of keeping good bulls are very little if any more than for poor bulls, since the higher investment cost is largely offset by longer life of the bull and increased value of the calves (Figure 11).

A more rapid, but more costly method of improving the production of the herd is by purchasing cows and heifers of probable high production. Milk records and butter-fat tests for individual cows, such as those obtained through herd improvement associations, are essential for intelligent culling of low producing cows from the herd.

VALUE OF COWS

The average inventory, buying, and selling values of cows that were obtained are shown in Figure 12, compared with the U. S. Department of Agriculture farm price of cows for Oregon; and in Table XV is

shown by regions the change in values from the first to the last year of the study.

Comparatively little correlation was found between the value of the cows and their yield, or between their value and cost of production. This condition was quite noticeable to those taking the records in this study. Many dairymen with unusually high producing cows valued them at prices

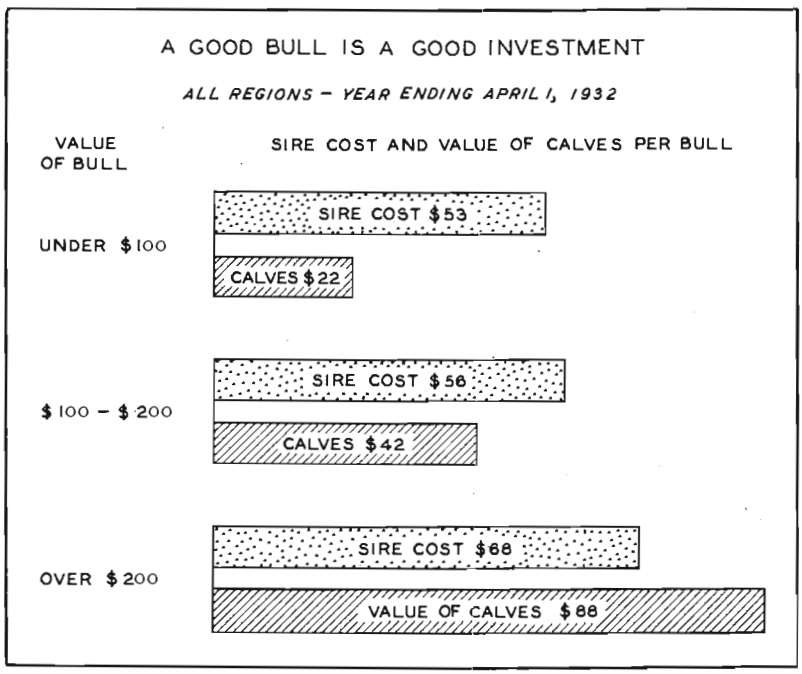

Figure 11. The data on which this chart is based are given in Bulletin 312, Oregon Agricultural Experiment Station, *Cost of Keeping Dairy Herd Sires and Suggestions on their Selection and Management.*

of ordinary cows, often not knowing or appreciating how good their cows really were; while other dairymen, with poorer than average cows believed that they were worth prices considerably above average. Another cause of the lack of correlation between value and production was pure-bred stock, much of which had no extra yielding ability, but was valued at higher prices simply because it was registered.

With the great advantage in cost of production that has been shown for high yielding cows, it is obvious that they should be valued at substantially higher prices. Theoretical values of cows with various yields of butter-fat, based on a capitalization of their comparative cost of production advantage as compared with average cows, are shown in Figure 13, the computations on which the chart is based are given in Table XVI.

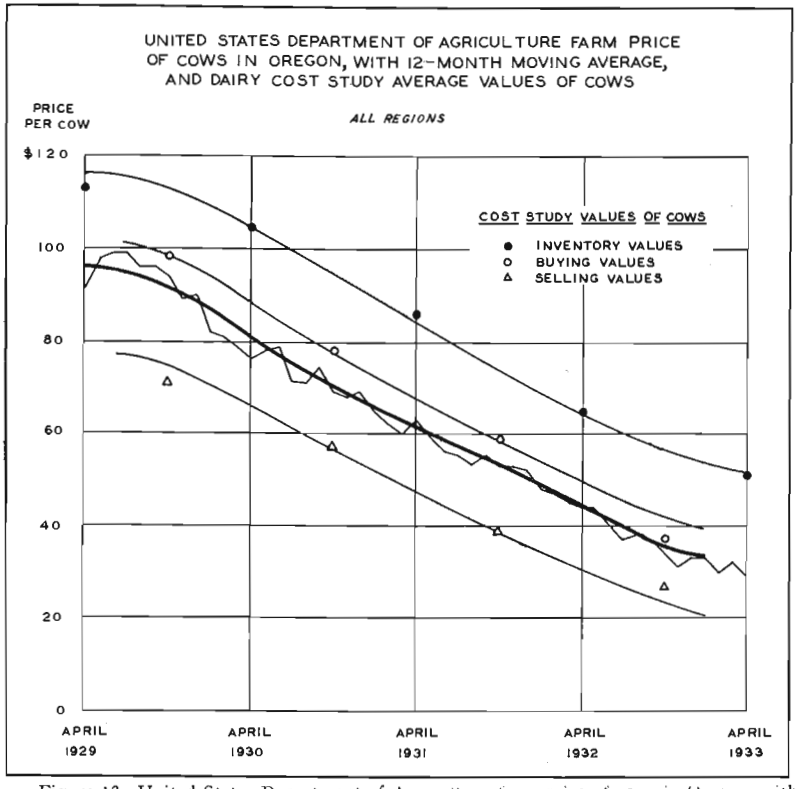

Figure 12. United States Department of Agriculture farm price of cows in Oregon, with 12-month moving average, and dairy cost study average values of cows.

TABLE XV. AVERAGE VALUES OF COWS, BY REGIONS AND YEARS

For the year ending April 1	Opening inventory	Cows purchased	Heifers freshened	Cows sold	Closing inventory
Willamette Valley					
1930	$113	$94	$85	$72	$103
1931	103	81	76	62	88
1932	88	64	59	41	69
1933*	72	38	51	28	56
Coast regions					
1930	111	104	83	61	108
1931	104	68	66	42	84
1932	84	44	54	34	62
1933*	61	20	43	23	48
Irrigated regions					
1930	114	104	91	79	109
1931	109	79	70	61	86
1932	86	57	53	41	65
1933*	57	44	42	27	49
All regions					
1930	113	99	86	71	106
1931	104	78	72	57	86
1932	86	59	56	39	66
1933*	64	37	46	26	51

*The data for the year ending April 1, 1933, covered chiefly the four principal types of dairying, but since there was no significant difference in value of cows between types in the same region the values of cows are shown in this table as for regions, based on all of the records in each region.

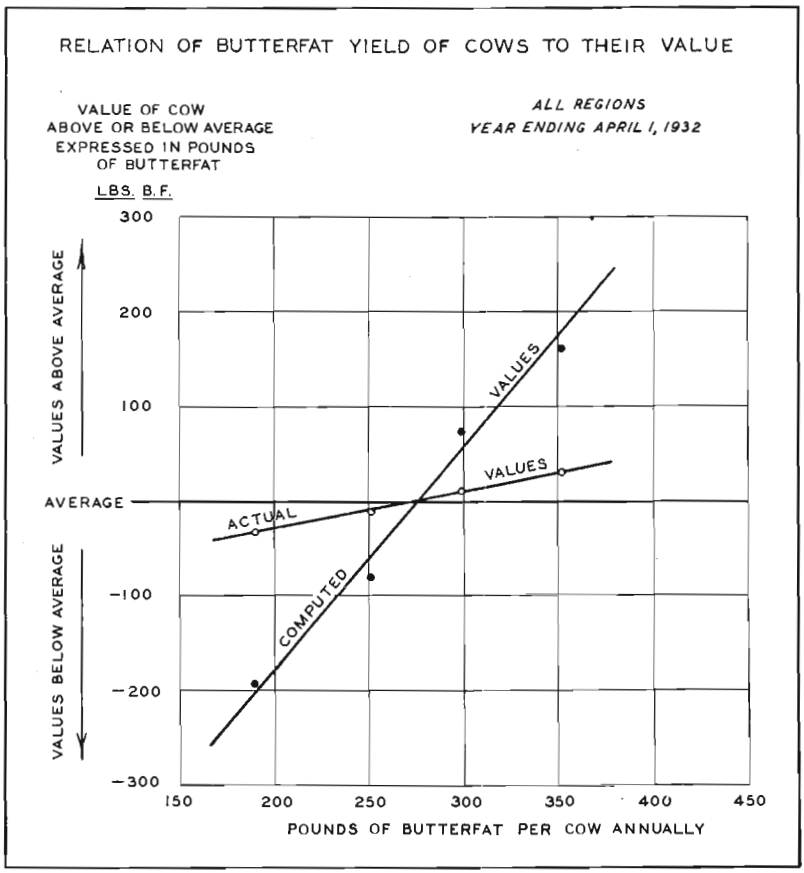

Figure 13. A cow with a given yield of butter-fat should be valued as much more or less than an "average" cow as the market value of the number of pounds of butter-fat shown by the "computed values" line. The data and computations on which this chart is based are given in Table XVI. Similar data for each of the two previous years (Table XXXVIII) show practically this same relationship for the different price levels for both cows and butter-fat in those years.

PURE-BRED STOCK

As previously stated, this study did not include farms engaged primarily in breeding and raising pure-bred stock for sale. For the year ending April 1, 1932 about one-fourth of the herds studied were composed either partly or wholly of pure-bred animals.

A comparison of the grade, part pure-bred, and all pure-bred herds is given in Table XVII. The pure-bred cows were valued at considerably higher prices, and gave slightly more production, but on account of the greater valuation and consequent larger charges for interest and depreciation, generally speaking, showed no advantage in cost of production.

This does not mean that good pure-bred cattle are not economical or efficient producers of milk. It simply shows that many of the pure-bred cows on the farms included in this study are no better than the grade cows. Pure-bred cows, when kept primarily for the purpose of producing milk or cream for sale, are worth no more than grade cows unless they give more milk; and high prices should not be paid for registered stock unless it has producing ability.

TABLE XVI. COMPUTATION OF VALUE OF COWS BASED ON THEIR YIELD OF BUTTER-FAT

All regions. Year ending April 1, 1932

Items	Pounds of butter-fat per cow annually			
	Under 225	225–275	275–325	Over 325
1 Number of farms	102	123	135	104
2 Average butter-fat per cow, pounds	189	251	299	352
3 Market value of butter-fat per pound	28¢	29¢	32¢	34¢
Value of cows				
4 Value in each group	$67	$73	$80	$86
5 Deviation from average value ($76)	$–9	$–3	$4	$10
6 Deviation from average expressed in pounds of butter-fat at market value	–33	–10	12	30
Annual profit per cow				
7 Amount in each group	$–25	$–19	$–9	$–3
8 Deviation from average profit ($–14)	$–11	$–5	$5	$11
9 Deviation from average capitalized at 25 per cent*	$–44	$–20	$20	$44
10 Capitalized deviation expressed in pounds of butter-fat at market value, pounds	–159	–70	62	131
11 *Computed value of cows above or below average, in pounds butter-fat* (item 6 + item 10) (pounds)	–192	–80	74	161

*To cover 20 per cent depreciation and 5 per cent interest on the computed additional value of the cow.

TABLE XVII. GRADE vs. PURE-BRED COWS

Year ending April 1, 1932

Grade or pure-bred cows	Number of farms	Average value of cows	Butter-fat per cow	Total net cost	
				Per cow annually	Per pound butter-fat
			Pounds		
Market milk (Willamette Valley)					
All grade	61	$74	309	$130	42¢
Part pure-bred	22	87	281	119	42
All pure-bred	4	143	324	133	41
Cheese milk (Coast regions)					
All grade	43	69	267	$88	33¢
Part pure-bred	8	89	289	91	32
All pure-bred	.....	.....	.....	.....	.....
Churning Cream (Irrigated regions)					
All grade	77	$65	237	$75	32¢
Part pure-bred	21	92	266	83	31
All pure-bred	4	151	275	93	34

FEEDING PRACTICE

A summary of the average amounts fed of the various kinds of hay, succulent feeds, and grain is given for the principal types of dairying in

TABLE XVIII. AVERAGE AMOUNTS PER COW ANNUALLY OF THE VARIOUS KINDS OF HAY, SUCCULENTS, AND GRAIN, FOR THE PRINCIPAL TYPES OF DAIRYING

Average of four years ending April 1, 1933

Kind of feed	Market milk (Willamette Valley)	Churning cream (Willamette Valley)	Cheese milk (Coast regions)	Churning cream (Irrigated regions)
	Pounds	*Pounds*	*Pounds*	*Pounds*
Alfalfa hay	1,150	818	209	5,692
Clover hay	1,208	1,189	368	114
Vetch-and-oats hay	1,804	2,273	388	61
Other hay: grain, mixed, etc.	1,010	744	2,411	680
TOTAL HAY	5,172	5,024	3,376	6,547
Corn silage	3,204	2,760	712	816
Other silage	858	453	246	82
Kale	947	1,180	34	17
Green corn	559	466	684	91
Other green feed	869	398	888	90
Roots and potatoes	1,005	271	1,957	98
TOTAL SUCCULENTS	7,442	5,528	4,521	1,194
Oats	440	713	12	114
Barley	103	138	14	181
Wheat	69	84	....	20
Other and mixed farm grain	197	252	122	39
Dairy feeds	756	150	282	79
Mill feed: mill-run, bran, etc.	466	262	97	40
Oil meals	59	34	19	2
Miscellaneous	22	14	4	9
TOTAL GRAIN	2,112	1,647	550	484

Table XVIII, and by regions, in Table XXXIX. The principal significant changes during the period of the study, in addition to the decrease in total amount of grain fed, which has been referred to previously (Table XI), were decreases in the amounts of mixed dairy rations and oil meals.

Since feed amounts to more than half the total cost of producing milk and butter-fat, it is to be expected that differences in feeding practice have considerable effect on cost. In any consideration of feeding practice, however, yield per cow must also be considered, for feed consumption is closely related to yield of milk, which we have seen is a dominant factor influencing cost.

Of the four classes of feed—hay, succulents, grain and pasture—pasture furnishes digestible nutrients at the lowest cost and grain at the highest cost.*

Pasture. Average acreages per farm of different classes of pasture in each region are given in Table XIX. The native pasture in the Willamette

*It is recognized that this is not true on the basis of experimental data alone as to percentage of digestible nutrients in feeds. These percentages approximate 50 per cent for hay, 15 per cent for succulents, and 75 per cent for grain; and the amount of nutrients from pasture, as determined by subtracting the barn feed from the T. D. N. requirement of the cow, approximates five pounds per day. But the net regression coefficients for pounds of hay, succulents and grain per cow, and days of pasture, on the T. D. N. requirement per cow, computed for the 1529 records obtained in the first three years of this study, are .352, .126, .617, and 10.8 for the hay, succulents, grain and pasture respectively; and there are other indications that these coefficients give better ratios for the respective nutrient values of the classes of feed, for example, the fact that an average of five pounds of T. D. N. per day of pasture would not support the many cows that get practically their entire feed from pasture during the summer.

Valley and Coast regions is mostly stump, brush, and woods pasture; in the Irrigated regions it is mostly sage-brush land, which furnishes a limited amount of feed in spring and fall. Most of the tame-grass pastures are mixed grasses and clovers. In addition to these acreages, considerable pasture is also obtained from crops and hay meadows.

TABLE XIX. ACREAGES OF DIFFERENT TYPES OF PASTURE PER FARM, BY REGIONS

Year ending April 1, 1932

Kind of pasture	Willamette Valley	Coast regions	Irrigated regions	All regions
	Acres	*Acres*	*Acres*	*Acres*
Native	48	57	48	49
Non-irrigated tame grass	8	25	3	10
Irrigated	*	1	20	6
TOTAL	56	83	71	65

*Less than .5 acre.

The relation of amount of pasture to costs of production for cheese milk production in the Coast regions is shown in Table XX. With more pasture the feed, labor, and total cost per cow is less; and likewise the cost per pound of butter-fat, in spite of a lower yield of butter-fat per cow. A similar relationship is shown in Table XL for market milk in the Willamette Valley, and for churning cream in the Irrigated regions.

TABLE XX. RELATION OF AMOUNT OF PASTURE TO COST OF PRODUCING CHEESE MILK

Coast regions. Year ending April 1, 1932

Items	Percentage of feed (total digestible nutrients) from pasture		
	Under 20 per cent	20–29 per cent	30 per cent and over
Number of farms	6	23	22
Cows per farm	32	28	44
Pounds butter-fat per cow annually	291	272	264
Amount per cow annually			
Hay, pounds	4,525	3,706	2,907
Succulent, pounds	11,751	4,597	2,837
Grain, pounds	369	629	285
Pasture, days	162	197	240
Cost per cow annually			
Feed	$64	$53	$44
Labor	25	26	22
Total net cost	106	93	82
Total net cost per pound of butter-fat	37¢	34¢	31¢

The chief lack of pasture is in the Willamette Valley. It would seem that many Willamette Valley dairymen could substantially reduce their costs of production by developing more pasture for their cows, irrigated Ladino clover pastures being feasible on many farms.*

*See Bulletin 264, Oregon Agricultural Experiment Station, *Irrigated Pastures for Dairy Cattle.*

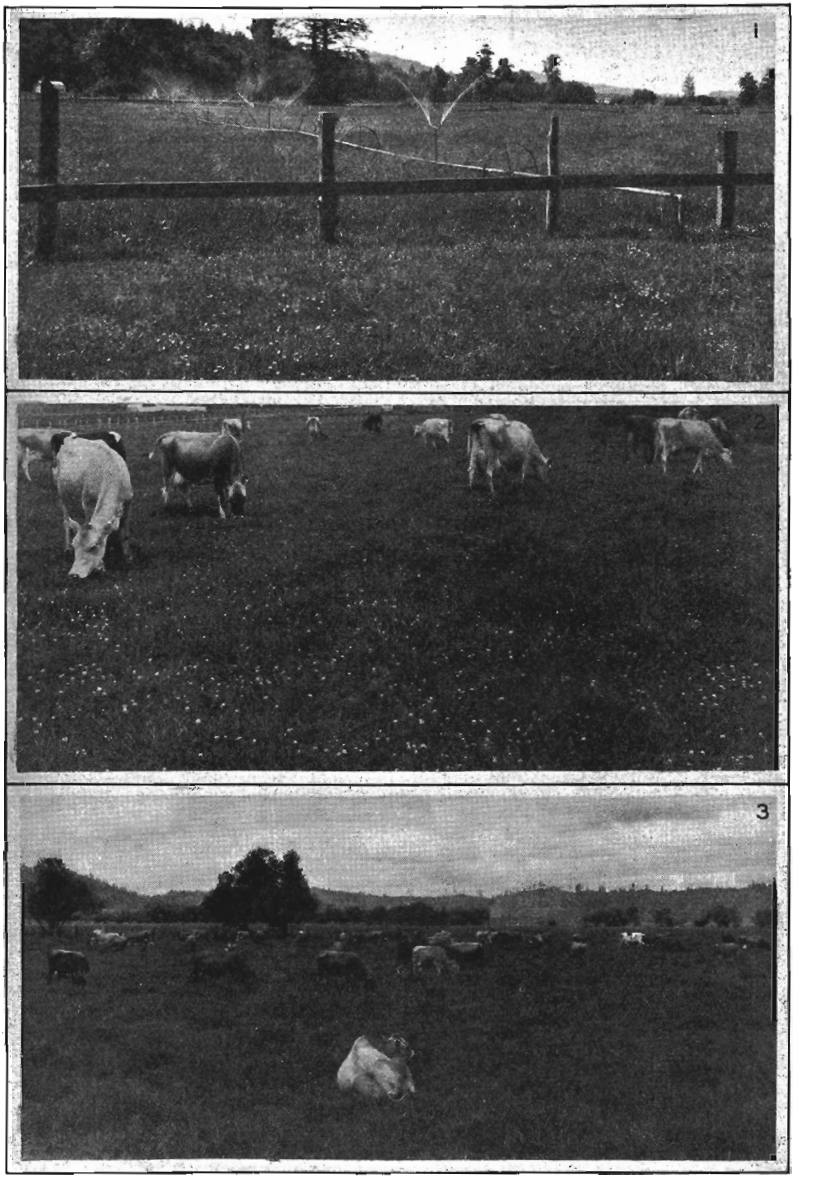

Figure 14. Luxuriant pastures in the Coast regions.

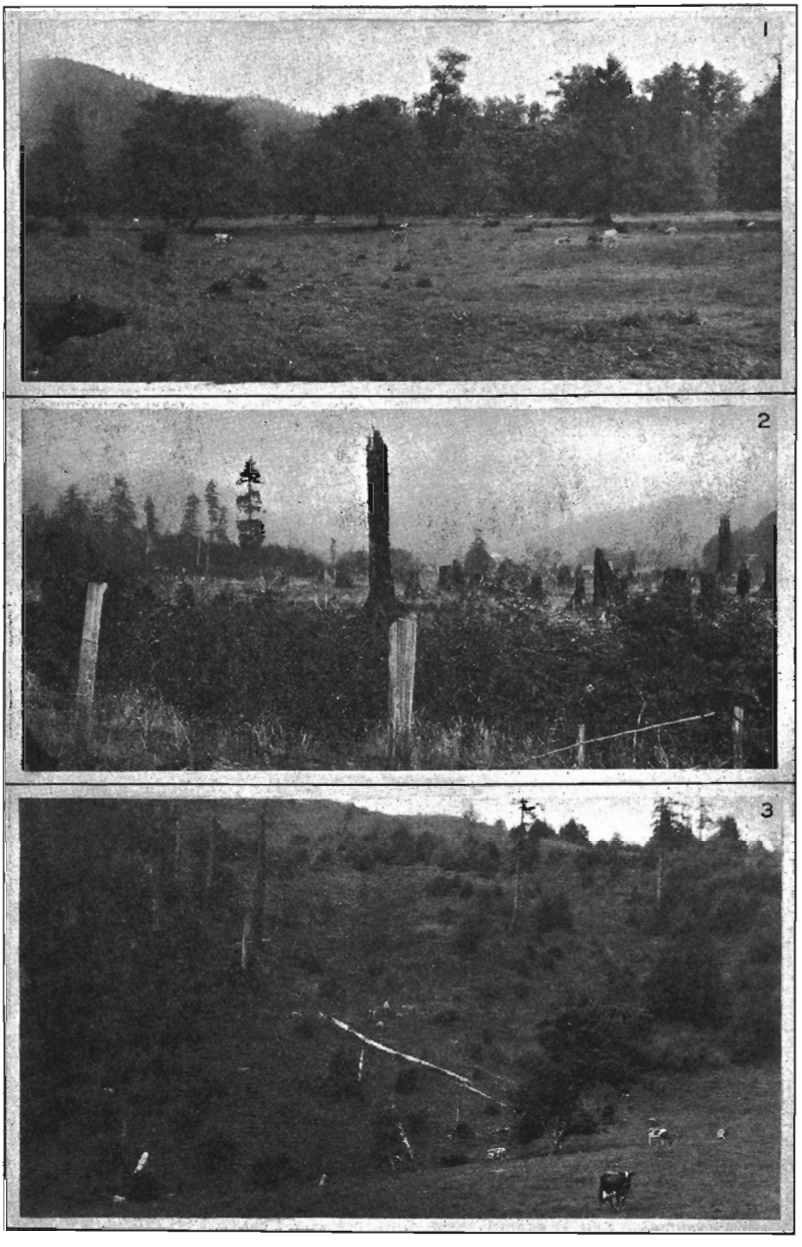

Figure 15. Types of native pasture in the Coast regions.

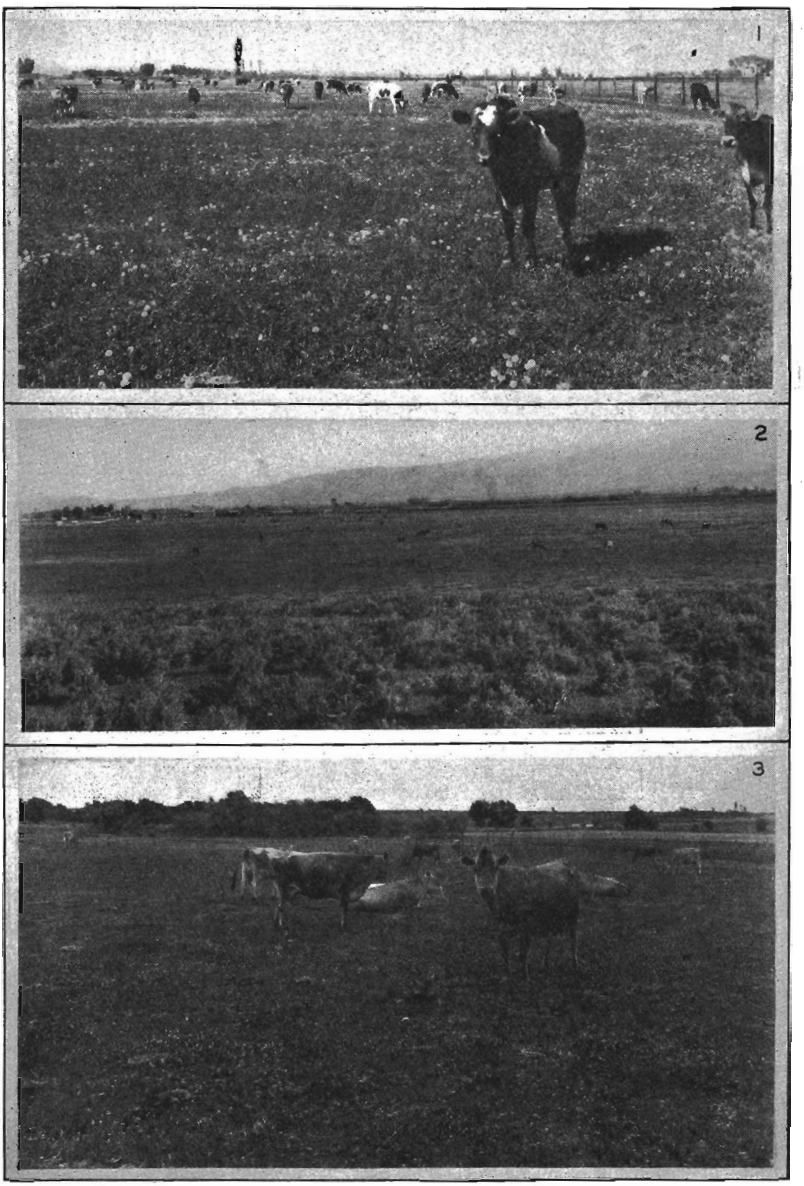

Figure 16. Pastures in the Irrigated regions.

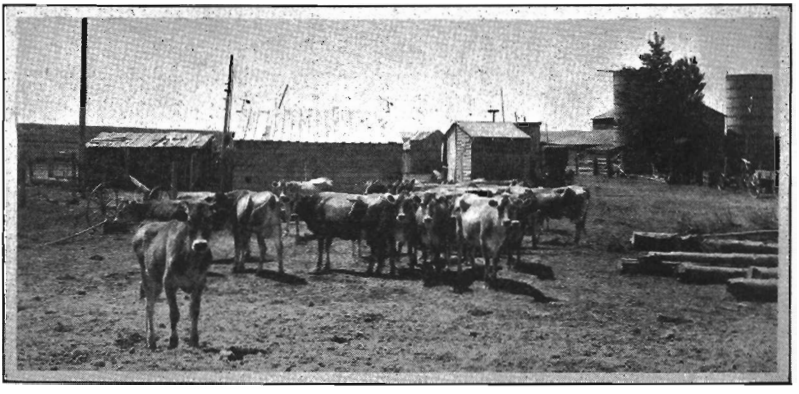

Figure 17. Lack of pasture causes high costs on many farms. These cows, on an Eastern Oregon farm, are kept in the barn lot and fed hay and silage the year round.

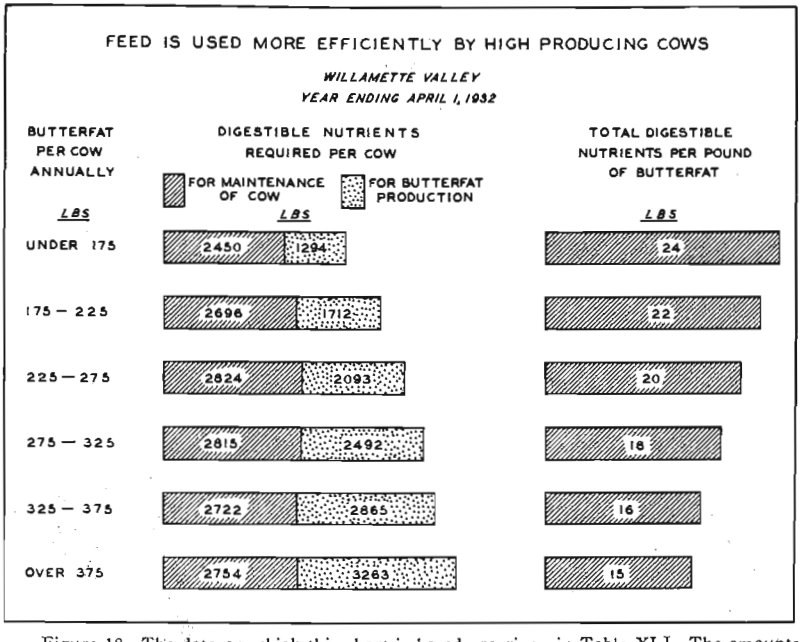

Figure 18. The data on which this chart is based are given in Table XLI. The amounts of digestible nutrients required are based on the Haecker feeding standard.

Grain feeding. Dairy cows require feed for two main purposes: first, for maintenance of the body weight of the cows, and the energy used in their daily activity; and second, for the production of milk. Experimental work indicates that the amount of feed required for maintenance is a fixed amount in proportion to the weight of the cow, while the amount required

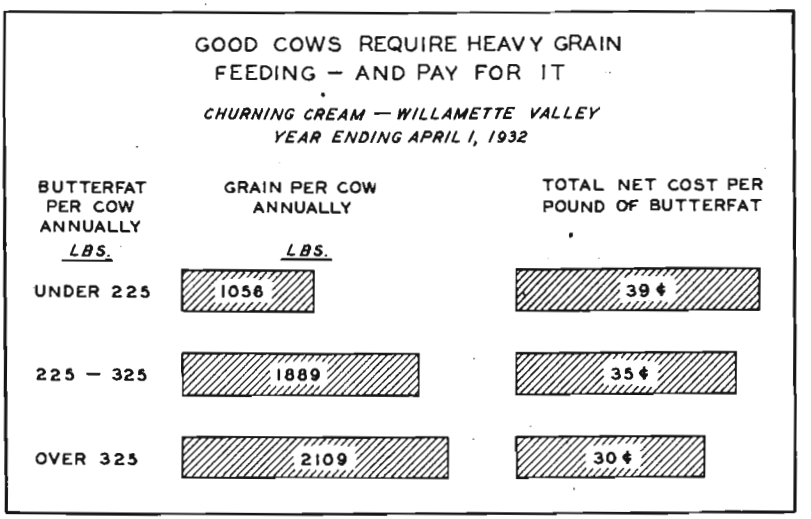

Figure 19. Additional data for these groups of farms and similar data for market milk and cheese milk are given in Table XLII.

for milk production is in direct proportion to the amount of milk produced. Because of the large fixed amount of feed that is used for maintenance, whether any milk is produced or not, low yielding cows require much more feed per unit of product than cows with higher yields. This is shown graphically in Figure 18, which is based on computations of total digestible nutrient requirements according to the Haecker feeding standard.

Cows giving the higher yields of product, however, are unable to consume the required amount of nutrients in the form of bulky feeds such as hay and silage, and with increasing yields it becomes necessary to feed an increasingly larger proportion of the feed in the more concentrated form of grain. Even though grain is usually the highest priced form of nutrients, high yielding cows pay for it and still give lower costs of production, as we have seen, and as is shown in another form in Figure 19.

Cows should produce up to a certain amount—perhaps 15 pounds of milk a day, or 20 pounds of butter-fat a month, or 150 pounds of butter-fat a year—on good roughage alone, with no grain feeding. Feeding grain to cows producing no more than these amounts simply replaces a cheaper feed with one more costly, thus increasing cost of production. This is illustrated by the high cost for heavy grain feeding to low-producing cows in Figure 20. Many dairymen make the mistake of trying to force high production from cows that do not have the high producing ability by feeding grain to them. The fault is in the cows rather than the feed.

Recommended grain feeding practice. When cows are provided with all the good roughage they will consume, which may be alfalfa hay alone,

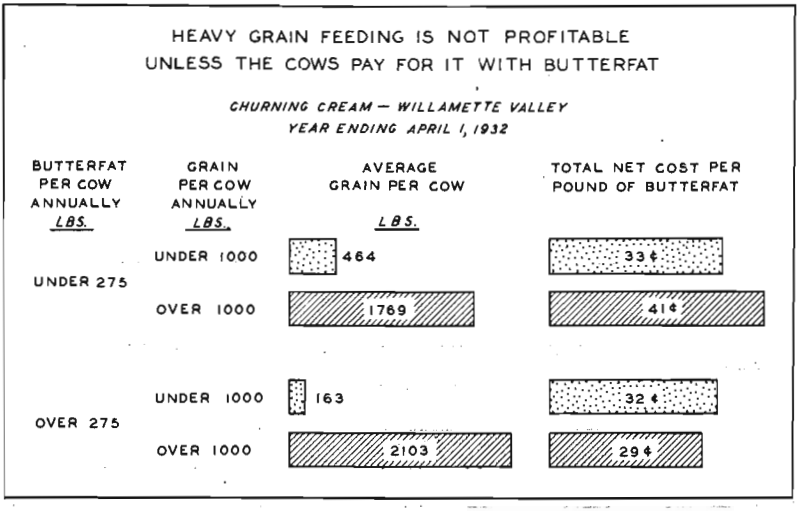

Figure 20. Additional data for this tabulation are given in Table XLIII.

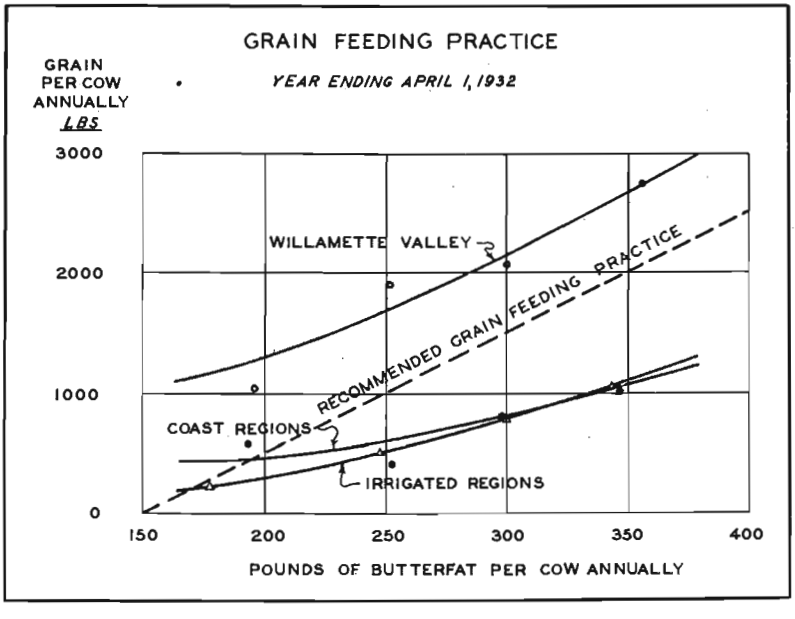

Figure 21. This chart indicates that many low-producing cows are being fed too much grain, while many high-producing cows could profitably be fed more, particularly in the Coast and Irrigated regions (Table XLIV).

or a good hay and a succulent feed, or a good pasture, the recommendations for grain feeding approximate as follows:

Milk testing 3.5 per cent to 4.5 per cent:	Feed 1 pound of grain for each 2½ pounds of milk over 16 pounds per day.
Milk testing 4.5 per cent to 5.5 per cent:	Feed 1 pound of grain for each 2 pounds of milk over 12 pounds per day.

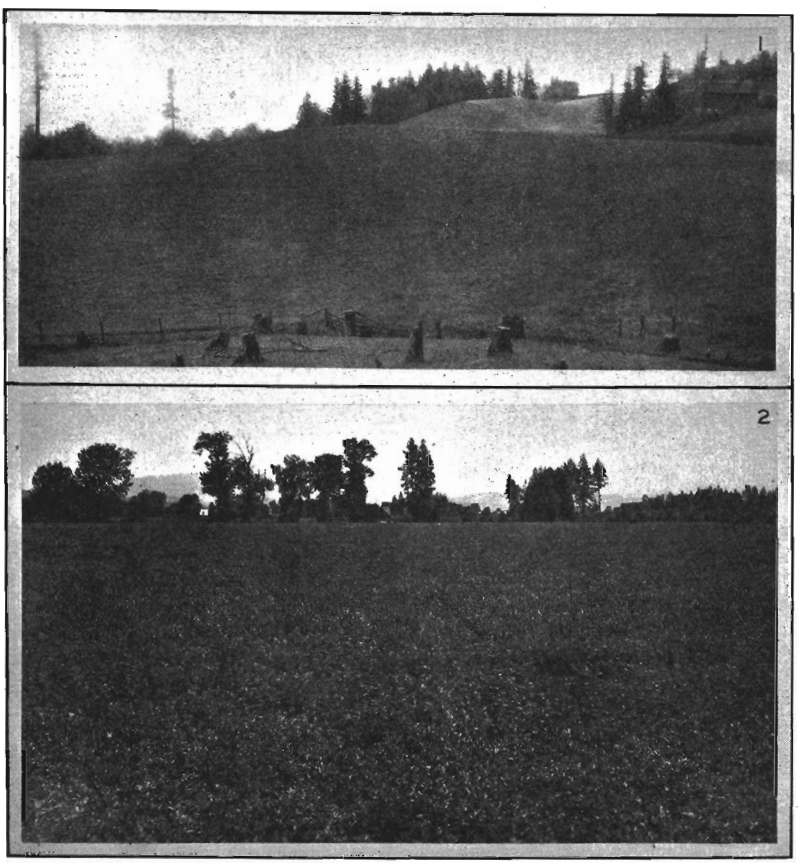

Figure 22. Alfalfa is the hay crop of outstanding value, and also furnishes much of the succulent feed when fed green. (1) Alfalfa on rolling land in Multnomah county. (2) A Baker county alfalfa field.

In Figure 21 is shown the average grain feeding practice in each region for cows of varying yields of butter-fat, in comparison with the foregoing recommended grain feeding practice. The recommended grain feeding practice has been converted in the chart to an annual basis of 10

pounds of grain for each pound of butter-fat over 150 pounds per cow annually. Average grain feeding in the Willamette Valley is considerably heavier than the recommendation, while in the Coast and Irrigated regions it is lighter, at least for the heavier producing cows.

The recommended grain-feeding practice assumes that the cows receive all they will consume of a *good quality* of roughage or pasture. Where the roughage or pasture is of poor quality, as on many Willamette Valley farms, heavier grain feeding than the recommendation may be necessary; and where pastures are unusually luxuriant, as on many of the Coast region farms, less grain feeding may be required. Figure 21 suggests, however, that many dairymen *with good cows* in the Coast and Irrigated regions might increase the yield of their cows and thus decrease their costs per pound of butter-fat by feeding more grain.

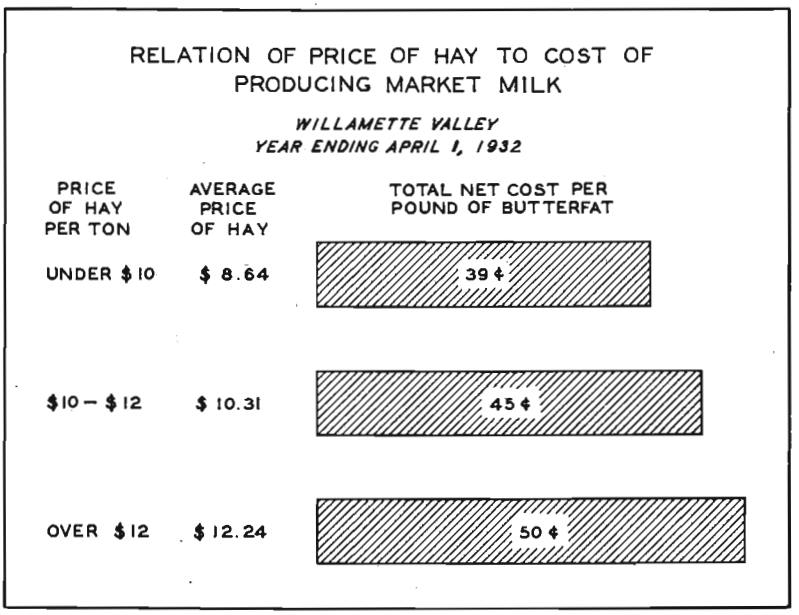

Figure 23. The data on which this chart is based, and similar data for cheese milk and churning cream, are given in Table XLV.

The physical condition of the cow should also be taken into consideration in connection with the recommended grain-feeding practice, feeding more heavily if the cows are in a thin condition.

Many farmers think that heavier grain feeding increases the butter-fat test of the milk. No relation was found, however, between the amount of grain fed and the butter-fat test.

Hay. Hay amounts to more than 20 per cent of the average total cost of production, and more than 40 per cent of the total feed cost. The foregoing discussion of grain feeding has shown that lower costs are obtained by feeding hay and other roughage up to the limit of the capacity of the

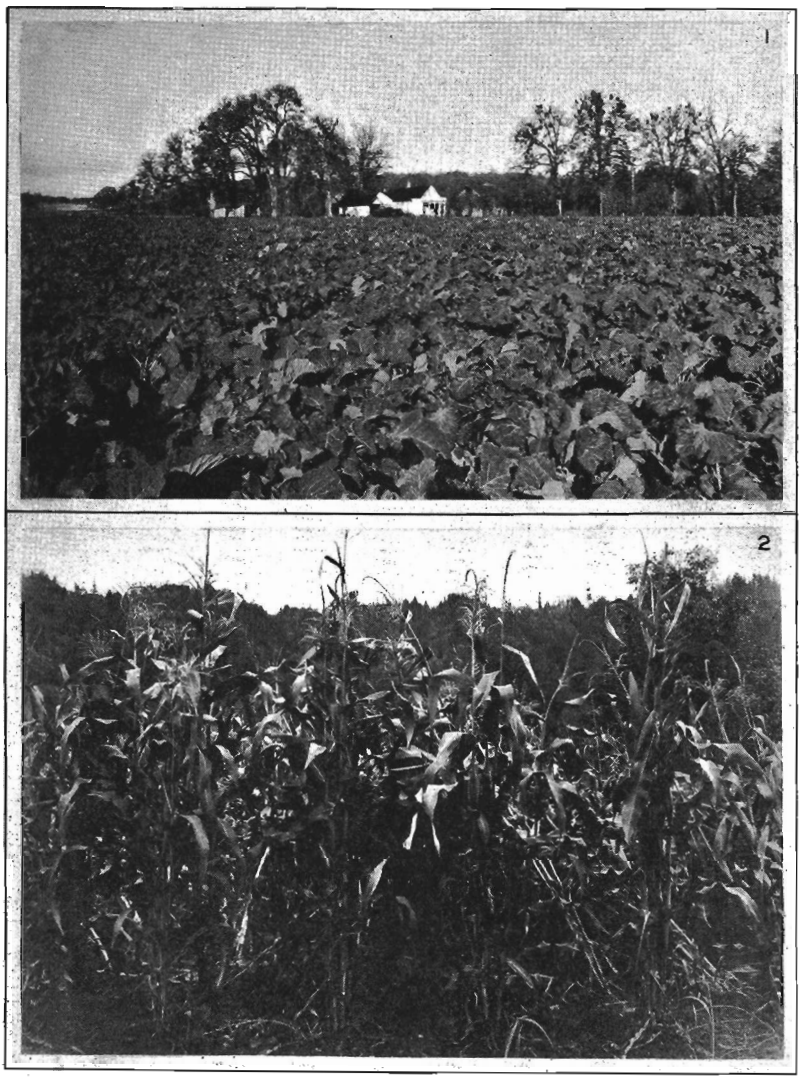

Figure 24. Kale and corn silage are the leading succulent feeds. (1) Field of kale in the Willamette Valley. (2) Silage corn in Coos county.

cow. The kind and quality of hay undoubtedly have much to do with the amount of hay that cows will consume, and hence with costs of production. The heavy consumption of hay and light grain feeding in the Irrigated regions are made possible by the high quality alfalfa hay in those regions.

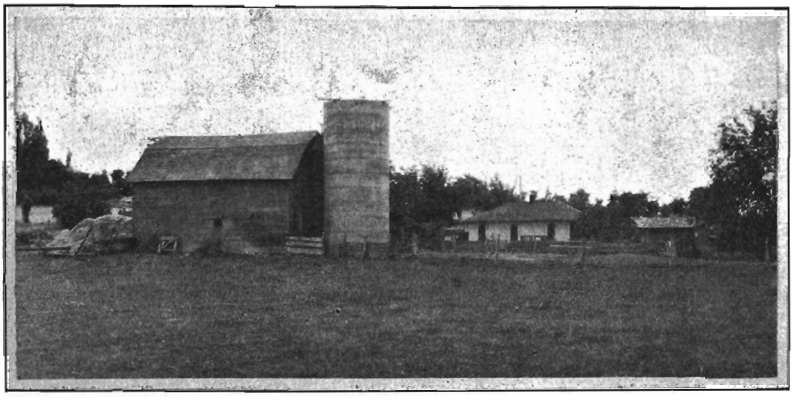

Figure 25. Although fewer silos are found on dairy farms in the Irrigated regions, many dairymen who have them think that they are indispensible. The forms for this concrete silo were purchased by the Farm Bureau on the Umatilla irrigation project and rented out to the farmer at a nominal charge, quite a number of silos such as this being built in that region as a result, largely by exchange work among neighbors.

Figure 26. Root crops are used as a succulent feed chiefly in the Coast regions, but are a valuable reserve feed in the Willamette Valley when kale freezes.

Differences in the price of hay made considerable difference in cost (Figure 23), which might be expected from the fact that hay is so large a proportion of the total cost. Because of its bulkiness and consequent

high cost of shipping, the market value of hay varies considerably between communities, depending on whether there is a surplus or deficiency. High hay costs on many individual farms are caused by running out of hay in the spring and having to pay exorbitant prices for hay to carry the cows through to pasture.

Because of the major importance of this large item in cost, dairymen should give particular attention to obtaining their supply of hay at reasonable cost. Most of them, of course, raise their own hay; and from the standpoint of profits for the entire farm business the costs of producing the hay are important. A previous study has covered costs and factors affecting costs of producing hay.*

Succulent feeds. Practical experience and experimental work in feeding dairy cows have shown the importance and desirability of a good succulent feed in the ration. No relation between feeding of succulents and costs of production was apparent in this study, however. The succulent feeds amounted to less than 8 per cent of the total cost, and the effect of variations in this comparatively small item are obliterated by the more outstanding cost relationships in feeding that have been discussed. Costs of producing succulent feeds have been studied and reported upon in a previous bulletin.†

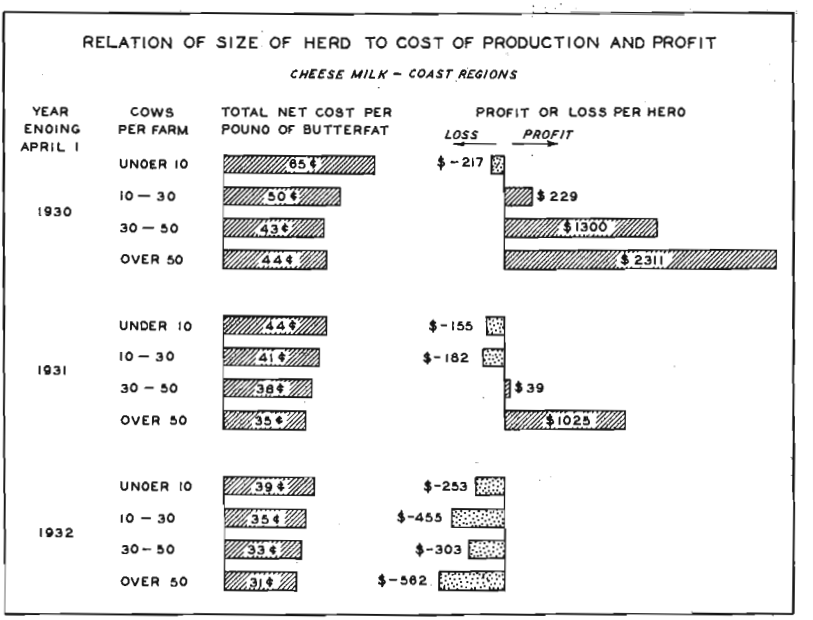

Figure 27. Larger herds are more efficient, have lower costs of production, and when prices are profitable, return the largest profit per herd, but when prices are unprofitable they return the largest loss per herd (Table XLVI).

*Bulletin 241, Oregon Agricultural Experiment Station, *Cost and Efficiency in Producing Alfalfa Hay in Oregon;* and Bulletin 248, *Cost and Efficiency in Producing Hay in the Willamette Valley.*

†Bulletin 251, Oregon Agricultural Experiment Station, *Cost of Producing Silage and Kale in the Willamette Valley.*

SIZE OF HERD

Nearly all economic studies of farming or of farm enterprises show advantages in efficient production for larger size of business, and Figure 27 and Table XXI show that dairying in Oregon is no exception in this respect. It will be seen in Table XXI that all costs decreased with increasing size of the herd. The lower feed costs reflect the lower prices that are obtainable in buying feed in larger quantities; labor costs are lower because of the fact that many operations take little if any longer for a large herd than for a small one, for example, going after the cows, and getting things ready for milking.

TABLE XXI. RELATION OF SIZE OF HERD TO COST OF PRODUCING CHEESE MILK

Coast regions. Year ending April 1, 1932

Items	Number of cows per farm			
	Under 10	10–30	30–50	50 and over
Number of farms	4	27	11	9
Cows per farm	8	21	37	89
Pounds butter-fat per cow annually	309	270	282	262
Days pasture per cow annually	211	221	207	217
Cost per cow annually				
Feed	$67	$54	$51	$45
Labor	33	26	25	21
Use of buildings	8	5	6	4
Sire	5	2	2	1
Other costs	14	13	16	12
TOTAL GROSS COST	$127	$100	$100	$83
Credits	6	4	7	3
NET COST PER COW	$121	$96	$93	$80
COST PER POUND BUTTER-FAT	39¢	35¢	33¢	31¢

With lower costs of production and a larger volume of business, it would be expected that the larger herds would return larger profits, and this is certainly true for normal conditions, as is shown in Figure 27 in the graph showing profit or loss for the first year of the study. When prices are generally unprofitable, however, the larger volume of business suffers the more loss. By the last year of the study, prices were so low in proportion to cost of production that they more than offset the cost of production advantage of the larger herds, and they show the largest amount of loss per farm. Thus, while in general, larger herds are more efficient, have a lower cost of production, and usually give much larger profits, it should be recogized that there is also a risk of greater loss should conditions become too unfavorable.

Are Oregon dairy herds too small? This last relationship has a bearing on whether dairy farmers in Oregon should increase the size of their herds. It has been pointed out previously that for many farms, particularly in churning cream production in the Willamette Valley, the dairy enterprise is more or less a sideline, giving some return, though not full wages or feed prices, for surplus labor and unmarketable feed that would otherwise be wasted. Under such conditions a small dairy herd increases the total farm income and profit; while a larger herd, by failing to return

full value for purchased feed, or feed that could be sold, and for labor that could be used profitably in other ways, might decrease the total farm returns.

Another important consideration in connection with the size of dairy herd is the capacity of the dairyman to handle a larger herd. Many men who can handle a small business fairly successfully, are incapable of successfully assuming the greater responsibilities and requirements of a larger business. A 10-cow man is better off with 10 cows than with 50. The additional capital required for a larger herd is also a serious obstacle for many farmers.

From the figures that have been shown, however, it should be clear to many Oregon dairymen that under the right conditions, with a satisfactory market, they could reduce their costs of production and greatly increase their total returns by enlarging their herds. The relation of the size of the entire farm business to financial returns is discussed on page 64.

LABOR EFFICIENCY

It has been shown that higher yields per cow, larger amounts of pasture per cow, and larger herds, all give definite advantages in the use

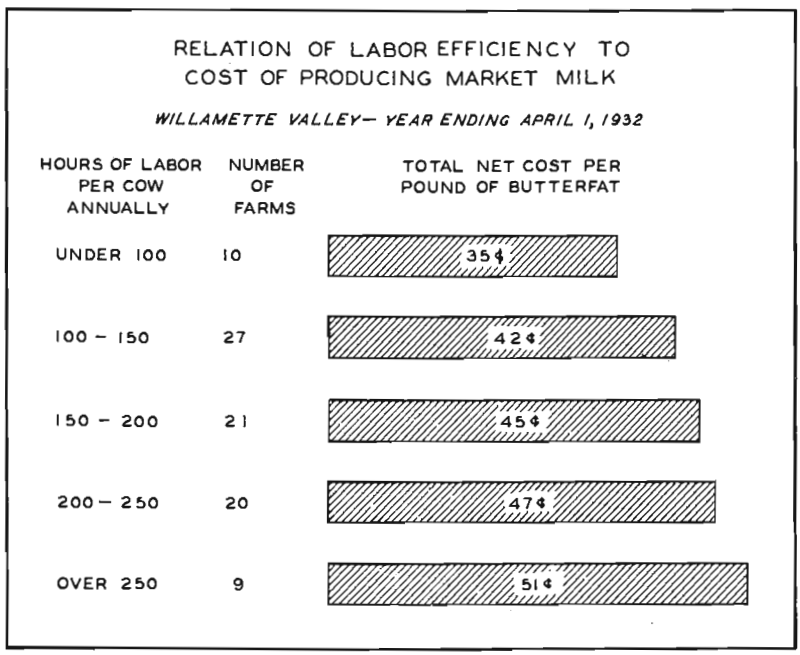

Figure 28. Additional data for this tabulation and for other types of production are given in Table XLVIII.

of labor in dairying. The relation of the amount of labor required to costs of production, giving the combined effect of these and other influences affecting the amount of labor required, is shown in Figure 28 and Table XLVIII.

Perhaps the most important factor in labor efficiency is the efficiency of the individual worker. Some men work faster and more efficiently than others.

Other factors in labor efficiency are the kind of buildings and equipment, and the layout of the buildings, lanes, fields, and pastures. The effect on cost of these minor factors is not distinguishable in this study, but certain descriptive data that were obtained are of interest.

Buildings. Information pertaining to the buildings used for the dairy enterprise is given in Table XXII (see also Figures 29, 30, and 31).

Many Oregon dairy farms have straw sheds or "loafing sheds" for their cows. These vary from simple shelters under straw piles to quite substantial buildings (see Figures 38 and 40). The cows are bedded down in these sheds, the manure and bedding being tramped down by the

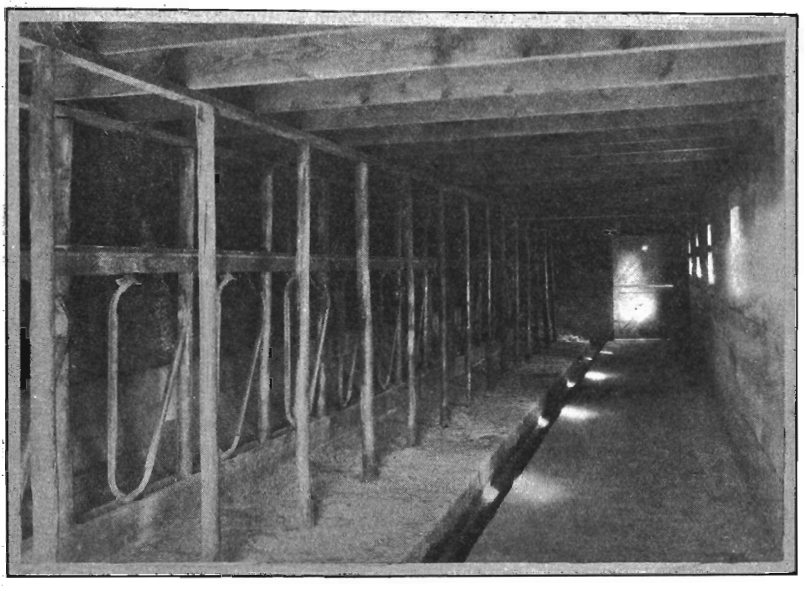

Figure 29. The vertical poles serve to separate the cows and keep them in place but do not necessitate walking around partitions in releasing the cows

cows as it accumulates, and cleaned out in most cases only once a year. Certain data on these sheds obtained in the study are given in Table XXIII, omitting the more makeshift types that were chiefly storm shelters. Practically all of the dairymen who have these loafing sheds are enthusiastic about them, finding that they give much protection against exposure as compared with turning the cows out; that they kept the cows cleaner and more comfortable, and save work, as compared with keeping the cows in the barn; and that they are a means of saving manure and of converting straw into fertilizer.

Equipment. Data on the dairy equipment are given in Table XXIV. Comparison of farms using milking machines with those milking by hand

TABLE XXII. DATA ON BUILDINGS, FOR PRINCIPAL TYPES OF DAIRYING

Year ending April 1, 1932

Items	Market milk (Willamette Valley)	Churning Cream (Willamette Valley)	Cheese Milk (Coast regions)	Churning Cream (Irrigated regions)
Total value of dairy barns, per farm	$1,622	$954	$1,881	$766
Value per farm proportional to the use for cows				
Dairy barns	$1,110	$545	$1,521	$549
Milk houses	165	40	58	43
Other buildings	23	29	23	13
Water systems	79	33	37	18
Total buildings for cows	$1,377	$647	$1,639	$623
Percentage of barns with—	%	%	%	%
Floors				
Concrete	16	11	4	14
Wood	80	84	92	75
Concrete and wood	4	4	4	5
Earth	0	1	0	6
Cows facing				
Out	8	3	24	10
In	91	95	76	88
Both ways	1	2	0	2
Stanchions				
Straight	42	55	78	70
Swinging	51	35	20	22
Ties	7	10	2	8
Water cups	7	2	25	0
Litter carriers	15	1	4	1
Manure pits	2	0	6	0
Average distance	*Feet*	*Feet*	*Feet*	*Feet*
From house to barn	208	235	405	224
From barn to pasture	505	528	374	512

TABLE XXIII. DATA ON STRAW SHEDS OR "LOAFING SHEDS"*

Year ending April 1, 1931

Items	Willamette Valley	Coast regions	Irrigated regions	All regions
Total number of farms	276	101	137	514
Farms with straw sheds	56	5	21	82
Cows per farm (farms with straw sheds)	11	23	19	14
Average ground area of sheds, square feet	1,357	2,754	1,497	1,478
Ground area per cow, square feet	122	121	80	107
Percentage of farms confining cows to shed, per cent	12	67	6	13
Percentage feeding hay in shed, per cent	35	33	45	37
Percentage cleaning out shed—				
Once annually, per cent	66	60	38	59
Twice annually, per cent	17	20	24	19
More than twice annually, per cent	17	20	38	22
Total manure from sheds per farm,† loads	41	56	52	44
Manure from sheds per cow,† loads	3.6	2.1	2.8	3.2

*Some of the items in this table were missing on a few of the records. The figures given for each item are based on the total data available.

†On many farms young stock are also kept in the shed, and the amount of manure is from the entire herd.

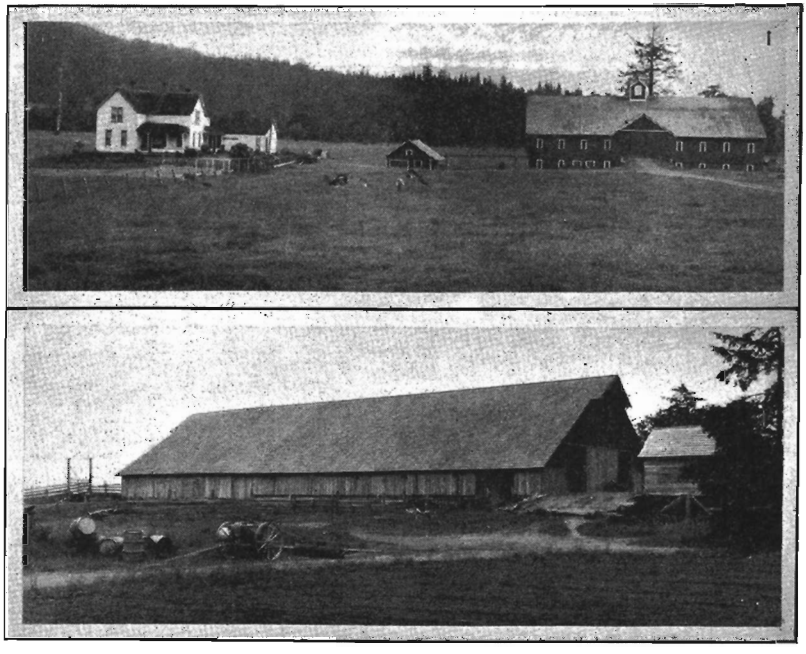

Figure 30. Substantial buildings on dairy farms in the Coast regions.

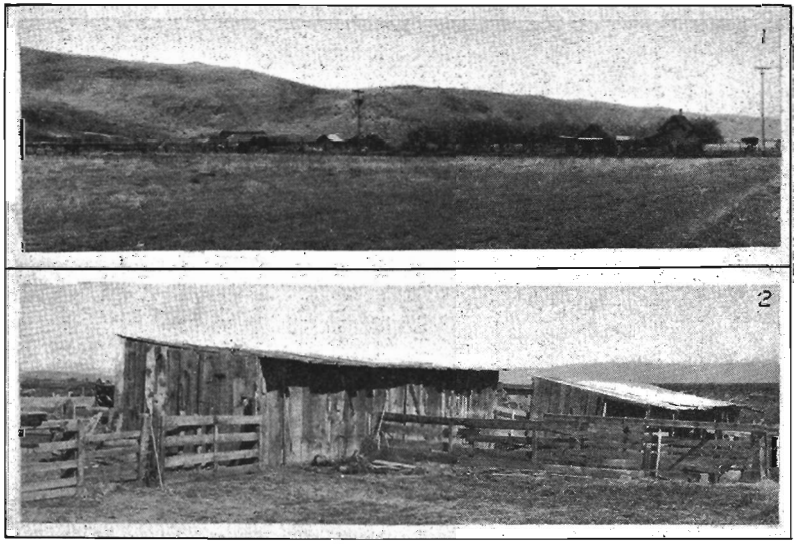

Figure 31. Many farms in the Irrigated regions are newly developed and buildings are inadequate. (1) An 80-cow herd was milked and cared for in this set of buildings. (2) Ten cows were milked in this "barn" which also houses the cream separator.

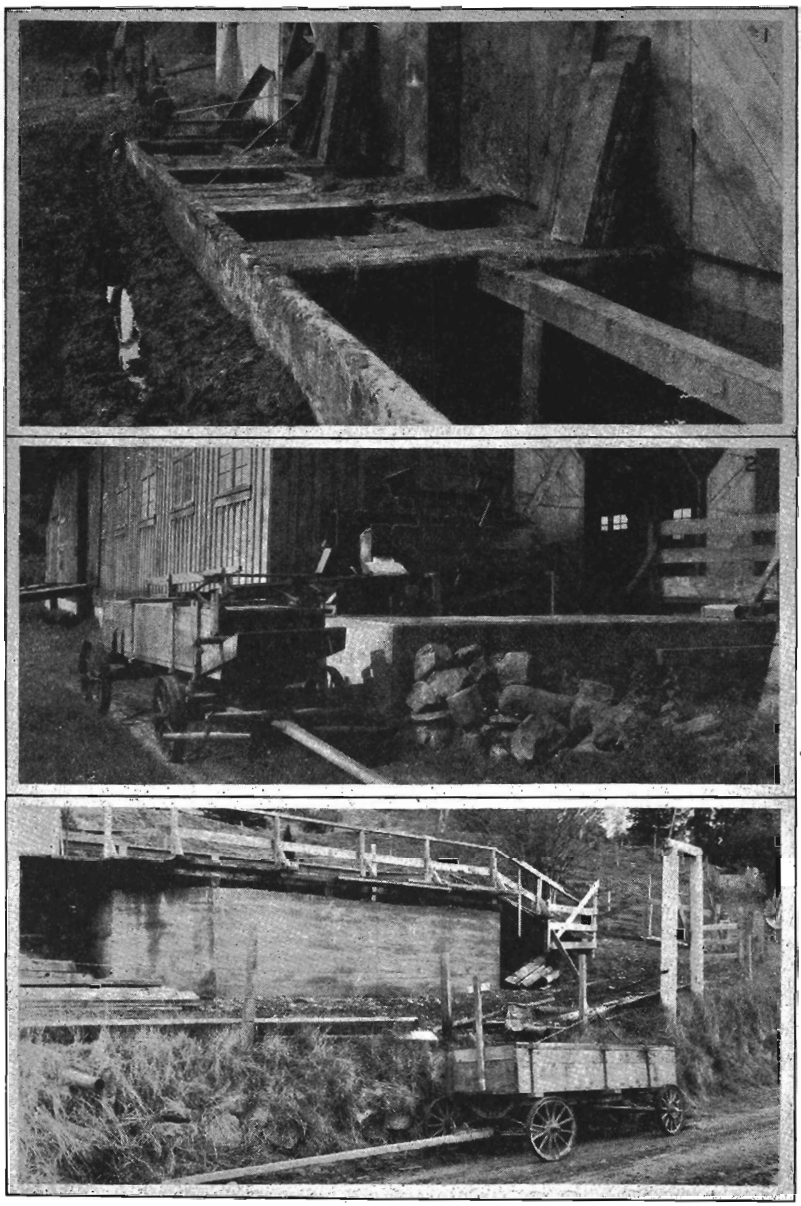

Figure 32. Liquid tanks, found on many of the farms in the Coast regions are valuable in conserving fertility. (1) Covering planks raised to show construction; note the rotary pump, operated by a gas engine, for emptying. (2) A home-made dipper for emptying. (3) Barn on a side hill makes possible emptying by gravity.

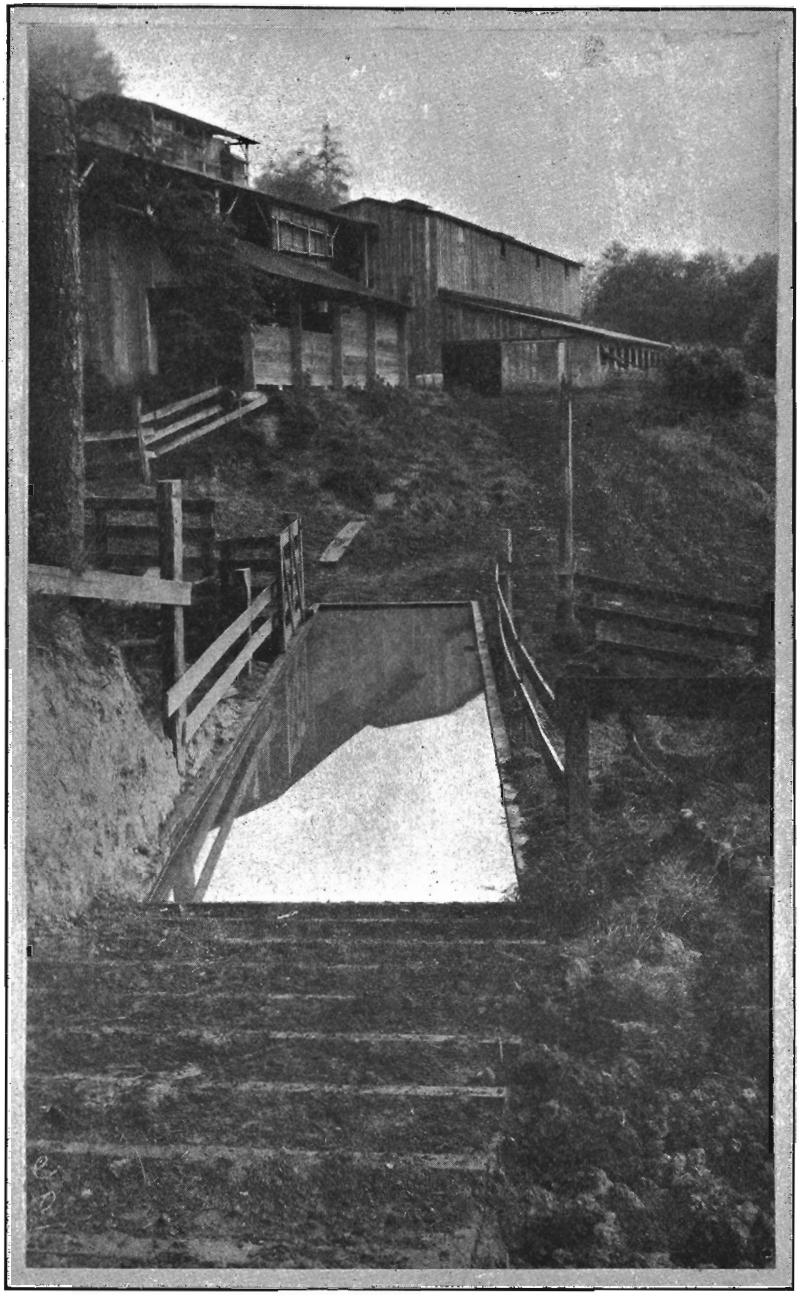

Figure 33. Washing tank through which the cows walk as they come in from muddy lanes.

produced no significant conclusions, an outstanding reason for this being that the farms using milking machines had considerably larger herds and the labor requirements and costs were therefore not comparable.

TABLE XXIV. VALUE OF DAIRY EQUIPMENT, FOR PRINCIPAL TYPES OF DAIRYING

Year ending April 1, 1932

Items	Market milk (Willamette Valley)	Churning cream (Willamette Valley)	Cheese milk (Coast regions)	Churning cream (Irrigated regions)
Number of farms	87	81	51	102
Cows per farm	17	11	36	16
Percentage of farms using milking machines	34%	23%	75%	35%
Average value per farm				
Milking machines	$73	$44	$262	$101
Cream separators	4	62	5	66
Milk coolers	28	*	1	0
Sterilizers, water heaters	46	1	5	1
Cans, buckets, etc.	37	14	53	13
Other equipment	1	0	0	1
TOTAL DAIRY EQUIPMENT	$189	$121	$326	$182

*Less than $0.50.

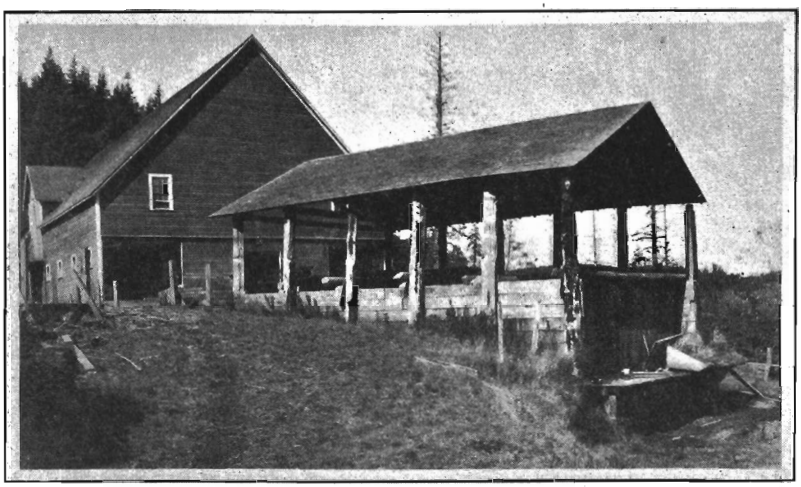

Figure 34. Manure pit on a large Coos county dairy farm. Lack of means of conserving manure is responsible for a large loss of fertility on many Oregon farms.

BUTTER-FAT TEST

The butter-fat test of the milk is closely related to costs of production per unit of milk and per unit of butter-fat, as shown in Figure 35 and Table XLIX. With higher test the yield of milk per cow decreases and the cost per 100 pounds of milk increases; while the yield of butter-fat per cow increases, the cost per pound of butter-fat decreases. Many dairy-

men could profitably take this into consideration in connection with the price basis on which they sell their product.

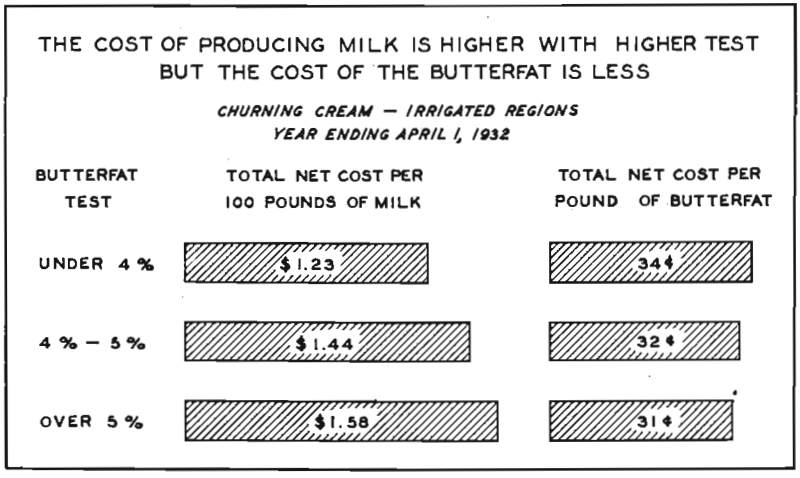

Figure 35. The data on which this chart is based and similar data for market milk and cheese milk are given in Table XLIX.

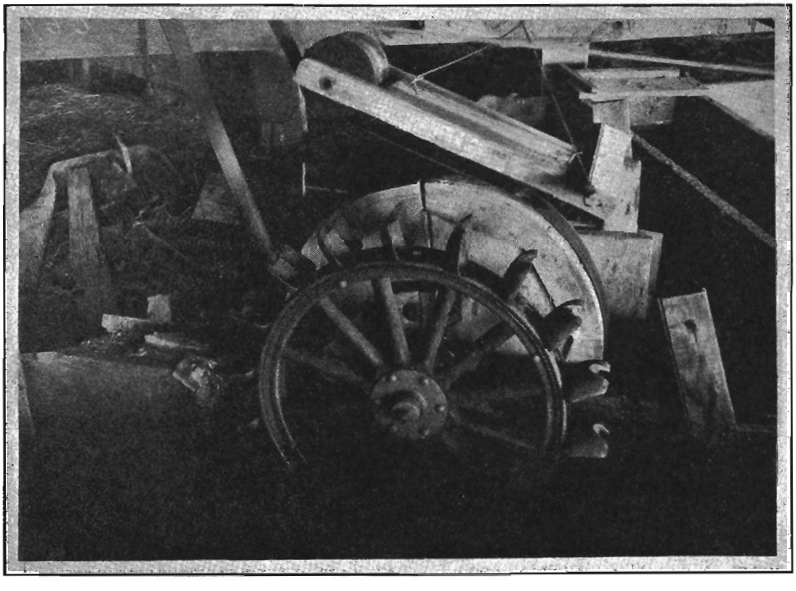

Figure 36. This home-made water wheel and a generator on the farm of R. H. Christensen, on Coos River, gives lights in the barn and runs the milking machine, and also gives lights and runs the washing-machine in the house. Many Oregon farms have a little water power that could be utilized in this way.

SEASON OF FRESHENING

In the Willamette Valley and Irrigated regions the predominating practice is to have most of the cows freshen in the fall. This has the advantage of making more work on the dairy enterprise in the winter, and less in the summer when it competes with work on crops (see Figure 39). It also tends to prolong the milking period and increase total production, since, as has been said, the cows "freshen" twice during the year—once when they have their calves in the fall, and again when pasture comes in the spring. This practice of fall freshening is a disadvantage in market milk production because it gives an uneven production of milk while the demand is fairly uniform throughout the year; the "basic average and surplus" plan of paying for market milk is designed to encourage more uniform production.

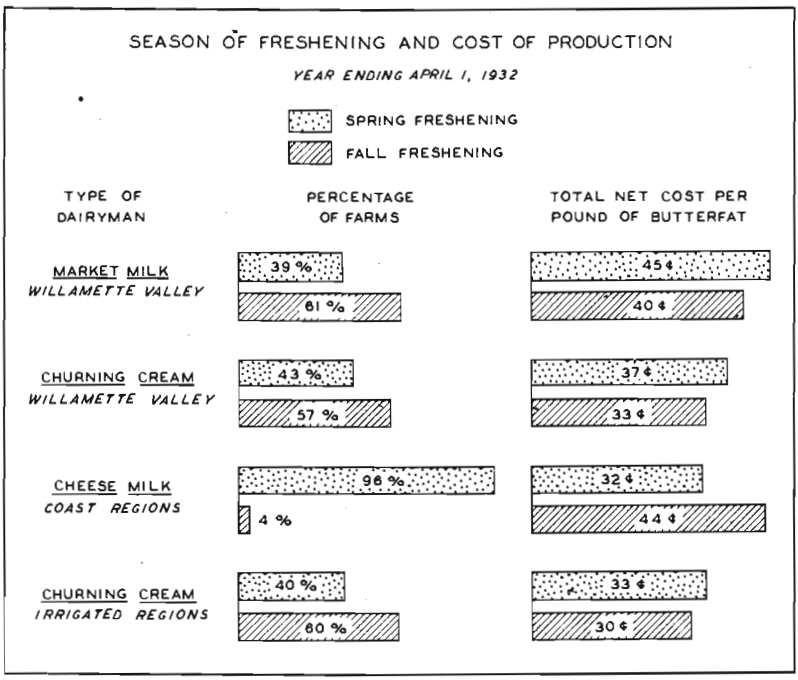

Figure 37. Additional data for this tabulation are given in Table L.

In the Coast regions the prevailing practice is to have the cows freshen in the spring, since pasture is abundant, less crops are grown, and winter feeds are comparatively high priced. This results in light milking during the winter when feeding and barn work are heaviest, and gives the uniform distribution of labor throughout the year shown in Figure 39.

Figure 37 indicates that the prevailing practice in each region as to season of freshening results in the lowest costs of production. Part of the cause of the higher costs for those not following the prevailing custom,

however, is that much of the irregular freshening is due to breeding troubles with the cows, which reduces their production. The most desirable season of freshening for a given farm is dependent on individual conditions such as seasonal variation in price, need of an even milk flow throughout the year, labor competition with other farm enterprises, and utilization of pasture.

CULLING, DEATH LOSS, AND REPLACEMENT OF COWS

The number of cows that died or were sold and the replacements by cows purchased and heifers raised, are shown for the year ending April 1, 1932, in Table XXV. Average values of cows are shown in Table XV.

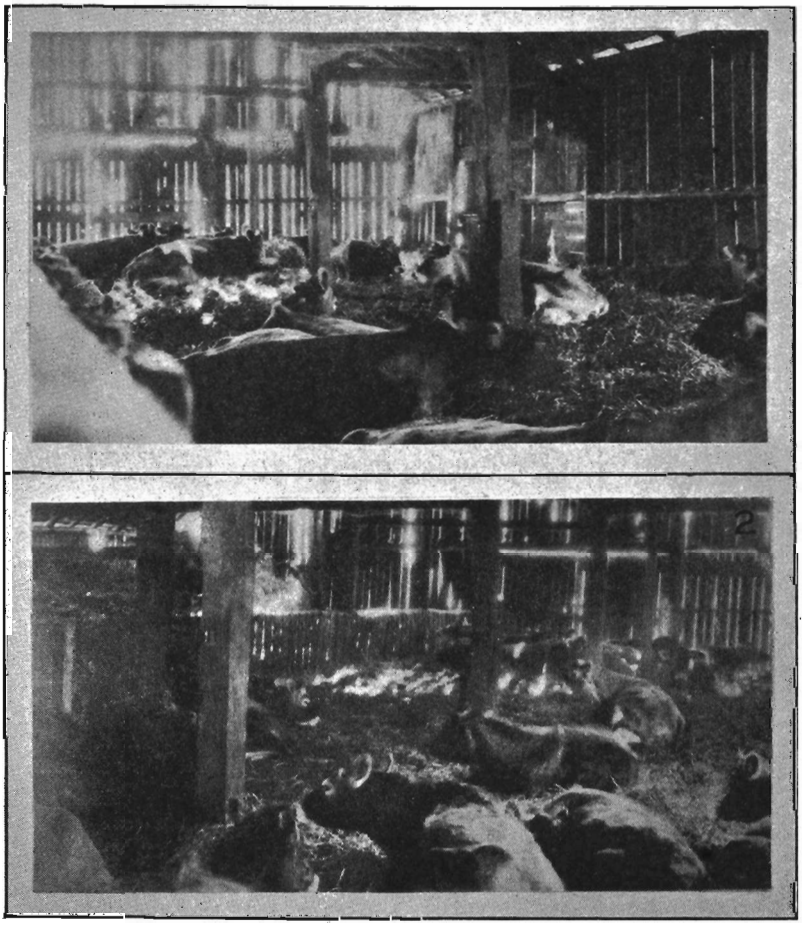

Figure 38. Cows at rest in the bedding in a "loafing shed." Sheds like this keep the cows cleaner and more comfortable than when kept in stanchions, save work, and are a means of accumulating and conserving manure and converting straw into fertilizer.

The average death loss for the entire study was 2½ per cent of the average number of cows annually. Nineteen per cent of the average number of cows were sold annually, about two-thirds of them for beef and

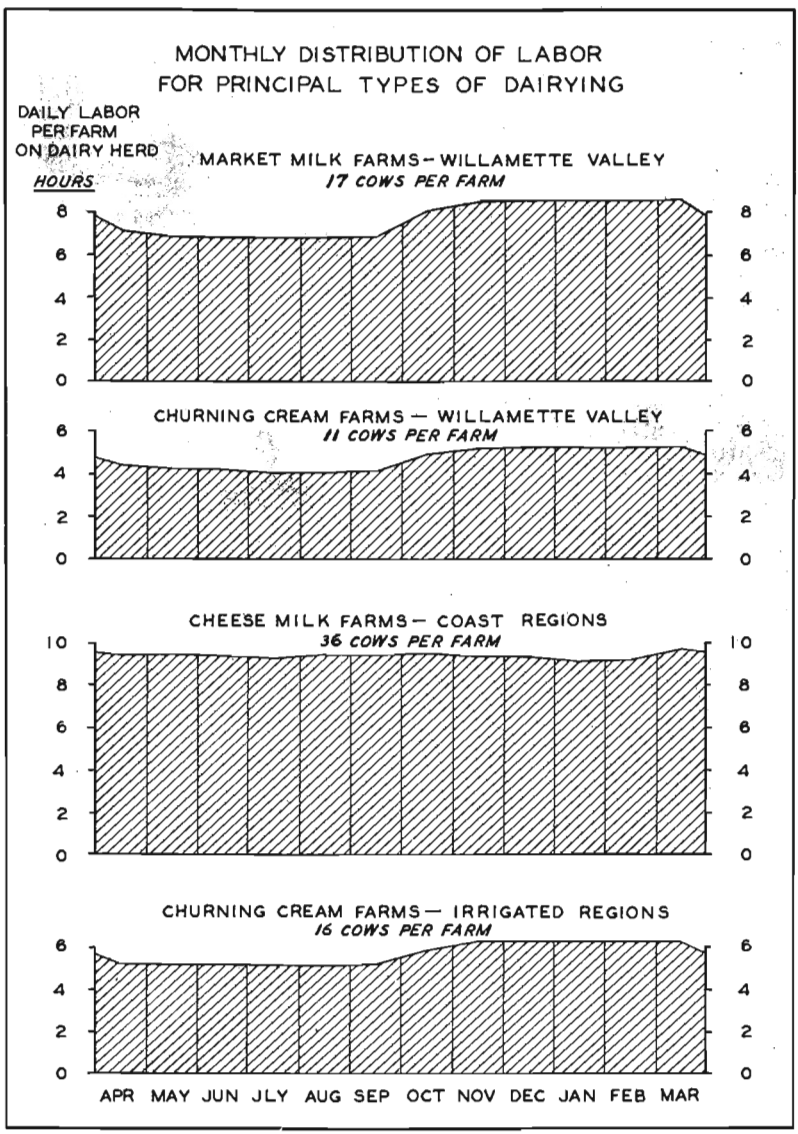

Figure 39. Since most farms in the Coast regions practice "summer dairying" the labor distribution through the year is much more even than in the other regions.

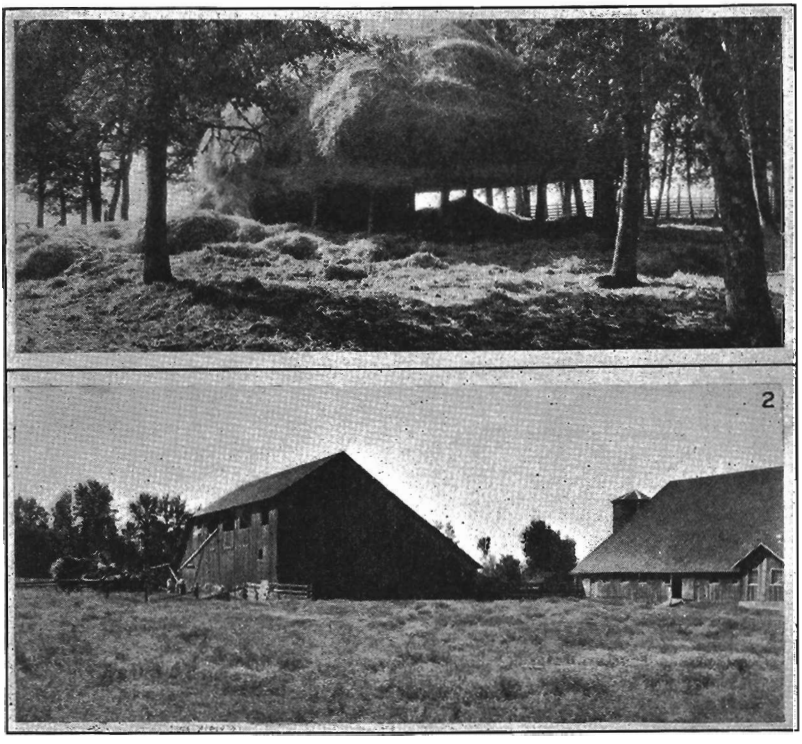

Figure 40. Straw sheds or "loafing sheds" are found on many farms, varying from simple shelters to substantial separate buildings. In the lower picture note the straw being threshed into the shed for bedding and the fenced passageway for the cows between the barn and the shed.

one-third to other farmers as milk cows. Those sold as milk cows averaged about double the price of those sold for beef, the average prices in the

TABLE XXV. INVENTORIES, DEATH LOSS, SALES AND REPLACEMENTS OF COWS, BY REGIONS

Year ending April 1, 1932

Regions	Opening inventory	Died	Sold	Purchased	Heifers freshened	Closing inventory
Total number of cows						
Willamette Valley	3,392	88	732	195	820	3,587
Coast regions	2,720	76	373	63	493	2,827
Irrigated regions	1,996	77	359	42	469	2,071
All regions	8,108	241	1,464	300	1,782	8,485
Cows per farm						
Willamette Valley	13.6	.4	2.9	.8	3.3	14.4
Coast regions	30.6	.8	4.2	.7	5.5	31.8
Irrigated regions	16.0	.6	2.9	.3	3.8	16.6
ALL REGIONS	17.5	.5	3.1	.6	3.8	18.3

TABLE XXVI. CAUSES GIVEN BY THE DAIRYMEN FOR DEATHS OF COWS
Two-year period ending April 1, 1932

Cause of death	Willamette Valley	Coast regions	Irrigated regions	All regions
Bloat	19	6	34	59
Calving	23	10	18	51
Milk-fever, garget, udder infections	17	13	20	50
Accidents	15	18	10	43
Indigestion, impaction, etc.	24	7	11	42
Poisoning	16	10	9	35
Old age	8	13	11	32
Swallowing wire, nails, etc.	19	4	2	25
Miscellaneous causes	22	15	20	57
Cause unknown	16	20	11	47
TOTALS	179	116	146	441

last year of the study being $39 and $19 for milk cows and beef cows, respectively. The average death loss and the proportion of the total number of cows that are sold annually for beef indicate that the average production life of milk cows is between six and seven years.

Bloat, calving, and accidents were the most frequent causes of deaths of cows (Table XXVI). Bloat was especially prevalent in the Irrigated regions. The high production of losses by accidents in the Coast regions is due to an extra hazard from drowning in high water, sloughs, etc.

On the average, 19 per cent of the cow replacements were by purchase, and 81 per cent by heifers raised. The values of both the cows purchased and the heifers raised averaged less than the inventory values of the cows on hand; increase in value, particularly of the heifers as they mature and develop, offsets much of the loss on cows that die or are sold to the butcher, and explains why the average depreciation of cows amounts to only five or six dollars annually, which probably to many persons seems low. Abnormal death loss or culling loss on any individual farm, how-

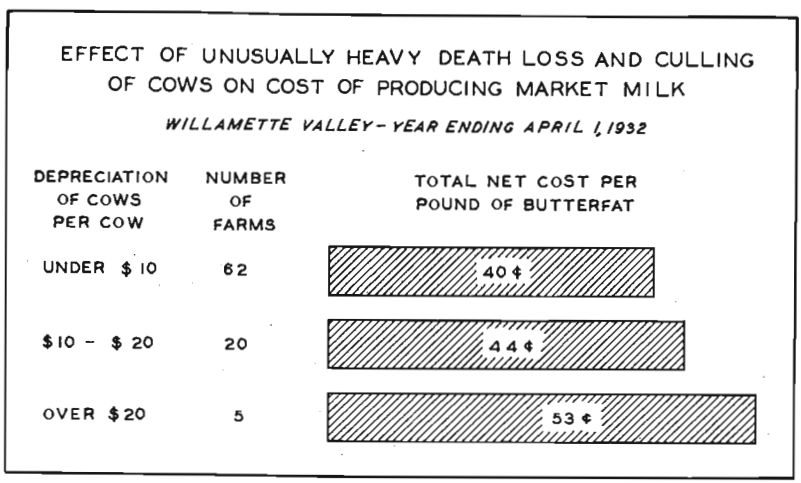

Figure 41. Additional data for this tabulation are given in Table LI.

ever, may greatly increase the cow depreciation figure in any one year, and frequently accounts for abnormally high costs of production (Figure 41). During the period of this study a number of herds suffered severe culling losses due to efforts to eradicate contagious abortion.

Data obtained in this study on costs of raising dairy heifers, which will be presented in a separate bulletin, show that, in general, the cost of raising heifers is higher than their value at time of freshening. This emphasizes the importance of raising only good heifers that will be worth the high cost of production when mature, and is another reason for the use of good dairy sires that will constantly improve the quality of the heifers raised.

THE OREGON DAIRY FARM BUSINESS

In the first year of this study a farm organization record of the entire farm business was obtained on all but 14 of the 551 farms from which cost of production records were obtained, making 537 complete farm business records. The data from these records are summarized in the following pages to show something of the capital requirements, kinds of crops and livestock raised, financial returns and some of the factors affecting financial returns on Oregon dairy farms.

CAPITAL REQUIREMENTS

The average capital investment was nearly twenty-three thousand dollars per farm (Table XXVII) and many farms represented investments of more than twice that amount, as will be seen in a later tabulation. Most of this investment was in land, which in this study has not been

TABLE XXVII. VALUE OF BUILDINGS AND AVERAGE CAPITAL INVESTMENT ON OREGON DAIRY FARMS, BY REGIONS

Year ending April 1, 1930

Items	Willamette Valley	Coast regions	Irrigated regions	All regions
Number of farms	289	100	148	537
Value of buildings per farm—				
Houses	2,173	2,383	1,724	2,088
Barns	1,364	2,138	821	1,358
Milk houses	61	79	82	71
Silos	86	80	41	73
Other buildings	703	416	450	579
TOTAL BUILDINGS	4,387	5,096	3,118	4,169
Capital investment per farm—				
Total real estate	20,066	22,774	13,443	18,745
Dairy cattle	1,861	3,892	2,212	2,336
Other livestock	540	325	710	547
Tractors	205	122	56	148
Automobiles and trucks*	122	92	44	99
Dairy equipment	129	307	203	183
Other machinery and equipment	647	389	516	559
Feed and seed	300	122	229	247
TOTAL CAPITAL INVESTMENT	23,870	28,023	17,413	22,864

*Only the value proportional to the use for farm business.

charged to the dairy enterprise, raising of the crops being considered as separate enterprises. It is seldom practicable, however, entirely to separate dairying from the raising of feed, hence in preceding pages, the importance of having good pasture has been stressed. A considerable capital investment in land may therefore be considered as usually a necessary part of the dairy-farm business.

Detailed statements of the value of buildings and equipment apportioned to the dairy enterprise have been given in Tables XXII and XXIV.

CROP AND LIVESTOCK ENTERPRISES

A good idea of the kinds of crop and livestock enterprises on Oregon dairy farms may be obtained from Table XXVIII. It will be seen that the Willamette Valley and Irrigated regions are quite highly diversified, while the Coast regions specialize on dairying to a high degree. This is still more evident from the distribution of receipts in the next tabulation.

TABLE XXVIII. ACREAGES OF CROPS AND ANIMAL UNITS OF LIVESTOCK PER FARM, BY REGIONS
Year ending April 1, 1930

Items	Willamette Valley	Coast regions	Irrigated regions	All regions
Acres per farm				
Wheat	14	1	9	10
Oats	17	2	3	10
Barley	4	1	3	3
Alfalfa hay	3	.....	30	10
Clover hay	10	5	3	7
Vetch-and-oats hay	10	3	1	6
Corn	5	2	1	4
Potatoes	2	1	1	1
Other crops	17	17	7	15
Total crops	82	32	58	66
*Animal units per farm**				
Horses	3.2	2.4	4.0	3.3
Dairy cattle	17.4	35.9	20.3	21.6
Other cattle	.....	.....	.8	.2
Sheep	1.4	.4	2.8	1.6
Goats	.2	.....	.....	.1
Hogs	1.2	1.3	1.8	1.4
Chickens	1.2	.8	1.0	1.1
Turkeys	.1	.....	.4	.1
Total livestock	24.7	40.8	31.1	29.4

*For definition of *animal units* see page 71.

FINANCIAL RETURNS

Average financial summaries for the farms in each region are given in Table XXIX, showing the principal receipts and expenses, and financial returns computed as labor income, which is the return received by the operator of the farm for a year's work and management of his farm business, after allowing prevailing wages for unpaid labor, depreciation of buildings and equipment, and 5 per cent interest on the entire capital investment. In addition to the labor income he also receives the certain items in his living such as use of the house, food, fuel, etc., which are not covered by the financial record.

TABLE XXIX. AVERAGE FINANCIAL SUMMARY FOR OREGON DAIRY FARMS, BY REGIONS
Year ending April 1, 1930

Items	Willamette Valley	Coast regions	Irrigated regions	All regions
Number of farms	289	100	148	537
Receipts per farm—				
Grain	$371	$44	$241	$276
Hay	67	11	287	116
Other crops	430	147	425	376
Dairy cattle and products	1,805	4,443	1,897	2,321
Hogs	177	128	242	185
Poultry and eggs	306	108	329	275
Other livestock and products	38	----	98	48
Feed and seed inventory increase	242	100	125	183
Other receipts	158	120	86	132
TOTAL RECEIPTS	$3,594	$5,101	$3,730	$3,912
Expenses per farm—				
Hired labor (including board)	339	442	298	348
Building and equipment repairs	79	106	76	83
Feed and pasture purchased	525	815	455	559
Threshing	47	6	34	36
Milk hauling	83	102	17	68
Miscellaneous livestock expense	43	71	39	47
Fuel, oil, electricity	16	21	12	15
Taxes	263	419	199	274
Depreciation of buildings and equipment	330	338	225	303
Value of unpaid family labor	255	286	280	268
Miscellaneous	287	274	389	313
TOTAL EXPENSES	$2,267	$2,880	$2,024	$2,314
FARM INCOME	1,327	2,221	1,706	1,598
Interest on capital investment (5 per cent)	1,193	1,401	871	1,143
LABOR INCOME	$ 134	$ 820	$ 835	$ 455

The average labor income in the Coast and Irrigated regions, with the living from the farm in addition, was the equivalent of fairly good wages. In the Willamette Valley, however, the average return was less than prevailing wages. This is in accord with the cost of production data for that year, which gave for the Willamette Valley, an average cost of 55 cents per pound of butter-fat as compared with an average price of 52 cents; in the Coast regions a cost of 48 cents and a price of 54 cents, and in the Irrigated regions a cost of 43 cents and a price of 46 cents.

A summary of the capital investment and financial returns for the principal types of dairying is given in Table XXX.

VARIATION IN LABOR INCOMES

There was wide variation in labor incomes between individual farms, 8 per cent of the farms having labor incomes averaging $–1709, while at the other extreme 9 per cent of the farms had labor incomes averaging $3,321. Important factors accounting for this variation are discussed in the following section.

FACTORS AFFECTING FINANCIAL RETURNS

Yield of butter-fat per cow. It was shown that high-producing cows are an outstanding factor in securing low costs of producing milk and

TABLE XXX. CAPITAL INVESTMENT AND FINANCIAL SUMMARY FOR PRINCIPAL TYPES OF DAIRYING

Year ending April 1, 1930

Items	Market milk (Willamette Valley)	Churning cream (Willamette Valley)	Cheese milk (Coast regions)	Churning cream (Irrigated regions)
Number of farms	75	97	55	119
Value of buildings per farm	$3,428	$3,818	$5,342	$3,141
Capital investment per farm:				
Real estate	$22,787	$17,057	$27,654	$13,263
Dairy cattle	2,200	1,598	4,611	2,190
Other livestock	424	639	332	651
Dairy equipment	140	112	405	200
Other equipment and machinery	841	986	511	647
Feed and seed	281	336	102	227
TOTAL CAPITAL INVESTMENT	$26,673	$20,728	$33,615	$17,178
Receipts per farm:				
Crops	$918	$622	$95	$933
Dairy cattle and products	2,525	1,175	5,287	1,736
Other livestock and products	276	750	240	728
Other receipts	391	493	185	226
TOTAL RECEIPTS	$4,110	$3,040	$5,807	$3,623
Expenses per farm:				
Hired labor (including board)	$538	$249	$558	$283
Feed and pasture purchased	690	354	893	413
Taxes	321	207	505	200
Depreciation of buildings and machinery	318	310	337	229
Unpaid family labor	229	278	284	261
Other expenses	698	406	576	582
TOTAL EXPENSES	$2,794	$1,804	$3,153	$1,968
FARM INCOME	$1,316	$1,236	$2,654	$1,655
Interest on capital investment (5 per cent)	1,334	1,036	1,681	859
LABOR INCOME	$ −19	$ 200	$ 973	$ 796

TABLE XXXI. RELATION OF BUTTER-FAT YIELD OF COWS TO LABOR INCOME

Year ending April 1, 1930

Butter-fat per cow	Number of farms	Average butter-fat per cow	Cows per farm	Dairy receipts per farm	Labor income per farm
Willamette Valley		*Pounds*			
Under 225 pounds	64	187	13	$1,087	$ −271
225–325 pounds	166	275	12	1,797	138
Over 325 pounds	59	365	13	2,606	560
Coast regions					
Under 225 pounds	21	196	29	3,161	−16
225–325 pounds	59	274	30	4,724	981
Over 325 pounds	20	356	23	4,961	1,223
Irrigated regions					
Under 225	37	190	16	1,525	394
225–325 pounds	85	274	15	1,978	947
Over 325 pounds	26	364	11	2,161	1,094

butter-fat, and Table XXXI shows that yield per cow also bears a very strong relationship to profit per farm. In all regions labor incomes were consistently higher on the farms with higher yield per cow, further emphasizing the extreme importance of good cows.

Size of business. There are a number of measures of size of business, such as the total farm acreage, acreage of crops, capital investment, total receipts, and for dairy farms, number of cows per farm. In Table XXXII the farms have been grouped according to capital investment per farm as a measure of size. It will be seen that the acres of crops and number of cows in each group show corresponding distributions as to size of business.

TABLE XXXII. RELATION OF SIZE OF FARM BUSINESS TO LABOR INCOME
Year ending April 1, 1930

Total investment per farm	Number of farms	Average investment per farm	Crop per farm	Number of cows per farm	Labor income per farm
Willamette Valley			*Acres*		
Under $20,000	154	$14,144	50	10	$144
$20,000–$40,000	103	28,237	96	13	74
Over $40,000	32	56,610	189	24	274
Coast regions					
Under $20,000	48	$14,627	20	15	$280
$20,000–$40,000	36	28,856	36	30	1,061
Over $40,000	16	66,336	61	63	1,899
Irrigated regions					
Under $20,000	105	$12,018	45	12	$763
$20,000–$40,000	35	26,326	76	17	959
Over $40,000	8	49,225	157	37	1,226

In the Coast and Irrigated regions the larger businesses gave the larger returns, but for the Willamette Valley this relationship is not clearly indicated. In the discussion of size of dairy herd as related to costs of production it was pointed out that under unfavorable conditions larger volume of business loses its advantage, and may even become a disadvantage. The smaller average labor income in the Willamette Valley seems to be the explanation of the lack of profitableness of the larger farms in that region in the year studied.

Labor efficiency. To obtain at least a rough measure of the efficiency in use of labor on the farms studied, the acres of crops and animal units on each farm were converted to work-units, figuring an acre of crop as two work units and an animal unit as 10 work units. In Table XXXIII the farms have been grouped according to the number of work units per man, showing considerable higher labor incomes on the farms with more work units per man, as would be expected. The figures on acres of crops and animal units per farm indicate that the more efficient farms were considerably larger, size of business being one of the most important factors in securing efficiency in the use of labor.

TABLE XXXIII. RELATION OF LABOR EFFICIENCY TO LABOR INCOME
Year ending April 1, 1930

Work units* per man	Number of farms	Average work units per man	Men per farm	Acres of crops per farm	Animal units per farm	Labor income per farm
Willamette Valley						
Under 200	122	146	2.0	50	19	$–121
200–300	105	248	1.8	83	28	191
Over 300	62	379	1.6	144	31	537
Coast regions						
Under 200	37	144	2.0	23	24	$358
200–300	46	245	2.0	35	42	751
Over 300	17	405	2.1	45	75	2,013
Irrigated regions						
Under 200	48	153	1.9	40	21	$554
200–300	65	244	1.7	56	29	981
Over 300	35	354	1.9	89	48	949

*One work unit is computed as .5 acres of crop or .1 animal unit.

Appendix A

DETAILS OF METHODS USED AND EXPLANATION OF COST ITEMS

Considerable difference of opinion is possible on many practices in computing and analyzing farm costs. In this study effort has been made to conform in general with commonly accepted procedure, such as there is in studies of this kind; but the primary aim has been to accomplish the objective of the study and any procedure that has promised to facilitate this has been adopted. It is thought that such defensible differences in procedure as might be suggested would have no appreciable effect on the validity of the conclusions that have been drawn.

Sampling. Effort was made to obtain numbers of records from each county approximately proportional to the number of dairy cows and amounts of milk produced in the county.

In most of the counties the procedure in selecting the farms was first to obtain as complete a list as possible of the dairymen with six or more cows, including all types of dairy farms except those engaged primarily in the breeding and raising of dairy cattle for sale or the distribution of fluid milk. These lists were made up from lists of patrons obtained from creameries, dairies, condenseries, county agents' files, or other sources. In a few of the counties, lists of representative dairymen made up by the county agents were used. A random selection of the desired number of names from these lists was checked over with county agents or others familiar with local conditions to judge its representativeness as to conditions for dairying in the county, types of dairying, and types of dairymen. Additions or eliminations from the lists were made if it were judged that a more representative cross-section was thus obtained.

In the fourth year the extent of the study was reduced to 12 of the original 22 counties. It was decided that the records obtained gave representative samples of the four principal types of dairying; namely, market-milk and churning-cream production in the Willamette Valley, cheese milk in the Coast regions, and churning cream in the Irrigated regions, but not of the principal dairy regions nor of the state as a whole. The fourth-year figures, therefore, have been presented only by types of dairying, with the exception of the average prices by regions in Table XII and XV.

It is thought that the four years covered by the study are representative of normal seasonal conditions. The principal abnormal condition was winter injury of succulent feeds and pastures in the Willamette Valley in the winter of 1932-33, the last year of the study, with a backward spring and shortage of hay following. Very little effect of this condition, however, is evident in the data for the last year, which closes April 1, 1933.

Enumeration. The data were obtained in personal interviews with the dairymen by members of the Farm Management and Dairy Husbandry departments assisted by graduate students in Farm Management. The farms were visited twice the first year—once in the summer or fall of 1929 to enter the beginning-of-the-year inventories and acreages of crop for the year and to encourage the keeping of feed and milk production records—

and again in the spring of 1930 to complete the record. In the subsequent years the farms were visited only at the close of the year, since the beginning-of-the-year inventories were available from the previous year's record.

Most of the cooperators kept at least a record of their sales of milk or cream, and many voluntarily kept records of their feed and other expense items in order to give more accurate information in the survey. Farm account books were furnished to those interested in keeping them. An individual summary of the costs for his own farm was returned to each dairyman for each year, and a comparison with the high, low, and average costs in his region. Any questions as to the figures in these individual reports were checked over at the next visit to the farm.

Continuity. The same farms were included each year as much as possible, but a few were dropped and others added each year in order to obtain a more representative cross-section, or because absence or illness of the operators or other conditions compelled the dropping of certain farms. Of the total of 574 farms, 193 were included for the entire 4 years, 256 for 3 years, 66 for 2 years, and 59 for only 1 year. The reduced number of records for 4 years as compared with 3 years was, of course, because of the reduction in the extent of the survey for the fourth year.

Scope of the record. In the first year of the study the two visits to each farm made possible the taking of a complete farm organization record in addition to the dairy enterprise cost record. In the subsequent years the record was limited to the dairy enterprise, with notation of the acreages devoted to the various crop enterprises and the numbers of other kinds of livestock on each farm.

The dairy enterprise record covered all details of the cow-cost of milk production and also detailed costs of raising heifers and of keeping herd sires, making it a combination of three separate cost records. In a few cases where part or all of the product was retailed, costs incident to the retailing were separated out and not included in the data used in this study. The nature of the detailed information is obvious from the tabulations presented and from the discussion of the various items that follow.

Checking of data. When taking the records from the dairymen numerous checks on the accuracy of the data were made. For example, the number of cows at the beginning of the year plus purchases and heifers freshening, minus cows that died or were sold, should equal the number on hand at the end of the year. One of the most important checks was the comparison of the net feed available for the cows with the estimated ration fed. After the first year certain items from the previous year's record gave helpful checks, particularly the comparison between the computed amount of digestible nutrients in the feed and the feeding-standard requirement of the cows.

In addition to this checking of the record as it was taken from the farmer, a second person in the survey party checked it over as soon as possible afterwards. Any discrepancies were then called to the attention of the enumerator and, if necessary, the farmer was phoned or revisited to obtain the correct data. A few records were discarded because the data appeared unreliable or because of unquestionably abnormal conditions.

Still further checking was obtained by editing of the data during the office computation and tabulation. This necessitated obtaining supplementary or corrected data by correspondence in some cases and the discarding of a few additional records. All transfers, computations, and tabulations of the data in the office procedure were checked by cross-totaling, back-solutions, or duplicate computation.

Methods of analysis. As is obvious from this bulletin the data have been analyzed by the method of grouping and cross-tabulating. In studying a given causal factor, effort has been made to tabulate with it any other factors that might be correlated with it, and to consider any correlation thus indicated when drawing conclusions. Most of the tabulations have been limited to single regions and types of dairying to eliminate the effects of these factors at the outset.

The general principle has been followed of tabulating and averaging totals for individual farms, rather than averages. In averaging data for more than one year the unweighted annual averages have been averaged together to avoid undue weighting from differences in numbers of records in the different years. Except for records discarded entirely, as previously mentioned, all records included by any tabulation have been used in that tabulation unless definitely indicated otherwise.

Most of the tabulations shown are for the year ending April 1, 1932, the last year with the full extent of the survey. In all cases, however, similar relationships were found in the other years of the study.

Renters computed as owners. For dairymen on rented farms, in order to make the records comparable, interest, depreciation, and repairs were charged on the buildings and equipment in place of rent. In a few cases of stock-share rental of the dairy cattle a similar procedure was followed, computing interest and depreciation on the cows as though they were owned by the dairyman.

Average number of cows in herd. The number of cows is based on the total number of months that each cow was in the herd during the year, including the dry period. The average number of cows was obtained by dividing by 12 the total number of months for all cows in the herd at any time during the year. Heifers freshening for the first time were counted as cows from the time that they freshened.

Production per cow. Although estimates of sales were used in a few cases, for most of the farms the amount of milk or butter-fat sold was obtained either from records kept by the dairyman or from the dairy or creamery buying the product. If the product was sold as cream, the equivalent amount of whole milk produced was computed. To the amount sold was added the estimated amounts of milk fed to calves and used in the house, and the equivalent in milk of the cream used, including that churned into butter for home use. The total production of the dairy as thus obtained was divided by the average number of cows (explained above) to obtain the average production per cow.

Amounts of feed. The amounts of feed consumed by the cows were determined by checking against each other the ration fed to the cows and the net amount of feed consumed by the cows, as indicated for each kind

of feed by the total amount produced on the farm, the amounts purchased, sold, and on hand at the beginning and end of the year, and the amounts consumed by other livestock on the farm. Any available information such as feed sale-slips or bills, or herd improvement association records, were also made use of in this connection.

Hay. Hay raised was charged at value stored in the barn at haying time. Hay purchased was charged at actual cost including hauling. Included with the hay is a small amount of other dry roughage such as corn fodder and straw fed as a substitute for hay. Straw that was consumed by cows running to straw stacks was ignored as negligible in both amount and value.

Succulents. Except in the very few cases of sales of succulent feeds, in which the actual sale value was used, all silage, kale and other green feed, and roots, were charged at $5.00 per ton the first year, $4.00 the second, $3.50 the third, and $3.00 the fourth year. In arriving at these values the prevailing price and comparative feeding value of hay and costs of production of succulent feeds* were considered.

Grain. This includes mill feeds, dairy rations, oil meals, and other concentrates as well as farm grains. Grain and other concentrates purchased were charged at actual cost including hauling. Grain raised was charged at sale value on the farm. If the grain was chopped or ground, the prevailing commercial rate for chopping or grinding was included in the value of the feed.

Pasture. The number of days of pasture is the dairyman's judgment as to the equivalent number of days of full pasture feed. For example, if it was considered that the cows received full pasture for 2 months, and half feed for 4 additional months, the amount of pasture was recorded as 4 months, or 120 days. The pasture was valued at prevailing rates per head per month in the locality for pasture of equivalent quality.

Total digestible nutrients (T.D.N.). The average annual T.D.N. requirement per cow was computed for each herd according to the Haecker feeding standard. The amount of T.D.N. in the feed consumed was computed by the following ratios: roughage, 75 per cent; succulents, 15 per cent; concentrates, 75 per cent; pasture, 5 pounds of T.D.N. per day. The 5† pounds of T.D.N. per day of pasture is the average figure obtained by subtracting the T.D.N. in the barn feed from the T.D.N. requirement.

Labor. The labor item includes all labor used in milking, feeding, and caring for the milking herd, and in cooling and separating the milk, but not labor for raising feed crops, for care of young stock, or for hauling the milk or cream. It includes the work of the operator of the dairy, members of the family, and hired labor, all valued at prevailing wages for similar work and including the value of board if furnished. The labor costs of

*See Bulletin 251, Oregon Agricultural Experiment Station, *Cost of Producing Silage and Kale in the Willamette Valley.*

†The authors recognize that this figure should be higher, perhaps by 100 per cent or more, because the T. D. N. requirement for cows under farm conditions probably exceeds experimental standard requirements, and the proportion of utilized nutrients in the total feed utilized probably is less than the experimentally determined percentages because of waste, poor quality, and other reasons. In the absence of a more satisfactory figure, however, the five pounds of T. D. N. per day, determined by difference, has been used.

marketing the product, of raising heifers, and of keeping herd sires, were computed separately.

Buildings and equipment. The charges for use of buildings and equipment cover the proportion that was estimated to be chargeable to the milking herd of the interest, depreciation, and repairs on buildings and equipment used for the dairy. Interest is computed at 5 per cent; depreciation is based on the value and estimated life of the building or piece of equipment. Purchases of milk cans, buckets, and similar equipment are included as repairs of equipment.

Sire cost. The cost of maintaining the herd sire was computed separately and pro-rated to the cows and heifers bred during the year.* Breeding fees paid are also included in this item.

Interest on value of cows. Interest is computed at 5 per cent on the average value of the cows. The cows were valued at the prevailing buying price for cows of similar quality.

Depreciation of cows. This figure represents death loss, and loss on cows sold, but does not include the drop in market value of cattle that occurred during the year. Depreciation was computed as follows: The sum of the value of cows sold and the value of the cows at the end of the year was subtracted from the sum of the values of the cows at the beginning of the year, the value of cows purchased and the value of heifers added to the milking herd. From this "net decrease" was then deducted any part of it that was accounted for by a decrease from the beginning to the end of the year in the value of the average herd.

If, instead of a "net decrease" as computed above, increase in value was shown as a result of heifers developing or cows showing increased production, the increase was credited in the individual cost record and in determining average figures for depreciation of cows.

Miscellaneous. A number of smaller items are included under this heading of which the more important are veterinary; medicines and tonics; fly spray; tuberculosis and contagious abortion testing; dairy herd improvement association expense; bedding; salt; minerals; electricity; fuel and oil; the proportion chargeable to the milking herd of the insurance on buildings, stock, and stored feed; taxes on the cows; and the amount of auto expense chargeable to the dairy, not including, however, use of the automobile for marketing the milk or cream, which was computed separately.

Credit for calves. Calves born during the year were credited at the farmer's estimate of their value at birth.

Credit for manure. The manure saved was credited at the dairyman's estimate of its value at the barn. Manure dropped in pastures was not credited because the charge for pasture was a net amount in addition to the manure left in the pasture. The market value of manure varies in different localities. In some places there is no market for it and some dairymen do not consider it worth anything above the labor of hauling and applying,

*See Bulletin 312, Oregon Agricultural Experiment Station, *Cost of Keeping Dairy Herd Sires and Suggestions on Their Selection and Management.*

which is, of course, a considerable item; others, however, could sell it if they wished, for as much as two or three dollars per ton at the barn.

Credit for skim milk. On farms where milk was separated the skim milk was credited at a uniform value of 30¢ per hundred pounds the first two years, and 25¢ the last two, with the exception that for a few farms where skim milk was bought or sold the actual sale price was used. These values were based chiefly on the comparative price and feeding value of grain. The amount of skim milk was computed by subtracting from all of the milk separated three times the amount of butter-fat that it contained.

Average selling price and hauling charges. The figures shown for average selling price, or for total value of the product, are based on the net prices received on the farm for all of the product sold—hauling or shipping costs incurred being deducted from the gross prices paid. For farmers who hauled their own milk or cream, the costs for labor and operation of automobile or truck were computed.

Profit or loss. In a few of the tabulations, figures for profit or loss have been shown. This is the difference between the total net cost of production of all the milk or cream produced and its value at the average price received for the product sold.

Farm organization data. As is evident from the tabulations, the farm organization data have been summarized in the more or less standard form for labor-income computation. Animal units were computed as 1 mature horse or cow, 2 colts or young cattle, 7 sheep or goats, 14 lambs, 5 sows, 10 fattened hogs, 100 chickens, or 75 turkeys kept on the farm for 12 months. In the tabulation showing the effect of labor efficiency a rough form of work unit—.5 acres of crop or .1 animal unit—has been used.

Appendix B

DETAILED AND SUPPLEMENTARY TABLES

TABLE XXXIV. DETAILED COSTS PER FARM, PER COW, AND PER POUND OF BUTTER-FAT WITH PERCENTAGE DISTRIBUTION

All regions. Year ending April 1, 1932

Average of 464 herds, 8,224 cows, producing 2,221,984 pounds of butter-fat

Average herd 18 cows, producing 270 pounds of butter-fat per cow

Items	Cost per farm annually	Cost per cow annually	Cost per pound of butter-fat	Percentage of total gross cost
				%
Purchased feed				
Hay	$ 44	$ 2.46	0.9¢	2.3
Succulents	2	.09	.....	.1
Grain	149	8.43	3.1	7.7
Pasture	8	.42	.2	.4
Farm-grown feed				
Hay	372	21.02	7.8	19.3
Succulents	150	8.49	3.1	7.8
Grain	95	5.37	2.0	4.9
Pasture	154	8.68	3.2	8.0
TOTAL FEED	974	54.96	20.3	50.5
Operator's labor	296	16.68	6.2	15.4
Family labor	123	6.95	2.5	6.4
Hired labor	89	5.03	1.9	4.6
TOTAL LABOR	508	28.66	10.6	26.4
Sire maintenance	38	2.12	.8	1.9
Bedding	9	.51	.2	.5
Salt and minerals	8	.44	.2	.4
Veterinary and medicine	6	.32	.1	.3
Tuberculosis and abortion testing	4	.21	.1	.2
Milk testing	5	.29	.1	.3
Gas and oil	8	.48	.2	.4
Electricity	15	.84	.3	.8
Fire insurance	7	.40	.1	.4
Taxes	18	1.04	.4	.9
Use of auto	1	.08	.....	.1
Building repairs	5	.28	.1	.2
Equipment repairs	8	.45	.2	.4
Other miscellaneous	15	.85	.3	.8
TOTAL MISCELLANEOUS	147	8.31	3.1	7.6
Depreciation of buildings	49	2.77	1.0	2.5
Depreciation of equipment	24	1.34	.5	1.2
Depreciation of herd sires	1	.08	.....	.1
Depreciation of cows	92	5.17	1.9	4.8
TOTAL DEPRECIATION	166	9.36	3.4	8.6
Interest on buildings	52	2.94	1.1	2.7
Interest on equipment	9	.53	.2	.5
Interest on herd sires	4	.20	.1	.2
Interest on cows	68	3.81	1.4	3.5
TOTAL INTEREST	133	7.48	2.8	6.9
TOTAL GROSS COST	1,928	108.77	40.2	100.0
Credit for calves	41	2.29	.8	2.1
Credit for manure	83	4.71	1.7	4.3
Credit for skim milk	72	4.08	1.5	3.8
TOTAL NET COST—1932	1,732	$ 97.69	36.2¢	89.8
TOTAL NET COST—1931	1,897	$110.77	39.7¢	.....
TOTAL NET COST—1930	2,136	$134.75	49.9¢	.....

TABLE XXXV. COST OF PRODUCING MILK AND BUTTER-FAT IN OREGON AND AVERAGE PRICE RECEIVED BY TYPE OF PRODUCTION AND YEARS

Type of production, year ending April 1	Number of farms	Cows per farm	Butter-fat per cow	Total net cost		Price received per pound butter-fat
				Per cow	Per pound butter-fat	
Market milk (Willamette Valley)			*Pounds*			
1930	76	15	279	$163	58¢	56¢
1931	79	17	302	136	45	54
1932	87	17	304	128	42	40
1933	54	15	270	104	39	27
Condensery milk (Willamette Valley)						
1930	44	13	282	144	51	49
1931	29	11	296	117	40	36
1932	24	12	285	102	36	26
Churning cream (Willamette Valley)						
1930	102	10	255	133	52	44
1931	74	9	256	103	40	31
1932	81	11	257	89	34	24
1933	35	12	237	80	33	18
Cheese milk (Coast regions)						
1930	55	33	275	126	46	55
1931	54	35	280	105	38	39
1932	51	36	270	89	33	29
1933	41	33	258	77	30	23
Churning cream (Irrigated regions)						
1930	120	14	258	108	42	44
1931	107	15	255	88	35	32
1932	102	16	243	77	32	24
1933	52	18	224	55	24	17

TABLE XXXVI. VARIATION IN COST OF PRODUCING MILK AND BUTTER-FAT, BY REGIONS

Year ending April 1, 1932

Cost per pound of butter-fat	Willamette Valley	Coast regions	Irrigated regions	All regions
	Farms	*Farms*	*Farms*	*Farms*
Under 25¢	14	1	19	34
25¢–35¢	77	37	53	167
35¢–45¢	90	41	43	174
45¢–55¢	51	7	9	67
Over 55¢	18	3	1	22
Total	250	89	125	464

TABLE XXXVII. RELATION OF YIELD OF BUTTER-FAT PER COW TO COSTS OF PRODUCING CHEESE MILK AND CHURNING CREAM

Year ending April 1, 1932

Items	Cheese milk (Coast regions) Pounds butter-fat per cow annually				Churning Cream (Irrigated regions) Pounds butter-fat per cow annually			
	Under 225	225–275	275–325	Over 325	Under 225	225–275	275–325	Over 325
Number of farms	8	20	13	10	32	35	25	10
Cows per farm	28	46	34	22	18	15	13	15
Pounds of milk per cow	4,814	5,640	6,404	7,856	3,917	5,349	6,570	7,372
Butter-fat test (per cent)	4.1	4.5	4.7	4.4	4.5	4.7	4.6	4.7
Pounds butter-fat per cow	198	254	303	342	175	252	300	344
Cost per cow								
Feed	$47	$46	$55	$57	$38	$47	$52	$54
Labor	24	22	25	28	22	27	31	33
Total net cost	84	82	97	105	66	78	86	93
Cost per pound butter-fat								
Feed	24¢	18¢	18¢	17¢	21¢	19¢	17¢	16¢
Labor	12	9	8	8	13	11	10	9
Total net cost	42	32	32	31	37	31	29	27

TABLE XXXVIII. COMPUTATION OF VALUE OF COWS BASED ON THEIR YIELD OF BUTTER-FAT

All regions

Items*	Year ending April 1, 1930 Pounds butter-fat per cow annually				Year ending April 1, 1931 Pounds butter-fat per cow annually			
	Under 225	225–275	275–325	Over 325	Under 225	225–275	275–325	Over 325
1 Number of farms	123	168	154	106	91	149	135	139
2 Average butter-fat per cow, pounds	192	252	299	360	196	254	296	353
3 Market value of butter-fat, cents	.49	.50	.51	.54	.38	.41	.41	.44
Value of cows								
4 In each group, dollars	99	110	113	118	89	91	96	106
Deviation:								
5 In dollars	−11	0	3	8	−7	−5	0	10
6 In pounds butter-fat, pounds	−22	0	6	15	−18	−12	0	23
Profit per cow								
7 In each group, dollars	−16	−2	9	30	−11	−1	7	21
Deviation:								
8 In dollars	−19	−5	6	27	−16	−6	2	16
9 Capitalized (25 per cent), dollars	−76	−20	24	108	−64	−24	8	64
10 In pounds butter-fat, pounds	−154	−40	47	202	−168	−59	20	147
11 *Computed value above or below average in pounds of butter-fat (6 + 10), pounds*	−176	−40	53	217	−186	−71	20	170

*For more complete statement of these items see Table XVI.

TABLE XXXIX. AVERAGE AMOUNTS PER COW ANNUALLY OF THE VARIOUS KINDS OF HAY, SUCCULENTS, AND GRAIN, BY REGIONS

Average of three years ending April 1, 1932

Kind of feed	Willamette Valley	Coast regions	Irrigated regions	All regions
	Pounds	*Pounds*	*Pounds*	*Pounds*
Alfalfa hay	812	136	6,102	1,886
Clover hay	1,296	483	134	740
Vetch-and-oats hay	1,845	447	64	943
Other hay: grain, mixed, etc.	994	2,465	715	1,415
TOTAL HAY	4,947	3,531	7,015	4,984
Corn silage	3,106	804	850	1,787
Other silage	539	421	24	374
Kale	1,318	156	26	613
Green corn	547	585	108	452
Other green feed	584	850	61	546
Roots and potatoes	625	2,235	171	1,046
TOTAL SUCCULENTS	6,719	5,051	1,240	4,818
Oats	644	77	125	328
Barley	144	43	223	129
Wheat	76	8	19	40
Other and mixed farm grain	240	111	50	150
Dairy feeds	517	392	139	383
Mill feed: mill run, bran, etc.	351	137	58	208
Oil meals	67	30	3	39
Miscellaneous	21	13	13	16
TOTAL GRAIN	2,060	811	630	1,293

TABLE XL. RELATION OF AMOUNT OF PASTURE TO COST OF PRODUCING MARKET MILK AND CHURNING CREAM

Year ending April 1, 1932

Items	Market milk (Willamette Valley) Percentage of T.D.N. from pasture		Churning cream (Irrigated regions) Percentage of T.D.N. from pasture	
	Under 10	Over 10	Under 15	Over 15
Number of farms	50	37	37	65
Cows per farm	17	17	14	17
Pounds of butter-fat per cow annually	324	279	265	233
Amount per cow annually				
Hay, pounds	5,116	4,739	8,556	5,740
Succulents, pounds	8,529	6,889	2,024	957
Grain, pounds	2,812	1,810	641	428
Pasture, days	47	158	109	185
Cost per cow annually				
Feed	$76	$63	$53	$42
Labor	38	30	29	25
Total net cost	139	114	86	72
Total net cost per pound of butter-fat	43¢	41¢	32¢	31¢

TABLE XLI. RELATION OF YIELD OF BUTTER-FAT PER COW TO AMOUNT OF DIGESTIBLE NUTRIENTS REQUIRED

Willamette Valley. Year ending April 1, 1932

Items	Pounds of butter-fat per cow annually					
	Under 175	175–225	225–275	275–325	325–375	Over 375
Number of farms	9	42	58	66	58	17
Average butter-fat per cow, pounds	155	203	251	300	346	403
Milk per cow annually, pounds	3,656	4,756	5,814	6,718	7,722	8,431
Butter-fat test, per cent	4.2	4.3	4.3	4.5	4.5	4.8
Average weight of cows, pounds	847	932	976	973	941	952
Digestible nutrients required*—						
Maintenance of cow, pounds	2,450	2,696	2,824	2,815	2,722	2,754
Milk produced, pounds	1,294	1,712	2,093	2,492	2,865	3,263
Total, pounds	3,744	4,408	4,917	5,307	5,587	6,017
Total digestible nutrients required per pound of butter-fat, pounds	24	22	20	18	16	15

*Haecker feeding standard.

TABLE XLII. RELATION OF YIELD OF BUTTER-FAT PER COW TO AMOUNT OF GRAIN FED AND COST OF PRODUCING CHURNING CREAM, MARKET MILK, AND CHEESE MILK

Year ending April 1, 1932

Type of production: butter-fat per cow annually	Number of farms	Average butter-fat per cow	Grain per cow annually	Total net cost	
				Per cow annually	Per pound butter-fat
Churning Cream (Willamette Valley)		*Pounds*	*Pounds*		
Under 225 pounds	29	190	1,056	$73	39¢
225-325 pounds	34	270	1,889	94	35
Over 325 pounds	18	373	2,109	112	30
Market Milk (Willamette Valley)					
Under 225 pounds	6	213	1,024	110	52
225-325 pounds	49	278	1,891	121	43
Over 325 pounds	32	352	3,211	141	40
Cheese Milk (Coast regions)					
Under 225 pounds	8	198	239	84	42
225-325 pounds	33	270	388	87	32
Over 325 pounds	10	342	779	105	31
Churning Cream (Irrigated regions)					
Under 225 pounds	32	175	233	66	37
225-325 pounds	60	271	581	81	30
Over 325 pounds	10	344	1,007	93	27

TABLE XLIII. RELATION OF LIGHT AND HEAVY GRAIN FEEDING OF LOW- AND HIGH-YIELDING COW TO COST OF PRODUCTION

Churning cream. Willamette Valley

Year ending April 1, 1932

Butter-fat per cow annually	Number of farms	Average butter-fat per cow	Average grain per cow	Total net cost	
				Per cow annually	Per pound butter-fat
Under 275 pounds		*Pounds*	*Pounds*		
Under 1,000 pounds grain per cow annually	12	181	454	$61	33c
Over 1,000 pounds grain per cow annually	38	223	1,769	91	41
Over 275 pounds					
Under 1,000 pounds grain per cow annually	4	332	163	107	32
Over 1,000 pounds grain per cow annually	27	344	2,103	101	29

TABLE XLIV. GRAIN FEEDING PRACTICE, BY REGIONS

Year ending April 1, 1932

Pounds of butter-fat per cow annually	Number of farms	Average butter-fat per cow	Grain per cow annually
Willamette Valley		*Pounds*	*Pounds*
Under 225	51	196	1,041
225–275	58	251	1,905
275–325	66	300	2,072
Over 325	75	356	2,750
Coast regions			
Under 225	16	193	582
225–275	26	252	418
275–325	32	298	806
Over 325	15	347	1,007
Irrigated regions			
Under 225	35	178	225
225–275	39	248	528
275–325	37	300	789
Over 325	14	343	1,060

TABLE XLV. RELATION OF PRICE OF HAY TO COST OF PRODUCTION

Year ending April 1, 1932

Average price of hay	Number of farms	Average price of hay	Hay per cow annually	Butter-fat per cow annually	Total net cost	
					Per cow annually	Per pound butter-fat
Market milk (Willamette Valley)			*Pounds*	*Pounds*		
Under $10	51	$ 8.64	4,849	308	$121	39¢
$10-$12	27	10.31	4,899	294	133	45
Over $12	9	12.24	5,982	322	162	50
Cheese milk (Coast regions)						
Under $12	21	$10.16	3,226	266	$84	32¢
$12-$14	19	12.55	3,622	272	90	33
Over $14	11	14.89	3,213	278	101	36
Churning cream (Irrigated regions)						
Under $8	28	$7.21	6,689	233	$72	31¢
$8-$10	40	8.54	6,731	243	76	32
Over $10	34	10.73	6,449	253	81	32

TABLE XLVI. RELATION OF SIZE OF HERD TO COST OF PRODUCTION AND PROFIT

Cheese milk farms, Coast regions

Number of cows per farm, year ending April 1	Number of farms	Average number of cows per farm	Total net cost per pound of butter-fat	Profit or loss per herd
1930				
Under 10	5	8	65¢	$–217
10–30	29	21	50	229
30–50	13	39	43	1,300
Over 50	8	84	44	2,311
1931				
Under 10	4	7	44¢	$–155
10–30	32	21	41	–182
30–50	8	37	38	39
Over 50	10	92	35	1,128
1932				
Under 10	4	8	39¢	$–253
10–30	27	21	35	–455
30–50	11	37	33	–303
Over 50	9	89	31	–562

TABLE XLVII. RELATION OF SIZE OF HERD TO COSTS OF PRODUCING MARKET MILK AND CHURNING CREAM

Year ending April 1, 1932

Items	Market milk (Willamette Valley) Number of cows per farm			Churning cream (Irrigated regions) Number of cows per farm		
	Under 10	10–20	20 and over	Under 10	10–20	20 and over
Number of farms	24	47	16	24	60	18
Cows per farm	8	14	38	8	14	30
Pounds butter-fat per cow annually	317	294	312	278	249	222
Days pasture per cow annually	84	104	89	158	154	173
Cost per cow annually						
Feed	$76	$65	$75	$53	$46	$41
Labor	46	38	27	32	29	20
Use of buildings	11	9	7	5	5	3
Sire	4	3	2	3	3	1
Other costs	19	20	25	18	14	15
TOTAL GROSS COST	$156	$135	$136	$111	$97	$80
Credits	12	10	8	23	17	13
NET COST PER COW	$144	$125	$128	$88	$80	$67
COST PER POUND BUTTER-FAT	45¢	42¢	41¢	32¢	32¢	30¢

TABLE XLVIII. RELATION OF LABOR EFFICIENCY TO COSTS OF PRODUCTION

Year ending April 1, 1932

Hours of labor per cow annually	Number of farms	Average hours per cow	Value of labor per cow	Average wage per hour	Number of cows per farm	Pounds butter-fat per cow	Total net cost	
							Per cow	Per pound butter-fat
Market milk (Willamette Valley)								
Under 100	10	69	$18	26¢	33	309	$108	35¢
100–150	27	124	31	25	21	297	125	42
150-200	21	171	40	23	12	313	140	45
200–250	20	225	49	22	11	307	144	47
Over 250	9	289	62	21	10	302	154	51
Cheese milk (Coast regions)								
Under 100	22	71	21	29	49	267	82	31
100–150	22	117	26	23	28	269	95	35
150–200	7	172	38	22	16	298	112	38
Churning cream (Irrigated regions)								
Under 100	22	85	19	22	24	216	67	31
100–150	49	127	27	21	14	250	79	32
150–200	26	174	35	20	12	265	84	32
Over 200	5	233	47	20	10	291	103	36

TABLE XLIX. RELATION OF BUTTER-FAT TEST OF MILK TO COST OF PRODUCING MARKET MILK, CHEESE MILK AND CHURNING CREAM

Year ending April 1, 1932

Butter-fat test	Number of farms	Average butter-fat test	Milk per cow annually	Butter-fat per cow annually	Total net cost		
					Per cow	Per 100 pounds milk	Per pound butter-fat
		%	*Pounds*	*Pounds*			
Market milk (Willamette Valley)							
Under 4 per cent	26	3.7	7,705	289	$128	$1.66	44¢
4–5 per cent	50	4.5	6,849	306	128	1.87	42
Over 5 per cent	11	5.2	6,594	340	132	2.00	39
Cheese milk (Coast regions)							
Under 4 per cent	5	3.6	6,747	240	83	$1.23	35c
4–5 per cent	42	4.6	5,924	271	89	1.50	33
Over 5 per cent	4	5.1	5,883	298	90	1.53	30
Churning cream (Irrigated regions)							
Under 4 per cent	16	3.7	6,848	252	84	$1.23	34¢
4–5 per cent	46	4.5	5,078	230	73	1.44	32
Over 5 per cent	40	5.2	4,981	257	79	1.58	31

TABLE L. RELATION OF SEASON OF FRESHENING TO COSTS OF PRODUCTION, FOR PRINCIPAL TYPES OF DAIRYING

Year ending April 1, 1932

Season of freshening*	Number of farms	Percentage of cows freshening in season indicated	Pounds of butter-fat per cow	Total net cost per pound of butter-fat
Market milk (Willamette Valley)		%	*Pounds*	
Spring	34	64	304	45¢
Fall	53	74	305	40
Churning cream (Willamette Valley)				
Spring	35	73	241	37
Fall	46	75	269	33
Cheese milk (Coast regions)				
Spring	49	91	271	32
Fall	2	53	209	44
Churning cream (Irrigated regions)				
Spring	41	69	219	33
Fall	61	66	261	30

*Spring freshening denotes more than 50 per cent of cows freshening before July 1; fall freshening, more than 50 per cent after July 1, except for the cheese milk in the Coast regions for which only farms with more than 75 per cent of the cows freshening before July 1 are included as spring freshening.

TABLE LI. RELATION OF DEATH LOSS AND CULLING OF COWS TO COST OF PRODUCING MARKET MILK

Year ending April 1, 1932 Willamette Valley

Depreciation per cow*	Number of farms	Average depreciation per cow	Pounds butter-fat per cow	Total net cost	
				Per cow annually	Per pound butter-fat
			Pounds		
Under $10	62	$2	305	$121	40¢
$10–$20	20	13	283	125	44
Over $20	5	25	347	183	53

*Covers death loss and replacement.

Appendix C

PORTLAND MILK-SHED COSTS

Because of special interest in costs of producing Grade B milk in the Portland milk shed in connection with price adjustments and marketing agreements a tabulation of these costs for each of the four years of the study is given in Table LII., The farms included in this tabulation are chiefly in Washington, Multnomah, and Clackamas counties, with a few in Columbia and Yamhill counties.

A formula for the Portland milk shed, similar to those given in Table XIII, for the cost of production in cents per 100 pounds of milk delivered

TABLE LII. COSTS OF PRODUCING MARKET MILK IN THE PORTLAND MILK SHED 1930-1933

Items	Year ending April 1			
	1930	1931	1932	1933
Number of farms	63	51	62	43
Cows per farm	13	14	15	14
Pounds milk per cow annually	6,490	7,113	7,088	6,449
Butter-fat test, per cent	4.1	4.2	4.21	4.2
Amount per cow annually				
Hay, pounds	4,937	4,396	4,663	5,019
Succulents, pounds	7,459	9,413	8,766	7,552
Grain, pounds	2,037	2,149	2,114	1,762
Pasture, days	114	105	108	103
Cost per cow annually				
Hay	$34	$22	$22	$22
Succulents	18	19	15	11
Grain	38	29	24	17
Pasture	6	6	5	5
TOTAL FEED	$96	$76	$66	$55
Labor	43	40	34	30
Use of buildings	8	9	9	9
Use of equipment	2	2	3	2
Sire cost	4	3	3	3
Interest on cows (5 per cent)	6	5	4	3
Depreciation of cows	8	6	6	5
Miscellaneous	6	8	8	6
TOTAL GROSS COST	$173	$149	$133	$113
Credit for calves	6	5	3	2
Credit for manure	11	12	8	6
TOTAL NET COST PER COW	$156	$132	$122	$105
COST PER 100 POUNDS MILK ON FARM	2.41	1.85	1.73	1.63
Hauling per 100 pounds milk	.25	.26	.24	.20
COST PER 100 POUNDS MILK DELIVERED	2.66	2.11	1.97	1.83

in Portland is: 6.0 A + 93. B + .96 C + 61., in which A is the U. S. Department of Agriculture farm price for Oregon of all loose hay per ton, B the price of oats per bushel, and C monthly farm wages without board. Applying this formula to the average of the U. S. Department of Agriculture prices for each year of the study gives the following estimated costs, with which are compared the determined costs.

Year ending April 1	Cost estimated by formula	Cost determined in this study
1930	$2.66	$2.66
1931	2..3	2.11
1932	1.94	1.97
1933	1.74	1.83

Appendix D

COST OF RAISING VEAL CALVES

In obtaining the data on costs of producing milk, raising dairy heifers, and keeping herd sires, which this study was designed to cover completely, certain data were obtained on costs of raising veal calves. These data, for the three-year period ending April 1, 1932, are summarized in this section.

Out of the total of 1,529 records taken during the three years there were 735 records of veal costs, covering the production of 4,559 veals. The number of farms raising veals, and the number of calves vealed, are compared with the total number of farms and total number of cows by years in Table LIII, and by regions for the year ending April 1, 1932, in Table LIV.

Items pertaining to veal costs that were obtained were the birth value of the calves, the feeding period and amount of milk daily, and the value of the veals when they were sold. Many of the veals were raised by nursing

TABLE LIII. NUMBER AND PERCENTAGE OF FARMS RAISING VEALS, AND NUMBER AND PERCENTAGE OF CALVES VEALED, BY YEARS
All regions

Items	Year ending April 1		
	1930	1931	1932
Total number of farms	551	514	464
Number of farms raising veals	248	253	234
Percentage of farms raising veals	45	49	50
Total number of cows	8,734	8,803	8,224
Number of calves vealed	1,512	1,597	1,450
Percentage of calves vealed	17	18	18
Number of cows on farms raising veals	3,295	3,603	3,523
Percentage of calves vealed	46	44	41

TABLE LIV. NUMBER AND PERCENTAGE OF FARMS RAISING VEALS AND NUMBER AND PERCENTAGE OF CALVES VEALED, BY REGIONS
Year ending April 1, 1932

Items	Willamette Valley	Coast regions	Irrigated regions	All regions
Total number of farms	250	89	125	464
Number of farms raising veals	131	28	75	234
Percentage of farms raising veals	52	31	60	50
Total number of cows	3,460	2,719	2,045	8,224
Number of calves vealed	673	282	495	1,450
Percentage of calves vealed	20	10	24	18
Number of cows on farms raising veals	1,538	705	1,280	3,523
Percentage of calves vealed	44	40	39	41

TABLE LV. PERIOD OF FEEDING VEALS, AND AMOUNT OF MILK CONSUMED, BY REGIONS

Average for three years ending April 1, 1932

Items	Willamette Valley	Coast regions	Irrigated regions	All regions
Number of records	393	77	153	623
Number of veals	1,969	748	1,001	3,718
Feeding period, days	40	41	44	41
Milk daily per veal, pounds	17	18	15	17
Total milk per veal, pounds	681	726	676	688
Butter-fat test, per cent	4.2	4.0	4.5	4.2
Butter-fat per veal, pounds	28.5	29.2	30.1	29.1

TABLE LVI. COSTS OF RAISING VEALS, BY YEARS

All regions

Items	Year ending April 1		
	1930	1931	1932
Number of records*	197	218	208
Number of veals*	1,166	1,317	1,235
Values per veal			
Market value of veals	$15.87	$13.40	$9.70
Value of milk consumed	12.39	12.20	8.64
Birth value of calves	2.29	1.55	.96
Labor return per veal	$1.19	$–.35	$0.10

*In this table and in those following, about 15 per cent of the records, covering veals that received feed other than whole milk and a few records in which the cost data were incomplete or obviously in error, have been omitted.

TABLE LVII. COSTS OF RAISING VEALS, BY REGIONS

Year ending April 1, 1932

Items	Willamette Valley	Coast regions	Irrigated regions	All regions
Number of records	123	27	58	208
Number of veals	607	267	361	1,235
Values per veal				
Market value of veals	$9.94	$9.75	$9.25	$9.70
Value of milk consumed	8.99	8.49	8.17	8.64
Birth value of calves	1.14	.76	.82	.96
Labor return per veal	$–.19	$ .50	$ .26	$ .10
Three-year-average labor return per veal	$ .16	$–.20	$1.04	$ .31

TABLE LVIII. VARIATION IN LABOR RETURN PER VEAL, BY REGIONS
Year ending April 1, 1932

Labor return per veal	Willamette Valley	Coast regions	Irrigated regions	All regions
	Farms	*Farms*	*Farms*	*Farms*
Gain				
Over $6	5	0	1	6
$4–$6	13	2	5	20
$2–$4	14	4	14	32
Under $2	25	8	12	45
Loss				
Under $2	35	4	19	58
$2–$4	13	3	4	20
$4–$6	9	4	2	15
Over $6	9	2	1	12

TABLE LIX. HOLSTEIN vs. JERSEY VEALS
Year ending April 1, 1932

Items	Willamette Valley		Irrigated regions	
	Holstein	Jersey	Holstein	Jersey
Number of farms	19	49	12	30
Number of veals	116	177	111	149
Feeding period, days	35	44	42	44
Milk daily per veal, pounds	19	15	17	15
Total milk per veal, pounds	671	648	724	652
Butter-fat test, per cent	3.6	4.7	3.7	4.9
Market value of milk per 100 pounds, dollars	1.22	1.29	.96	1.22
Values per veal				
Market value per veal, dollars	10.45	8.72	9.86	8.56
Value of milk, dollars	8.16	8.38	6.94	7.99
Birth value of calves, dollars	1.59	.84	1.44	.40
Labor return per veal, dollars	0.70	–.50	1.48	.17

TABLE LX. VEALS OF HIGHER MARKET VALUE ARE BETTER CALVES TO START WITH, RECEIVE MORE MILK, AND RETURN MORE PROFIT
Year ending April 1, 1932
Willamette Valley

Items	Market value per veal		
	Under $8	$8–$12	$12 and over
Number of farms	19	86	18
Number of veals	95	405	107
Feeding period, days	37	40	51
Milk daily per veal, pounds	18	18	15
Total milk per veal, pounds	682	714	776
Butter-fat test, per cent	4.2	4.3	4.0
Market value of milk per 100 pounds, dollars	1.18	1.26	1.26
Values per veal			
Market value of veals, dollars	7.06	9.78	13.08
Value of milk consumed, dollars	8.05	8.99	9.82
Birth value of calves, dollars	.74	1.13	1.52
Labor return per veal, dollars	–1.73	–.34	1.74

cows, and the amount of milk that such calves received was estimated by the dairyman. In 15 per cent of the records the veals received feed other than whole milk (mostly skim milk), and these records have been omitted in the tabulations shown in Tables LV to LX.

The average feeding period and amount of milk consumed is given in Table LV. Table LVI gives by years the average labor return per veal, computed by subtracting from the market value of the veal, the birth value of the calf and the value of the milk consumed, the latter valued at the average price received for all milk and butter-fat sold on the farm during the year. Similar figures by regions are given in Table LVII; and Table LVIII gives by regions the variation in labor return per veal between different farms.

Many veals are raised on hard milking cows, or on unmarketable milk that is not actually worth the average market value of milk used in these tabulations. It should be noted also that the computed labor return must cover any marketing costs incurred, such as dressing the veal or delivering to shipping point, upon which data were not obtained.

Comparison of Holstein and Jersey veals is given in Table LIX, and of veals of varying market value in Table LX.

Little, if any, correlation was found between the birth value of the calves and the profitableness of raising veals. The birth value of calves apparently is determined more by other factors, perhaps chiefly by the demand in the community for calves for fox feed.

Appendix E

REVIEW OF OTHER ECONOMIC DAIRY STUDIES

This review covered 53 bulletins presenting results of economic studies of dairying in 24 states during the period 1905-1930. These bulletins have been published by 20 states, the U. S. Department of Agriculture, and the Province of British Columbia. A bibliography of the bulletins is given at the end of this discussion, with a supplementary list of similar bulletins that have appeared since this review was made, which was at the outset of this study.

The Cornell Experiment Station leads in number of publications with 13, and Vermont is second with 8. Of the 53 studies, 39 were made by the survey method, 10 by detailed accounting methods, and 4 by combinations of survey and accounting. Twenty-eight of the bulletins deal chiefly with cost of production, 7 deal chiefly with farm organization, and 18 deal with both.

CONCLUSIONS AS TO FACTORS AFFECTING COST

In summarizing the conclusions reached in the several studies as to the effect of various factors on cost, it was difficult in some cases to decide whether or not a conclusion had been reached. The general policy followed in making this summary was to consider only conclusions that were rather definitely expressed. With this in mind, the principal conclusions expressed on what seem to be the six most generally considered factors are as follows:

1. **Production per cow.** This has been found quite generally to be the most important factor affecting cost. Twenty-seven of the bulletins report lower costs per pound of milk with higher annual production per cow.

2. **Value of cows.** Not much correlation has been found between cow values and their production. Only four studies, from three states, report higher production from cows of higher value, while Vermont (Bulletin 283) reports no correlation found.

3. **Season of production.** Studies in five states, including most of the Cornell studies, show lower cost for "winter dairying." The larger total annual production per cow and the larger proportion of product sold at the higher winter prices apparently more than offset the heavier feeding necessary. In one Cornell study (Bulletin 209) the winter dairying was found less profitable, however, because the seasonal price differential was not great enough, and in one Vermont study (Bulletin 304) uniform production throughout the year gave best returns. Two other bulletins point out that costs are higher in the winter than in the summer, but apparently overlook the effect of date of freshening on the *average* cost for the total annual production.

4. **Size.** Fourteen studies in seven states indicate lower costs for the larger herds, and four more studies in three additional states show lower *labor* cost. As a result of generally low price levels, however, more loss per farm is reported by Cornell (Bulletin 421) for farms with higher capitalization and by British Columbia for the farms with more crop acres.

5. **Butter-fat test of milk.** In five studies in four states the cost per pound of milk was found to be higher for milk of higher test. In three of these studies the cost per pound of butter-fat was found to be less with higher test.

6. **Feeding practice.** Conclusions as to effect of feeding practices upon cost of production are rather meager. Vermont (Bulletins 256 and 258) reports no outstanding correlation between intensity of feeding and cost per unit of product, Iowa (Bulletin 243) reports higher cost with heavier concentrate feeding, Wisconsin (Research Bulletin 83) reports lower feed cost with heavier feeding, and Cornell in one study (Bulletin 364) reports higher cost and in another (Bulletin 409) apparently finds the reverse or at least inconclusive results. Upon the effect of the nutritive ratio, Vermont (Bulletins 268 and 283) finds no correlation with cost, Minnesota (Technical Bulletin 44) and Wisconsin (Research Bulletin 79) find higher production per cow with a narrower ratio, and Cornell (Bulletin 409) finds lower cost with higher percentage of protein. Cornell (Bulletin 409), Vermont, Connecticut, and Washington report lower cost with silage feeding, but the substantiating data are not too conclusive; Cornell (Bulletin 364) and Virginia report no correlation between silage feeding and cost.

Production and quantity cost data. In 35 of the bulletins were found 73 sets of production and quantity cost data, with the exception that but-

TABLE LXI. SUMMARY OF PRODUCTION AND QUANTITY COST DATA BY REGIONS OF THE UNITED STATES

Seventy-three published reports

Items	Eastern United States	Central United States	Western United States	All reports
Number of reports	30	25	18	73
Number of farm records	3,050	1,021	573	4,644
Number of cow-years	58,101	16,936	19,429	94,466
Cows per farm	20	19	41	25
Milk per cow annually, pounds	5,737	5,949	6,307	5,950
Butter-fat test (62 reports), per cent	3.6	3.8	4.1	3.8
Amount per cow annually—				
Roughage, pounds	4,169	3,402	4,945	4,098
Succulents, pounds	5,684	6,657	4,641	5,760
Concentrates, pounds	1,733	1,753	1,026	1,566
Pasture (49 reports), days	145	164	151	153
Labor, hours	155	165	139	155

TABLE LXII. TOTAL DIGESTIBLE NUTRIENTS REQUIRED AND FED

Forty-six published reports

	Amount per cow annually	Total digestible nutrients per cow annually
	Pounds	*Pounds*
Roughage	3,767	1,883
Succulents	5,693	854
Concentrates	1,652	1,239
Total barn feed	.....	3,976
T.D.N. requirement (5,918 pounds 3.8 per cent milk)	.....	4,841
Pasture (T.D.N. by difference)	162 days	865

ter-fat production was available for only 62 sets, and days of pasture for only 49. These data are summarized in Table LXI, which also compares the data from the eastern, central, and western United States. In obtaining the data from the bulletins it was necessary in some cases, of course, to compute the specific figure desired from data expressed in another form; for instance, adding together pounds of silage and pounds of soiling crop to obtain pounds of succulents, or multiplying pounds of milk by the butter-fat test to obtain pounds of butter-fat produced.

For 46 of the sets of data that were complete—including both butter-fat test and days of pasture—the total digestible nutrient requirement of the cows was computed by the Haecker standard, assuming a 1,000-pound cow; and the T.D.N. in the roughage, succulents, and concentrates were computed at 50, 15, and 75 per cent respectively. The amount of nutrients obtained by subtracting the T.D.N. in the barn feed from the T.D.N. requirement, is five pounds of T.D.N. per day of pasture, the same figure that was obtained by a similar computation in the study reported in this bulletin.

Feed and labor costs in dollars and cents were computed by applying to the quantities of feed and labor uniform values approximating 1929 market values in Oregon. The values used were: roughage, $10.00 per ton; succulents, $5.00 per ton; concentrates, $30.00 per ton; pasture, 10¢ per day; labor, 30¢ per hour. Of the 24 sets of data for which the days of pasture were missing 17 were for years subsequent to 1917, and for these the reported actual value of pasture was used to compute total feed cost; for the 7 sets, covering previous years, the reported value of the pasture was doubled.

Tabulations to bring out the relationship of several factors to the feed and labor costs as thus computed are given in Tables LXIII to LXV. With higher yield of milk per cow the feed cost per cow is greater, but both the feed cost and labor cost per 100 pounds of milk are considerably lower, as would be expected (Table LXIII). With larger herds, also, costs per unit of milk are somewhat lower, but the effect of this factor is not nearly as marked as that of yield (Table LXIV). With higher butter-fat test the

TABLE LXIII. RELATION OF YIELD OF MILK PER COW TO FEED AND LABOR COSTS

Seventy-three published reports

Items	Pounds of milk per cow annually				
	Less than 5,000	5,000-5,999	6,000-6,999	7,000 and over	All reports
Number of reports	12	24	29	8	73
Cows per farm	22	21	26	37	25
Milk per cow annually, pounds	4,739	5,502	6,423	7,380	5,950
Butter-fat test (62 reports), per cent	4.0	3.9	3.7	3.8	3.8
Value of feed—					
Per cow, dollars	60	71	78	86	74
Per 100 pounds milk, dollars	1.27	1.29	1.22	1.17	1.24
Value of labor—					
Per cow, dollars	43	47	47	46	46
Per 100 pounds milk, dollars	.90	.86	.74	.63	.79
Total value—					
Per cow, dollars	103	118	125	132	120
Per one hundred pounds milk, dollars	2.17	2.15	1.96	1.80	2.03

TABLE LXIV. RELATION OF SIZE OF HERD TO FEED AND LABOR COSTS

Seventy-three published reports

Items	Number of cows per farm			All reports
	Less than 20	20–39	40 and over	
Number of reports	39	24	10	73
Cows per farm	15	24	61	25
Milk per cow annually, pounds	5,863	5,998	6,177	5,950
Butter-fat test (62 reports), per cent	3.7	3.8	4.1	3.8
Value of feed—				
Per cow, dollars	74	74	71	74
Per 100 pounds milk, dollars	1.27	1.25	1.14	1.24
Value of labor—				
Per cow, dollars	47	47	44	46
Per 100 pounds milk, dollars	.81	.79	.72	.79
Total value—				
Per cow, dollars	121	121	115	120
Per 100 pounds milk, dollars	2.08	2.04	1.86	2.03

TABLE LXV. RELATION OF BUTTER-FAT TEST OF MILK TO FEED AND LABOR COSTS

Sixty-two published reports

Items	Butter-fat test (per cent)				All reports
	Under 3.5	3.5–3.9	4.0–4.4	4.5 and over	
Number of reports	13	30	14	5	62
Cows per farm	20	24	24	30	24
Milk per cow annually, pounds	6,358	5,865	5,786	5,538	5,924
Butter-fat test (62 reports), per cent	3.4	3.7	4.2	4.7	3.8
Butter-fat per cow annually, pounds	214	214	245	262	225
Value of feed—					
Per cow, dollars	82	72	68	62	73
Per 100 pounds milk, dollars	1.29	1.24	1.19	1.14	1.23
Per pound butter-fat, dollars	.38	.34	.28	.24	.33
Value of labor—					
Per cow, dollars	46	44	45	51	45
Per 100 pounds milk, dollars	.73	.76	.78	.93	.77
Per pound butter-fat, dollars	.22	.21	.19	.20	.20
Total value—					
Per cow, dollars	128	116	113	113	118
Per 100 pounds milk, dollars	2.02	2.00	1.97	2.07	2.00
Per pound butter-fat, dollars	.60	.55	.47	.44	.53

TABLE LXVI. RELATION OF AMOUNT OF CONCENTRATES FED TO FEED COST AND OTHER FACTORS

Seventy-three published reports

Items	Pounds of concentrates per cow annually			
	Under 1,000	1,000-1,999	2,000 and over	All reports
Number of reports	13	44	16	73
Cows per farm	32	24	23	25
Milk per cow, pounds	5,740	5,804	6,522	5,950
Butter-fat test (62 reports), per cent	4.1	3.8	3.6	3.8
Concentrates per cow, pounds	634	1,552	2,359	1,566
Pasture per cow (49 reports), days	188	167	138	162
T.D.N. per day of pasture (46 reports), pounds	10	5	2	5
Value of feed—				
Per cow, dollars	58	73	87	74
Per 100 pounds milk, dollars	1.02	1.27	1.34	1.24

combined feed and labor cost per unit of milk remained nearly the same but the cost per unit of butter-fat decreased considerably (Table LXV).

Heavier grain feeding seems to be associated with less pasture; and at the values used in this analysis results in considerably higher feed cost both per cow and per unit of milk (Table LXVI). The decrease in the amount of nutrients per day of pasture suggests that there may have been considerable difference in the quality of the pasture as well as in the number of days; this relationship, however, may be partly or entirely due to differences in the quality of the roughage, or to other factors. Further statistical analysis and also experimental work are needed in connection with the nutrient value of feeds and pasture for dairy cows under farm conditions.

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