

An Economic Analysis of Alternative Milk Production Systems: Oregon Milk Marketing Area One 1971



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ABSTRACT

The primary objective of this study was to compare the economics of alternative milk production systems. Sixty-three dairymen selling milk in Oregon Milk Marketing Area One were randomly selected and surveyed to represent various herd sizes with drylot or pasture feeding, stanchion or platform milking, and loose or free-stall housing systems.

The average herd size for the sample was 81 cows. These cows produced an average of 11,948 pounds of 3.94 percent milk at a cost of \$6.38 per hundredweight. The \$6.23 average price received provided an average annual return of \$10,920 to unpaid labor and management, with a 7 percent return on investment.

The comparisons of the alternative feeding, milking, and housing systems revealed the following tendencies: (1) Drylot feeding had only a negligible profit advantage over pasture grazing; (2) Platform milking was more economical for the smaller herds; stanchion milking was less costly for the larger herds; (3) Loose housing had the cost advantage over free-stall housing.

Keywords: Dairy farms, Production systems, Dairy cattle, Milk, Farm management, Production costs, Budgeting, Economics

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AN ECONOMIC ANALYSIS OF ALTERNATIVE MILK PRODUCTION SYSTEMS;
OREGON MILK MARKETING AREA ONE; 1971

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The milk production enterprise in Oregon represents a wide variety of production systems, ranging from extensive systems based on pasture grazing and stanchion milking to more intensive systems with drylot feeding and platform milking. Each dairyman faces a unique resource situation with regard to the size and productivity of his cow herd, proximity to feed and produce markets, quantity and quality of labor, and management expertise and objectives. However, there is much to be learned about the economic implications of alternative production systems utilized by dairymen under different resource situations.

The purpose of this study was to perform a comparative analysis to contrast the profitability of alternative milk production systems for various cow herd sizes and locations. The production systems studied include combinations of drylot feeding or pasture grazing, stanchion or platform milking, and free-stall or loose housing. The research procedure involved identifying and surveying dairymen utilizing these various systems, and then analyzing the data obtained to provide comparable budget summaries for each system in different resource situations.

The study was conducted by the Oregon State University Department of Agricultural Economics and supported by the Milk Stabilization Division of the Oregon Department of Agriculture.

Scope of the Study

This study pertains to Grade A milk producers in Oregon Milk Marketing Area One. This includes all counties in Oregon except Wallowa, Union, Baker, Grant, Wheeler, Crook, Malheur, Harney, Lake, and Curry counties. This marketing area also includes Washington milk producers in Pacific, Wahkiakum, Lewis, Cowlitz, Yakima, Klickitat, Benton, Franklin, and Walla Walla counties, and California producers in Siskiyou County.

The study limits the definition of the dairy enterprise to that phase involved directly with milk production. The returns to this enterprise include value of milk, new-born calves, and manure produced by the cow herd. The cost of new cows added to the herd is based on the value of the animal when it enters the cow herd for the first time. Costs for buildings, improvements, machinery, and equipment are included only for those facilities directly involved in producing milk, housing the cow herd, storing feed, and removing manure. Feed production is considered as a separate enterprise, and the cost of feed is based on its market value at the time it is transferred

to storage for use in the enterprise. The costs for labor and operating expenses are those attributable to the cow herd.

Sampling Procedure

There were about 1,200 Grade A milk producers in Oregon Milk Marketing Area One in 1971. A one-page questionnaire was developed for each producer to obtain information on his location, herd size, and the components of his feeding, milking, and housing systems. With the help of the Oregon State University Extension Service, Oregon Department of Agriculture, and Multnomah County Health Department, information sufficiently complete for analysis was obtained for 920 dairy farms. This number was reduced to 760 with the exclusion of 114 dairymen using bucket milking systems and 46 using stanchion barns for housing their cows. These two types of systems are rarely considered in decisions to invest in new facilities and, therefore, were not included in this analysis.

Table 1 presents the percentage distribution of the 760 dairy enterprises among eight combinations of feeding, milking, and housing systems. The predominant system for both the small and large herd sizes consisted of pasture grazing with platform milking and free-stall housing. Another important system, particularly for the smaller herds, also involved pasture grazing but combined this with stanchion milking and loose housing.

This group of 760 producers was subdivided according to location into three regions. The "Coast" region includes those Oregon and Washington counties in Milk Marketing Area One which border on the Pacific Coast. The "Valley" region includes the counties of the Willamette Valley and adjacent counties in Southwest Washington. The remaining counties which make up Oregon Milk Marketing Area One are included in the "South and East" region. The number of dairy enterprises located in each region is indicated in Table 2, along with the counties included in each region.

Classifying the dairy enterprises among three regions, small (less than 70 cows) or large (70 cows and over) herd sizes, pasture or drylot feeding, stanchion or platform milking, and free-stall or loose housing would potentially define 48 subgroups. ^{1/} However, the number of dairy enterprises in many of these subgroups was zero or so small as to be insignificant. Eliminating these left 18 subgroups to be studied (Table 3). Those enterprises with less than 30 or more than 400 cows were removed from these subgroups to allow greater uniformity and more representative sampling. A total of 588 dairy enterprises were thus identified for possible inclusion in the survey.

The number of dairymen interviewed to obtain data for the study was limited

^{1/} Multiplying 3 regions times 2 sizes times 2 feeding systems times 2 milking systems times 2 housing systems gives 48 combinations of characteristics by which the enterprises could be classified.

Table 1. Distribution of 760 Dairy Enterprises among Eight Milk Production Systems by Size of Herd, Oregon Milk Marketing Area One, 1971

System			Cow herd size		Total of all herds
Feeding	Milking	Housing	Less than 70	70 or more	
			(%)	(%)	(%)
Pasture	Stanchion	Loose.....	13.3	1.8	15.1
		Free-stall..	9.0	3.4	12.4
	Platform	Loose.....	8.7	6.3	15.0
		Free-stall..	18.4	25.5	43.9
Drylot	Stanchion	Loose.....	0.4	1.2	1.6
		Free-stall..	0.4	0.0	0.4
	Platform	Loose.....	1.2	2.4	3.6
		Free-stall..	0.3	7.7	8.0
TOTAL OF ALL SYSTEMS....			51.7	48.3	100.0

Table 2. Dairy Enterprises by Region with the Counties Comprising Each Region, Oregon Milk Marketing Area One, 1971

Region	No. of enterprises ^{a/}	Counties	
Coast	154	Oregon:	Clatsop, Tillamook, Lincoln, Coos
		Washington:	Pacific, Wahkiakum
Valley	409	Oregon:	Columbia, Washington, Multnomah, Yamhill, Clackamas, Polk, Marion, Benton, Linn, Lane
		Washington:	Lewis, Cowlitz, Clark
South and East	197	Oregon:	Hood River, Wasco, Morrow, Umatilla, Jefferson, Deschutes, Klamath, Jackson, Josephine, Douglas
		Washington:	Yakima, Klickitat, Benton, Franklin, Walla Walla
		California:	Siskiyou
	760		

^{a/} Dairy enterprises for which complete information was received, excluding those with bucket milking systems and stanchion housing.

Table 3. Definition of Subpopulations, Total Number of Dairy Enterprises Identified in Each, and Size of Sample Drawn for Study

Region	Size of herd ^{a/}	Production system			Number identified	Sample size		
		Feeding	Milking	Housing				
Coast	Small	Pasture	Stanchion	Free-stall	17	2		
			Platform *	Loose	16	2		
				Free-stall	43	4		
	Large	Pasture	Platform	Free-stall	44	5		
Valley	Small	Pasture	Stanchion	Loose	22	3		
				Free-stall	24	3		
			Platform	Loose	18	2		
				Free-stall	74	7		
			Large	Pasture	Stanchion	Free-stall	15	2
					Platform	Loose	21	3
	Free-stall	127				9		
		Drylot	Platform	Free-stall	34	4		
	S and E	Small	Pasture	Stanchion	Loose	36	4	
					Free-stall	15	2	
Platform				Loose	22	3		
				Free-stall	15	2		
Large		Pasture	Platform	Loose	17	2		
				Free-stall	22	3		
			Drylot	Platform	Free-stall	21	3	
TOTALS					588	63		

^{a/} Small herds ranged from 30 to 70 cows, and large herds were from 70 to 400 cows in size.

by the research budget to 63. The number of enterprises sampled in each subgroup is indicated in Table 3. ^{2/} The sample dairy enterprises are believed to accurately represent the subgroups included in the study. However, the samples were not drawn from the entire population of dairy producers, due to the elimination of enterprises with incomplete information, those with bucket milking systems and stanchion housing, and those with fewer than 30 or more than 400 cows. The results should not be construed as representing anything beyond the scope of the subgroups as defined.

Survey Procedure

A letter was sent to the initial sample of 63 dairymen, explaining the objectives of the study and requesting their cooperation in obtaining the needed data. Telephone contact was then made to schedule the interview with the co-operator. All interviews were made by Eugene Panasuk, to reduce any variability due to interview procedure. The interview required two to four hours of the dairyman's time to obtain the needed data.

The data obtained from the interviews was summarized and analyzed. A computer report was prepared for each dairy enterprise, including a financial summary, analysis factors relating to labor, capital, dairy herd, and feed program management, and calculations of milk production costs and returns. ^{3/} The report allowed the dairyman to compare the figures for his enterprise with the averages for the other enterprises categorized by volume of milk produced.

The reports were sent to the cooperating dairymen so that they could check and confirm the data for their enterprise. Any questionable or unreasonable figures on these reports were drawn to the dairyman's attention. Based on consultations with the cooperators, a few errors in the data were found and corrected.

General Results for Sample

This section presents a description of the dairy enterprises sampled, a summary of the assumptions and procedures used in budgeting income and expense items, and an analysis of the economic implications.

Description of Sample

Of the 63 dairy farms surveyed, 73 percent were organized as sole proprietorships. The organization of the remaining 27 percent involved father-son, partnership, or lease agreements. The average size of the sample farms was 205 acres. The degree of specialization is indicated by the fact that 76 percent

^{2/} The technical aspects of the sampling procedure are presented in Appendix B.

^{3/} The reports were processed by the ODEAR (Oregon Dairy Enterprise Analysis Report) computer program, which is available through Extension Farm Management, Department of Agricultural Economics, Oregon State University.

of the dairymen reported no crop enterprises other than dairy feed production, and 70 percent reported no other livestock enterprises besides raising dairy heifers. The size of the sample dairy enterprises ranged from 31 to 315 cows; the average herd size was 81 cows.

The sample of 63 dairymen produced a combined total of over 60.9 million pounds of milk in 1971. Their milk sales represented 5.6 percent of the 1971 total in Oregon Milk Marketing Area One. Milk production averaged 11,948 pounds per cow, with 3.94 percent butterfat test. Holstein was the sole breed for 56 percent of the sample enterprises; an additional 24 percent had Holsteins in combination with other breeds.

The dairymen fed an average of 12.5 pounds of concentrate mix per cow per day plus 23.6 pounds of hay equivalent. Labor requirements for the enterprise averaged 11 minutes per cow-day. Twenty-five percent of this requirement was supplied by hired labor.

Assumptions and Procedures

The value of milk produced includes that sold to handlers and that used on the farm (Table 4). The value of sales was obtained from the records of the Milk Stabilization Division, State Department of Agriculture. The value of milk used on the farm was based on the 1971 average surplus price for that butterfat test.

The income to the enterprise from calves produced was based on the value of the new-born calf. Manure value, based on its usual soil nutrient content, was assumed to be one dollar per ton. The amount of manure produced was estimated as a function of the weight of the cows. ^{4/}

The quantity and cost of feed were based on the dairymen's records and observations. Concentrates include all grains and supplements fed to the cow herd (both milking and dry cows). Likewise, the roughages include hay, silage, cannery wastes, brewers malt, green chop, and pasture. Feed costs for purchased feeds were based on prices paid. For feeds grown by the dairyman, the market prices, i.e., the prices he could have received from sale at the time the feed was put in storage, were used. The cost for pasture was based on a charge per head per month, which varied depending on location, season, and quality of forage.

Labor costs are of two types - operator and family labor which is unpaid, and hired labor which is a cash expense. The amount of labor was measured in hours per day, according to the type of work done by each laborer. Unpaid labor was valued according to its contribution to the enterprise. The cost of hired labor includes, in addition to the cash wage, the value of housing, bonuses, utilities, milk consumed, fringe benefits, social security, and workmen's compensation insurance.

^{4/} Walter E. Matson, Planning Animal Waste Disposal Systems, Circular 763, Oregon State University Extension Service, Corvallis, Oregon, 1971, p. 6.

Table 4. Average Budget Summary for 63 Grade A Milk Production
Enterprises, Oregon Milk Marketing Area One, 1971

<u>General Information</u>			
Ave. cows in herd.....	81.0		
Total lbs. milk produced.....	967,367		
B.F. test of milk.....	3.94		
Lbs. milk per cow.....	11,943		
Lbs. fat per cow.....	470.6		
Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$23,457	\$ 289.59	\$2.42
Machinery & equipment.....	9,545	117.84	.99
Land in corrals.....	3,078	38.00	.32
Cow herd.....	36,588	451.70	3.78
Market quota.....	<u>15,147</u>	<u>187.00</u>	<u>1.57</u>
Total.....	\$87,815	\$1,084.13	\$9.08
<u>Income</u>			
Value of milk produced.....	\$60,261	\$ 743.96	\$6.23
Value of calves and manure.....	<u>4,979</u>	<u>61.47</u>	<u>.51</u>
Total.....	\$65,240	\$ 805.43	\$6.74
<u>Expenses</u>			
Concentrates.....	\$13,644	\$ 168.44	\$1.41
Roughages.....	12,901	159.27	1.33
Operating expenses.....	5,199	64.19	.54
Hauling and marketing.....	4,412	54.47	.46
Hired labor.....	3,463	42.75	.36
Operator and family labor.....	10,470	129.26	1.08
Management allowance.....	1,941	23.96	.20
Depreciation - buildings & improvements.	1,159	14.31	.12
- machinery & equipment....	1,141	14.09	.12
Herd replacement.....	3,985	49.20	.41
Interest (7%) - bldgs. & improvements...	1,642	20.27	.17
- mach. & equipment.....	668	8.25	.07
- land.....	216	2.67	.02
- cow herd.....	2,561	31.62	.26
- quota.....	1,060	13.09	.11
Bldg. & equip. repair, tax, & insurance.	1,841	22.73	.19
Tax & insurance on cows.....	<u>428</u>	<u>5.28</u>	<u>.04</u>
Total.....	\$66,731	\$ 823.85	\$6.89
NET DAIRY PROFIT.....	\$-1,491	\$ -18.42	\$-.15

An allowance for the management of the dairy enterprise was computed uniformly for each member of the sample. The allowance was \$1,050 plus \$11 per cow. For the sample average it is \$1,050 plus \$11 times 81 cows, or \$1,941 for the year. This formula was based on the results of a New York study of dairymen which found that total management requirements increase with herd size, but that the requirements per cow are less for larger herd sizes. 5/

Operating expenses include such items as veterinary, medicine, breeding, D.H.I.A., bedding, supplies, fuel, utilities, record-keeping, and other miscellaneous costs. Expenditures for these items were obtained from the producers' records. Where the expenditure represented enterprises in addition to milk production, the dairymen's estimate of the appropriate share allocable to the dairy enterprise was used.

The cost of herd replacement is equal to value of the cow herd at the beginning of the year, plus the value of new cows and lactating heifers added to the herd, minus the value of cows sold, minus value of the herd at the end of the year. For example, take an enterprise which began the year with \$52,650 worth of cows, added heifers worth \$10,800 at their first lactation, sold \$7,465 in cull cows, and had an ending herd value of \$52,000. The cost of herd replacement would be \$3,985 ($\$52,650 + \$10,800 - \$7,465 - \$52,000$).

The investments in land, buildings, improvements, machinery, equipment, and cows were based on the dairymen's appraisal of their current worth. Their assessment of quota value averaged \$8 per pound per day. Interest on these investments was figured at 7 percent as a compromise between what dairymen pay for borrowed capital and what they could earn if they invested their capital outside the dairy enterprise. Depreciation charges were based on the producers' observed decline in asset values.

Production Costs and Profits

The average cost of producing milk per hundredweight for the sample can be calculated by subtracting the value of calves and manure from the total expenses. Taking the figures from Table 4:

Total expenses per cwt. of milk produced.....	\$6.89
Calf and manure value per cwt. of milk.....	<u>-.51</u>
Net cost of production.....	\$6.38

This average net cost figure applies to the production of milk with an average test of 3.94 percent butterfat.

If the sample dairymen had been compensated in 1971 at an average milk price equal to this net cost, they would have earned an average return of \$12,411 for unpaid (operator and family) labor and management, plus a 7 percent return on the capital invested in the enterprise.

5/ Earl M. Hughes, Jr., and B. F. Stanton, Time Spent on Entrepreneurial and Related Activities, 44 New York Dairy Farms, 1964-65, A.E. Res. 187, Department of Agricultural Economics, Cornell University Agricultural Experiment Station, Ithaca, New York, 1965.

In 1971 the dairymen in the sample actually received an average price of \$6.23 per hundredweight for the milk produced, given the 3.94 percent butterfat test and market quota allocation. This return provided an average net profit for the dairy enterprise of \$-1,491, which means full compensation was not received for all the costs incurred by the average producer. At this price the average return to the sample dairymen's unpaid labor and management was \$10,920, with a 7 percent return on investment. Or looking at it another way, they averaged a \$12,411 return for unpaid labor and management and a 5.3 percent return on investment.

While the average annual net profit was \$-1,491, there was wide variation among the individual enterprises in their profitability. The three highest-profit enterprises averaged a net profit of \$20,036 in 1971. In contrast, the three lowest-profit enterprises had an average net profit of \$-17,518. Nearly 75 percent of the enterprises, however, had net profits between the extremes of an \$8,000-loss and an \$8,000-gain. Over 36 percent of the sample enterprises reported a positive net profit, indicating that all expenses were covered, including the value of unpaid labor and management and a 7 percent return on investment.

Comparison of Milk Production Systems

The profitability of the dairy enterprise is conditioned by many factors in addition to the choice of production systems. Among these are herd size, cow productivity, quality of labor and management, location, etc. One of the problems in attempting a comparison of various milk production systems is that those other factors are not constant among dairy enterprises. With large samples for each system, these other factors affecting profitability would tend to "average out", leaving any difference in profit due solely to the choice of production system. However, the surveying of such a large number of dairymen is so costly as to be prohibitive.

Because of the limited research budget for this study, an approach other than averaging the data for each system and comparing the results had to be employed. The method chosen was to use multiple regression analysis with variables representing the production system components and other influential factors such as herd size, location, etc. The regression equations were used to project the various items which make up the synthesized profit or loss budgets. The estimated coefficients of the regression equations, and more detail on the approach, are presented in Appendix B. Suffice to say that the regression analysis allowed for measuring the differences in the income and expense items due to the choice of production systems while holding all other factors constant.

The net dairy profit per cow for each combination of production systems studied, given the herd size and location of the enterprise, is presented in Table 5. Fifty cows was used as the size for the small enterprises, with 115 cows assumed for the large enterprises. Detailed budget summaries for each system combination, by location and size, are provided in Appendix A.

Table 5. Net Dairy Profit Per Cow by Milk Production System, Herd Size, and Location;
Oregon Milk Marketing Area One, 1971

Feeding	System		Coast		Valley		S and E	
	Milking	Housing	Small	Large	Small	Large	Small	Large
Pasture	Stanchion	Loose	--	--	-25.24	--	-43.04	--
		Free-stall	-126.72	--	-73.67	23.77	--	--
	Platform	Loose	- 61.13	--	- 8.06	63.05	-25.84	58.67
		Free-stall	-109.53	-35.12	-56.48	14.62	-74.26	10.25
Drylot	Stanchion	Loose	--	--	--	--	--	--
		Free-stall	--	--	--	--	--	--
	Platform	Loose	--	--	--	--	--	--
		Free-stall	--	--	--	14.63	--	10.46

The format of the following will be to compare the economics of the alternative systems based on the multiple regression analysis of the data from the 63 dairy enterprises surveyed. The apparent differences in income and expense reported here may or may not be real differences. The variable nature of the income and expense items associated with milk production makes projections a probabilistic matter. However, as will be discussed later, this information can provide useful management guidelines to present and potential dairy producers.

Drylot Versus Pasture Feeding Systems

Under a drylot feeding system, cows are assumed to be fed in confinement all year with no access to pasture. The pasture feeding system allows the cows to graze pasture for at least a portion of the year. As noted in Table 1, drylot feeding was not commonly practiced, accounting for only 13.6 percent of the 760 enterprises enumerated. However, with the trend towards larger herds and specialization, there is increasing interest in the economic feasibility of this type of system.

The figures below indicate the added income and added expense per cow for the drylot system compared to pasture grazing in the "Valley" and "South and East" regions.

	<u>Valley</u>	<u>S and E</u>
<u>Added income</u>		
Value of milk produced.....	\$139.05	\$129.66
<u>Added expense</u>		
Feed.....	107.44	100.45
Hauling and marketing.....	11.75	10.57
Labor.....	10.82	9.73
Interest.....	6.41	6.09
Repair, tax, and insurance.....	<u>2.62</u>	<u>2.61</u>
Total.....	\$139.04	\$129.45
Difference in profit per cow.....	\$ 0.01	\$ 0.21

The difference in profit per cow between the two systems of feeding is negligible, with the drylot system having a slightly greater advantage in the "South and East" region. The drylot systems tended to produce more milk per cow which increased income, but feed costs, particularly for concentrates, were also increased. The greater volume of milk production, likewise, influenced expenses for hauling, marketing, labor, and interest on quota. The drylot system required a larger investment in equipment, which affected interest, repairs, taxes, and insurance. There was no apparent difference in equipment depreciation.

For the individual dairyman, the selection of drylot feeding over pasture grazing is dependent on many factors, including the types and amounts of forage produced and available for purchase, size of cow herd, capital available for investment, labor to meet added requirements, provisions for manure disposal, and production response of the cows to drylot feeding. Drylot feeding

does offer the dairymen the opportunity to increase milk production through better control of the quantity and quality of feed consumed by his cows. From this comparison, however, it appears that without extenuating circumstances there is no significant economic advantage to drylot feeding over the more conventional pasture grazing system.

Platform versus Stanchion Milking Systems

The platform system involves milking in parlor arrangements on elevated platforms. With the stanchion system the cows are milked in non-elevated stanchions. Platform milking was the predominate system, accounting for 55 percent of the enterprises with less than 70 cows and 87 percent of those with 70 or more cows.

The following presents the reduced expenses per cow for the platform system compared to stanchion milking in enterprises with small (50-cow) herds and large (115-cow) herds:

	<u>Small</u>	<u>Large</u>
<u>Reduced expense</u>		
Labor.....	\$17.22	\$ 6.71
Depreciation.....	-5.67	-5.68
Interest.....	3.08	-5.56
Repair, tax, and insurance.....	<u>2.56</u>	<u>-4.62</u>
Difference in profit per cow.....	\$17.19	\$-9.15

For the 50-cow herd size, platform milking had lower costs than the stanchion system. Labor saving was the primary contributor to the lower cost. Capital costs for interest, repair, tax, and insurance were less, but depreciation was higher for platform milking.

In the large enterprise with 115 cows, the stanchion milking system had the economic advantage. The reduced labor cost for the platform system was more than offset by the higher depreciation, interest, and other capital costs for platform compared to stanchion milking. While the investment per cow was higher for the stanchion system in small herds, this relationship was reversed for the large herd size. The result was a net profit difference of \$9 favoring the stanchion milking for the larger herds.

The results of these economic comparisons would seem to be inconsistent with the greater incidence of platform milking in the larger herds. In rationalizing this, it should be pointed out that the advantages of platform milking, such as comfort (less bending and stooping), physical efficiency, and flexibility, may be too subtle to be accounted for in this analysis. More specifically, the lower per-cow investments for stanchion milking in the large herds may be due to the practice of milking cows in shifts, so that multiple use is made of the building space and equipment. Older ages of the facilities for the larger stanchion enterprises may also contribute to these lower investment figures.

Loose versus Free-stall Housing Systems

In the loose housing system the cows are housed in an open barn. With free-stall housing the cows have access to individual stalls. Sixty-five percent of the 760 dairy enterprises enumerated reported free-stall housing systems; 35 percent reported loose housing. Although free-stall housing was more frequently reported in both small and large herds, a higher proportion used free-stalls in the group with herds of 70 cows or more.

For both small and large herds in all three regions, loose housing tended to have the advantage over the free-stall system. The net reduction in per-cow costs for loose compared to free-stall housing is indicated below:

<u>Reduced expense</u>	
Bedding.....	\$-3.40
Labor.....	23.25
Depreciation.....	13.39
Interest.....	8.29
Repair, tax, and insurance.	<u>6.89</u>
Difference in profit per cow....	\$48.42

The \$48 cost saving for loose housing was due primarily to lower labor and capital costs. The capital-cost reduction was influenced largely by a \$90 per cow difference in building investment. However, the saving due to these items is lessened by the higher bedding costs associated with loose housing.

Here again, the results are different than might be expected. The advantages of free-stall housing (cleaner cows, less bedding, fewer udder injuries, and less space required) are often cited. However, this analysis does not bear out the economics of these advantages. The greater labor requirement for free-stall housing may be due to more frequent manure removal. Examination of the data revealed little difference in the ages of the free-stall and loose housing facilities. Therefore, in spite of the lower space requirement, it appears that free-stall housing does involve higher investments in buildings and equipment.

Interpreting the Results

The results of this study can provide useful information to dairymen as they contemplate investments to change or adjust their milk production systems. The results reported here are based on the differences and trends observed from the data for a sample of 63 enterprises.

In evaluating an investment in a new production system, the dairyman should study this analysis, revising the income and expense data as needed to portray his own situation. For example, suppose a milk producer is making plans to invest in a new housing system for his cows. He could contact a local contractor to get estimates of the construction costs for the two types of facilities. These will likely be higher than the values reported by the sample dairymen for their buildings, which may be several years old. From the estimates of initial

investment the producer can then project his capital costs for depreciation, interest, repairs, taxes, and insurance. Bedding, labor, and other costs associated with the two housing types can be estimated, using the results reported in Appendix A as guidelines. Finally, the comparison of the budgeted costs for each system of housing will indicate which system will be more economical, given his unique situation.

Summary and Conclusions

A sample of 63 dairy producers was selected, representing small or large herd sizes with drylot or pasture feeding, stanchion or platform milking, and loose or free-stall housing systems in three regions of Oregon Milk Marketing Area One. These dairymen were then surveyed, and the data obtained were analyzed to provide comparable budget summaries for each production system by herd size and regional location.

The herd size of the sample enterprises averaged 81 cows. These cows produced an average of 11,948 pounds of milk per cow, with 3.94 percent butterfat, at a cost of \$6.38 per hundredweight. The dairymen received an average price of \$6.23 per hundredweight of milk produced in 1971, based on their butterfat tests and quota allotments. This return provided an average return of \$10,920 to operator and family labor and management, with a 7 percent return on investment.

The following general tendencies were found regarding the comparisons of the alternative feeding, milking, and housing systems:

1. Cows in the drylot feeding systems tended to produce more milk, compared to conventional pasture grazing. However, considering the added expenses, the profit advantage was only negligible.
2. Milking in platform systems was found to be more economical than stanchion milking for dairy enterprises with herd sizes of around 50 cows. For 115-cow herds the labor saving for platform milking was more than offset by lower capital costs.
3. Loose housing in open barns had a cost advantage over free-stall housing systems. The advantage was due to lower labor and capital costs, although the bedding costs were higher for loose housing.

In the interpretation of the results presented, it is necessary to recognize that each dairy enterprise represents a unique situation, and any decision to change or adjust the system of milk production should be considered on its own economic merits.

APPENDIX A

BUDGET SUMMARIES

APPENDIX A: BUDGET SUMMARIES

List of Budget Summaries by Location, Herd Size, and Milk Production Systems

Region	Size of herd	Production systems			Table number	
		Feeding	Milking	Housing		
Coast	Small	Pasture	Stanchion	Free-stall	A-1	
			Platform	Loose	A-2	
				Free-stall	A-3	
	Large	Pasture	Platform	Free-stall	A-4	

Valley	Small	Pasture	Stanchion	Loose	A-5	
				Free-stall	A-6	
				Platform	Loose	A-7
				Free-stall	A-8	
	Large	Pasture	Stanchion	Free-stall	A-9	
				Platform	Loose	A-10
				Free-stall	A-11	
				Drylot	Platform	Free-stall

S and E	Small	Pasture	Stanchion	Loose	A-13	
			Platform	Loose	A-14	
				Free-stall	A-15	
	Large	Pasture	Platform	Loose	A-16	
				Free-stall	A-17	
				Drylot	Platform	Free-stall

Table A-1. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>		
Coast region		Ave. cows in herd.....	50	
Small herd size		Total lbs. milk produced.....	563,300	
Pasture grazing system		B.F. test of milk.....	4.12	
Stanchion milking		Lbs. milk per cow.....	11,266	
Free-stall housing		Lbs. fat per cow.....	464.2	

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$20,385	\$ 407.69	\$ 3.62
Machinery & equipment.....	8,693	173.86	1.54
Land in corrals.....	1,988	39.76	.35
Cow herd.....	22,819	456.37	4.05
Market quota.....	8,562	171.24	1.52
Total.....	\$62,447	\$1,248.92	\$11.08
<u>Income</u>			
Value of milk produced.....	\$35,939	\$ 718.77	\$ 6.38
Value of calves and manure.....	3,168	63.36	.56
Total.....	\$39,107	\$ 782.13	\$ 6.94
<u>Expenses</u>			
Concentrates.....	\$ 6,422	\$ 128.43	\$ 1.14
Roughages.....	8,337	166.74	1.48
Operating expenses.....	3,252	65.03	.58
Hauling and marketing.....	2,985	59.70	.53
Hired, operator, and family labor.....	12,568	251.36	2.23
Management allowance.....	1,600	32.00	.28
Depreciation - buildings & improvements.	773	15.46	.14
- machinery & equipment....	841	16.81	.15
Herd replacement.....	2,336	46.71	.41
Interest (7%) - bldgs. & improvements...	1,427	28.54	.25
- mach. & equipment.....	609	12.17	.11
- land.....	139	2.78	.02
- cow herd.....	1,598	31.95	.28
- quota.....	599	11.99	.11
Bldg. & equip. repair, tax, & insurance.	1,693	33.85	.30
Tax & insurance on cows.....	266	5.33	.05
Total.....	\$45,445	\$ 908.85	\$ 8.06
NET DAIRY PROFIT.....	\$-6,338	\$ -126.72	\$-1.12

Table A-2. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>		
Coast region		Ave. cows in herd.....	50	
Small herd size		Total lbs. milk produced.....	563,300	
Pasture grazing system		B.F. test of milk.....	4.12	
Platform milking		Lbs. milk per cow.....	11,266	
Loose housing		Lbs. fat per cow.....	464.2	

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$13,670	\$ 273.39	\$ 2.43
Machinery & equipment.....	7,290	145.79	1.29
Land in corrals.....	1,988	39.76	.35
Cow herd.....	22,819	456.37	4.05
Market quota.....	8,562	171.24	1.52
Total.....	\$54,329	\$1,086.55	\$ 9.64
<u>Income</u>			
Value of milk produced.....	\$35,939	\$ 718.77	\$ 6.38
Value of calves and manure.....	3,168	63.36	.56
Total.....	\$39,107	\$ 782.13	\$ 6.94
<u>Expenses</u>			
Concentrates.....	\$ 6,422	\$ 128.43	\$ 1.14
Roughages.....	8,337	166.74	1.48
Operating expenses.....	3,422	68.43	.61
Hauling and marketing.....	2,985	59.70	.53
Hired, operator, and family labor.....	10,545	210.89	1.87
Management allowance.....	1,600	32.00	.28
Depreciation - buildings & improvements.	424	8.47	.08
- machinery & equipment....	805	16.09	.14
Herd replacement.....	2,336	46.71	.41
Interest (7%) - bldgs. & improvements...	957	19.14	.17
- mach. & equipment.....	511	10.21	.09
- land.....	139	2.78	.02
- cow herd.....	1,597	31.95	.28
- quota.....	599	11.99	.11
Bldg. & equip. repair, tax, & insurance.	1,220	24.40	.22
Tax & insurance on cows.....	266	5.33	.05
Total.....	\$42,165	\$ 843.26	\$ 7.48
NET DAIRY PROFIT.....	\$-3,058	\$ -61.13	\$ -.54

Table A-3. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>		
Coast region		Ave. cows in herd.....	50	
Small herd size		Total lbs. milk produced.....	563,300	
Pasture grazing system		B.F. test of milk.....	4.12	
Platform milking		Lbs. milk per cow.....	11,266	
Free-stall housing		Lbs. fat per cow.....	464.2	

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$18,185	\$ 363.69	\$ 3.22
Machinery & equipment.....	8,693	173.86	1.54
Land in corrals.....	1,988	39.76	.35
Cow herd.....	22,819	456.37	4.05
Market quota.....	8,562	171.24	1.52
Total.....	\$60,247	\$1,204.92	\$10.68
<u>Income</u>			
Value of milk produced.....	\$35,939	\$ 718.77	\$ 6.38
Value of calves and manure.....	3,168	63.36	.56
Total.....	\$39,107	\$ 782.13	\$ 6.94
<u>Expenses</u>			
Concentrates.....	\$ 6,422	\$ 128.43	\$ 1.14
Roughages.....	8,337	166.74	1.48
Operating expenses.....	3,252	65.03	.58
Hauling and marketing.....	2,985	59.70	.53
Hired, operator, and family labor.....	11,707	234.14	2.08
Management allowance.....	1,600	32.00	.28
Depreciation - buildings & improvements.	773	15.46	.14
- machinery & equipment....	1,124	22.48	.20
Herd replacement.....	2,336	46.71	.41
Interest (7%) - bldgs. & improvements...	1,273	25.46	.23
- mach. & equipment.....	609	12.17	.11
- land.....	139	2.78	.02
- cow herd.....	1,597	31.95	.28
- quota.....	599	11.99	.11
Bldg. & equip. repair, tax, & insurance.	1,565	31.29	.28
Tax & insurance on cows.....	266	5.33	.05
Total.....	\$44,584	\$ 891.66	\$ 7.92
NET DAIRY PROFIT.....	\$-5,477	\$ -109.53	\$ -.98

Table A-4. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>		
Coast region		Ave. cows in herd.....	115	
Large herd size		Total lbs. milk produced.....	1,136,660	
Pasture grazing system		B.F. test of milk.....	4.11	
Platform milking		Lbs. milk per cow.....	9,884	
Free-stall housing		Lbs. fat per cow.....	406.2	

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$ 38,313	\$ 333.16	\$ 3.37
Machinery & equipment.....	16,048	139.55	1.41
Land in corrals.....	3,163	27.50	.28
Cow herd.....	52,483	456.37	4.62
Market quota.....	17,278	150.24	1.52
Total.....	\$127,285	\$1,106.82	\$11.20
<u>Income</u>			
Value of milk produced.....	\$ 72,405	\$ 629.61	\$ 6.37
Value of calves and manure.....	7,286	63.36	.64
Total.....	\$ 79,691	\$ 692.97	\$ 7.01
<u>Expenses</u>			
Concentrates.....	\$ 12,958	\$ 112.68	\$ 1.14
Roughages.....	16,822	146.28	1.48
Operating expenses.....	7,478	65.03	.66
Hauling and marketing.....	5,164	44.90	.45
Hired, operator, and family labor.....	16,925	147.17	1.49
Management allowance.....	2,315	20.13	.20
Depreciation - buildings & improvements.	1,778	15.46	.16
- machinery & equipment....	2,231	19.40	.20
Herd replacement.....	5,372	46.71	.47
Interest (7%) - bldgs. & improvements...	2,682	23.32	.24
- mach. & equipment.....	1,124	9.77	.10
- land.....	222	1.93	.02
- cow herd.....	3,674	31.95	.32
- quota.....	1,209	10.52	.11
Bldg. & equip. repair, tax, & insurance.	3,164	27.51	.28
Tax & insurance on cows.....	613	5.33	.05
Total.....	\$ 83,731	\$ 728.09	\$ 7.37
NET DAIRY PROFIT.....	\$ -4,040	\$ -35.12	\$ -.36

Table A-5. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>		
Valley region		Ave. cows in herd.....	50	
Small herd size		Total lbs. milk produced.....	696,750	
Pasture grazing system		B.F. test of milk.....	3.78	
Stanchion milking		Lbs. milk per cow.....	13,935	
Loose housing		Lbs. fat per cow.....	526.7	

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$15,317	\$ 306.34	\$ 2.20
Machinery & equipment.....	5,787	115.74	.83
Land in corrals.....	2,727	54.53	.39
Cow herd.....	22,819	456.37	3.27
Market quota.....	<u>10,591</u>	<u>211.81</u>	<u>1.52</u>
Total.....	\$57,241	\$1,144.79	\$ 8.21
<u>Income</u>			
Value of milk produced.....	\$42,572	\$ 851.43	\$ 6.11
Value of calves and manure.....	<u>3,168</u>	<u>63.36</u>	<u>.45</u>
Total.....	\$45,740	\$ 914.79	\$ 6.56
<u>Expenses</u>			
Concentrates.....	\$ 9,058	\$ 181.16	\$ 1.30
Roughages.....	9,197	183.94	1.32
Operating expenses.....	3,422	68.43	.49
Hauling and marketing.....	2,968	59.36	.43
Hired, operator, and family labor.....	12,022	240.44	1.73
Management allowance.....	1,600	32.00	.23
Depreciation - buildings & improvements.	541	10.82	.08
- machinery & equipment....	357	7.13	.05
Herd replacement.....	2,336	46.71	.34
Interest (7%) - bldgs. & improvements...	1,072	21.44	.15
- mach. & equipment.....	405	8.10	.06
- land.....	191	3.82	.03
- cow herd.....	1,597	31.95	.23
- quota.....	741	14.83	.11
Bldg. & equip. repair, tax, & insurance.	1,229	24.57	.18
Tax & insurance on cows.....	<u>266</u>	<u>5.33</u>	<u>.04</u>
Total.....	\$47,002	\$ 940.03	\$ 6.77
NET DAIRY PROFIT.....	\$-1,262	\$ -25.24	\$ -.21

Table A-6. Summary of Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>		
Valley region		Ave. cows in herd.....	50	
Small herd size		Total lbs. milk produced.....	696,750	
Pasture grazing system		B.F. test of milk.....	3.78	
Stanchion milking		Lbs. milk per cow.....	13,935	
Free-stall housing		Lbs. fat per cow.....	526.7	

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$19,832	\$ 396.63	\$ 2.85
Machinery & equipment.....	7,191	143.81	1.03
Land in corrals.....	2,727	54.53	.39
Cow herd.....	22,819	456.37	3.27
Market quota.....	10,591	211.81	1.52
Total.....	\$63,160	\$1,263.15	\$ 9.06
<u>Income</u>			
Value of milk produced.....	\$42,572	\$ 851.43	\$ 6.11
Value of calves and manure.....	3,168	63.36	.45
Total.....	\$45,740	\$ 914.79	\$ 6.56
<u>Expenses</u>			
Concentrates.....	\$ 9,058	\$ 181.16	\$ 1.30
Roughages.....	9,197	183.94	1.32
Operating expenses.....	3,252	65.03	.47
Hauling and marketing.....	2,968	59.36	.43
Hired, operator, and family labor.....	13,185	263.70	1.89
Management allowance.....	1,600	32.00	.23
Depreciation - buildings & improvements.	891	17.82	.13
- machinery & equipment....	677	13.53	.10
Herd replacement.....	2,336	46.71	.34
Interest (7%) - bldgs. & improvements...	1,388	27.76	.20
- mach. & equipment.....	504	10.07	.07
- land.....	191	3.82	.03
- cow herd.....	1,597	31.95	.23
- quota.....	741	14.83	.11
Bldg. & equip. repair, tax, & insurance.	1,573	31.45	.23
Tax & insurance on cows.....	266	5.33	.04
Total.....	\$49,424	\$ 988.46	\$ 7.12
NET DAIRY PROFIT.....	\$-3,684	\$ -73.67	\$ -.56

Table A-7. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>		
Valley region		Ave. cows in herd.....	50	
Small herd size		Total lbs. milk produced.....	696,750	
Pasture grazing system		B.F. test of milk.....	3.78	
Platform milking		Lbs. milk per cow.....	13,935	
Loose housing		Lbs. fat per cow.....	526.7	

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$13,117	\$ 262.34	\$ 1.88
Machinery & equipment.....	5,787	115.74	.83
Land in corrals.....	2,727	54.53	.39
Cow herd.....	22,819	456.37	3.27
Market quota.....	<u>10,591</u>	<u>211.81</u>	<u>1.52</u>
Total.....	\$55,041	\$1,100.79	\$ 7.89
<u>Income</u>			
Value of milk produced.....	\$42,572	\$ 851.43	\$ 6.11
Value of calves and manure.....	<u>3,168</u>	<u>63.36</u>	<u>.45</u>
Total.....	\$45,740	\$ 914.79	\$ 6.56
<u>Expenses</u>			
Concentrates.....	\$ 9,058	\$ 181.16	\$ 1.30
Roughages.....	9,197	183.94	1.32
Operating expenses.....	3,422	68.43	.49
Hauling and marketing.....	2,968	59.36	.43
Hired, operator, and family labor.....	11,162	223.23	1.60
Management allowance.....	1,600	32.00	.23
Depreciation - buildings & improvements.	541	10.82	.08
- machinery & equipment....	641	12.81	.09
Herd replacement.....	2,336	46.71	.34
Interest (7%) - bldgs. & improvements...	918	18.36	.13
- mach. & equipment.....	405	8.10	.06
- land.....	191	3.82	.03
- cow herd.....	1,597	31.95	.23
- quota.....	741	14.83	.11
Bldg. & equip. repair, tax, & insurance.	1,100	22.00	.16
Tax & insurance on cows.....	<u>266</u>	<u>5.33</u>	<u>.04</u>
Total.....	\$46,143	\$ 922.85	\$ 6.64
NET DAIRY PROFIT.....	\$ -403	\$ -8.06	\$ -.08

Table A-8. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>	
Valley region		Ave. cows in herd.....	50
Small herd size		Total lbs. milk produced.....	696,750
Pasture grazing system		B.F. test of milk.....	3.78
Platform milking		Lbs. milk per cow.....	13,935
Free-stall housing		Lbs. fat per cow.....	526.7

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$17,632	\$ 352.64	\$2.53
Machinery & equipment.....	7,191	143.81	1.03
Land in corrals.....	2,727	54.53	.39
Cow herd.....	22,819	456.37	3.27
Market quota.....	<u>10,591</u>	<u>211.81</u>	<u>1.52</u>
Total.....	\$60,960	\$1,219.16	\$8.74
<u>Income</u>			
Value of milk produced.....	\$42,572	\$ 851.43	\$6.11
Value of calves and manure.....	<u>3,168</u>	<u>63.36</u>	<u>.45</u>
Total.....	\$45,740	\$ 914.79	\$6.56
<u>Expenses</u>			
Concentrates.....	\$ 9,058	\$ 181.16	\$1.30
Roughages.....	9,197	183.94	1.32
Operating expenses.....	3,252	65.03	.47
Hauling and marketing.....	2,968	59.36	.43
Hired, operator, and family labor.....	12,324	246.48	1.77
Management allowance.....	1,600	32.00	.23
Depreciation - buildings & improvements.	891	17.82	.13
- machinery & equipment....	960	19.20	.14
Herd replacement.....	2,336	46.71	.34
Interest (7%) - bldgs. & improvements...	1,234	24.68	.18
- mach. & equipment.....	504	10.07	.07
- land.....	191	3.82	.03
- cow herd.....	1,597	31.95	.23
- quota.....	741	14.83	.11
Bldg. & equip. repair, tax, & insurance.	1,445	28.89	.21
Tax & insurance on cows.....	<u>266</u>	<u>5.33</u>	<u>.04</u>
Total.....	\$48,564	\$ 971.27	\$7.00
NET DAIRY PROFIT.....	\$-2,824	\$ -56.48	\$-.44

Table A-9. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>	
Valley region		Ave. cows in herd.....	115
Large herd size		Total lbs. milk produced.....	1,434,510
Pasture grazing system		B.F. test of milk.....	3.78
Stanchion milking		Lbs. milk per cow.....	12,474
Free-stall housing		Lbs. fat per cow.....	471.5

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$ 27,919	\$ 242.77	\$1.95
Machinery & equipment.....	12,594	109.51	.88
Land in corrals.....	4,862	42.28	.34
Cow herd.....	52,483	456.37	3.66
Market quota.....	<u>21,804</u>	<u>189.60</u>	<u>1.52</u>
Total.....	\$119,662	\$1,040.53	\$8.35
<u>Income</u>			
Value of milk produced.....	\$ 87,648	\$ 762.16	\$6.11
Value of calves and manure.....	<u>7,286</u>	<u>63.36</u>	<u>.51</u>
Total.....	\$ 94,934	\$ 825.52	\$6.62
<u>Expenses</u>			
Concentrates.....	\$ 18,648	\$ 162.16	\$1.30
Roughages.....	18,936	164.66	1.32
Operating expenses.....	7,478	65.03	.52
Hauling and marketing.....	5,772	50.19	.40
Hired, operator, and family labor.....	19,083	165.94	1.33
Management allowance.....	2,315	20.13	.16
Depreciation - buildings & improvements.	2,049	17.82	.14
- machinery & equipment....	1,201	10.44	.08
Herd replacement.....	5,372	46.71	.37
Interest (7%) - bldgs. & improvements...	1,954	16.99	.14
- mach. & equipment.....	882	7.67	.06
- land.....	340	2.96	.02
- cow herd.....	3,674	31.95	.26
- quota.....	1,526	13.27	.11
Bldg. & equip. repair, tax, & insurance.	2,358	20.50	.16
Tax & insurance on cows.....	<u>613</u>	<u>5.33</u>	<u>.04</u>
Total.....	\$ 92,201	\$ 801.75	\$6.41
NET DAIRY PROFIT.....	\$ 2,733	\$ 23.77	\$.21

Table A-10. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>	
Valley region		Ave. cows in herd.....	115
Large herd size		Total lbs. milk produced.....	1,434,510
Pasture grazing system		B.F. test of milk.....	3.78
Platform milking		Lbs. milk per cow.....	12,474
Loose housing		Lbs. fat per cow.....	471.5

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$ 26,658	\$ 231.81	\$1.86
Machinery & equipment.....	9,366	81.44	.65
Land in corrals.....	4,862	42.28	.34
Cow herd.....	52,483	456.37	3.66
Market quota.....	<u>21,804</u>	<u>189.60</u>	<u>1.52</u>
Total.....	\$115,173	\$1,001.50	\$8.03
<u>Income</u>			
Value of milk produced.....	\$ 87,648	\$ 762.16	\$6.11
Value of calves and manure.....	<u>7,286</u>	<u>63.36</u>	<u>.51</u>
Total.....	\$ 94,934	\$ 825.52	\$6.62
<u>Expenses</u>			
Concentrates.....	\$ 18,648	\$ 162.16	\$1.30
Roughages.....	18,936	164.66	1.32
Operating expenses.....	7,869	68.43	.55
Hauling and marketing.....	5,772	50.19	.40
Hired, operator, and family labor.....	15,638	135.98	1.09
Management allowance.....	2,315	20.13	.16
Depreciation - buildings & improvements.	1,244	10.82	.08
- mach. & equipment.....	1,118	9.72	.08
Herd replacement.....	5,372	46.71	.37
Interest (7%) - bldgs. & improvements...	1,866	16.23	.13
- mach. & equipment.....	656	5.70	.05
- land.....	340	2.96	.02
- cow herd.....	3,674	31.95	.26
- quota.....	1,526	13.27	.11
Bldg. & equip. repair, tax, & insurance.	2,096	18.23	.15
Tax & insurance on cows.....	<u>613</u>	<u>5.33</u>	<u>.04</u>
Total.....	\$ 87,683	\$ 762.47	\$6.11
NET DAIRY PROFIT.....	\$ 7,251	\$ 63.05	\$.51

Table A-11. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>		
Valley region		Ave. cows in herd.....	115	
Large herd size		Total lbs. milk produced.....	1,434,510	
Pasture grazing system		B.F. test of milk.....	3.78	
Platform milking		Lbs. milk per cow.....	12,474	
Free-stall housing		Lbs. fat per cow.....	471.5	

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$ 37,042	\$ 322.10	\$2.58
Machinery & equipment.....	12,594	109.51	.88
Land in corrals.....	4,862	42.28	.34
Cow herd.....	52,483	456.37	3.66
Market quota.....	21,804	189.60	1.52
Total.....	\$128,785	\$1,119.86	\$8.98
<u>Income</u>			
Value of milk produced.....	\$ 87,648	\$ 762.16	\$6.11
Value of calves and manure.....	7,286	63.36	.51
Total.....	\$ 94,934	\$ 825.52	\$6.62
<u>Expenses</u>			
Concentrates.....	\$ 18,648	\$ 162.16	\$1.30
Roughages.....	18,936	164.66	1.32
Operating expenses.....	7,478	65.03	.52
Hauling and marketing.....	5,772	50.19	.40
Hired, operator, and family labor.....	18,311	159.23	1.28
Management allowance.....	2,315	20.13	.16
Depreciation - buildings & improvements.	2,049	17.82	.14
- machinery & equipment....	1,854	16.12	.13
Herd replacement.....	5,372	46.71	.37
Interest (7%) - bldgs. & improvements...	2,593	22.55	.18
- mach. & equipment.....	882	7.67	.06
- land.....	340	2.96	.03
- cow herd.....	3,674	31.95	.26
- quota.....	1,526	13.27	.11
Bldg. & equip. repair, tax, & insurance.	2,889	25.12	.20
Tax & insurance on cows.....	613	5.33	.04
Total.....	\$ 93,252	\$ 810.90	\$6.50
NET DAIRY PROFIT.....	\$ 1,682	\$ 14.62	\$.12

Table A-12. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>	
Valley region		Ave. cows in herd.....	115
Large herd size		Total lbs. milk produced.....	1,789,975
Drylot feeding system		B.F. test of milk.....	3.39
Platform milking		Lbs. milk per cow.....	15,565
Free-stall housing		Lbs. fat per cow.....	527.7

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$ 37,042	\$ 322.10	\$2.07
Machinery & equipment.....	17,733	154.20	.99
Land in corrals.....	4,862	42.28	.27
Cow herd.....	52,483	456.37	2.93
Market quota.....	<u>27,208</u>	<u>236.59</u>	<u>1.52</u>
Total.....	\$139,328	\$1,211.54	\$7.78
<u>Income</u>			
Value of milk produced.....	\$103,639	\$ 901.21	\$5.79
Value of calves and manure.....	<u>7,286</u>	<u>63.36</u>	<u>.41</u>
Total.....	\$110,925	\$ 964.57	\$6.20
<u>Expenses</u>			
Concentrates.....	\$ 29,177	\$ 253.71	\$1.63
Roughages.....	20,763	180.55	1.16
Operating expenses.....	7,478	65.03	.42
Hauling and marketing.....	7,123	61.94	.40
Hired, operator, and family labor.....	19,556	170.05	1.09
Management allowance.....	2,315	20.13	.13
Depreciation - buildings & improvements.	2,049	17.82	.11
- machinery & equipment....	1,854	16.12	.10
Herd replacement.....	5,372	46.71	.30
Interest (7%) - bldgs. & improvements...	2,593	22.55	.14
- mach. & equipment.....	1,241	10.79	.07
- land.....	340	2.96	.02
- cow herd.....	3,674	31.95	.21
- quota.....	1,905	16.56	.11
Bldg. & equip. repair, tax, & insurance.	3,190	27.74	.18
Tax & insurance on cows.....	<u>613</u>	<u>5.33</u>	<u>.03</u>
Total.....	\$109,243	\$ 949.94	\$6.10
NET DAIRY PROFIT.....	\$ 1,682	\$ 14.63	\$.10

Table A-13. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>		
S & E Region		Ave. cows in herd.....	50	
Small herd size		Total lbs. milk produced.....	630,550	
Pasture grazing system		B.F. test of milk.....	3.86	
Stanchion milking		Lbs. milk per cow.....	12,611	
Loose housing		Lbs. fat per cow.....	486.8	

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$11,607	\$ 232.13	\$1.84
Machinery & equipment.....	5,167	103.33	.82
Land in corrals.....	2,300	45.99	.36
Cow herd.....	22,819	456.37	3.62
Market quota.....	9,585	191.69	1.52
Total.....	\$51,478	\$1,029.51	\$8.16
<u>Income</u>			
Value of milk produced.....	\$38,905	\$ 778.10	\$6.17
Value of calves and manure.....	3,168	63.36	.50
Total.....	\$42,073	\$ 841.46	\$6.67
<u>Expenses</u>			
Concentrates.....	\$ 6,936	\$ 138.72	\$1.10
Roughages.....	10,467	209.34	1.66
Operating expenses.....	3,422	68.43	.54
Hauling and marketing.....	3,743	74.86	.59
Hired, operator, and family labor.....	10,436	208.72	1.66
Management allowance.....	1,600	32.00	.25
Depreciation - buildings & improvements.	228	4.55	.04
- machinery & equipment....	212	4.23	.03
Herd replacement.....	2,336	46.71	.37
Interest (7%) - bldgs. & improvements...	813	16.25	.13
- mach. & equipment.....	362	7.23	.06
- land.....	161	3.22	.03
- cow herd.....	1,597	31.95	.25
- quota.....	671	13.42	.11
Bldg. & equip. repair, tax, & insurance.	977	19.54	.15
Tax & insurance on cows.....	266	5.33	.04
Total.....	\$44,227	\$ 884.50	\$7.01
NET DAIRY PROFIT.....	\$-2,154	\$ -43.04	\$-.34

Table A-14. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>		
S & E Region		Ave. cows in herd.....	50	
Small herd size		Total lbs. milk produced.....	630,550	
Pasture grazing system		B.F. test of milk.....	3.86	
Platform milking		Lbs. milk per cow.....	12,611	
Loose housing		Lbs. fat per cow.....	486.8	

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$ 9,407	\$188.13	\$1.49
Machinery & equipment.....	5,167	103.33	.82
Land in corrals.....	2,300	45.99	.36
Cow herd.....	22,819	456.37	3.62
Market quota.....	<u>9,585</u>	<u>191.69</u>	<u>1.52</u>
Total.....	\$49,278	\$985.51	\$7.81
<u>Income</u>			
Value of milk produced.....	\$38,905	\$778.10	\$6.17
Value of calves and manure.....	<u>3,168</u>	<u>63.36</u>	<u>.50</u>
Total.....	\$42,073	\$841.46	\$6.67
<u>Expenses</u>			
Concentrates.....	\$ 6,936	\$138.72	\$1.10
Roughages.....	10,467	209.34	1.66
Operating expenses.....	3,422	68.43	.54
Hauling and marketing.....	3,743	74.86	.60
Hired, operator, and family labor.....	9,575	191.50	1.52
Management allowance.....	1,600	32.00	.25
Depreciation - buildings & improvements.	228	4.55	.04
- machinery & equipment....	495	9.90	.08
Herd replacement.....	2,336	46.71	.37
Interest (7%) - bldgs. & improvements...	658	13.17	.10
- mach. & equipment.....	362	7.23	.06
- land.....	161	3.22	.03
- cow herd.....	1,597	31.95	.25
- quota.....	671	13.42	.11
Bldg. & equip. repair, tax, & insurance.	849	16.97	.13
Tax & insurance on cows.....	<u>267</u>	<u>5.33</u>	<u>.04</u>
Total.....	\$43,367	\$867.30	\$6.88
NET DAIRY PROFIT.....	\$-1,294	\$-25.84	\$-.21

Table A-15. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>	
S & E region		Ave. cows in herd.....	50
Small herd size		Total lbs. milk produced.....	630,550
Pasture grazing system		B.F. test of milk.....	3.86
Platform milking		Lbs. milk per cow.....	12,611
Free-stall housing		Lbs. fat per cow.....	486.8

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$13,921	\$ 278.42	\$2.20
Machinery & equipment.....	6,570	131.40	1.04
Land in corrals.....	2,300	45.99	.36
Cow herd.....	22,819	456.37	3.62
Market quota.....	9,585	191.69	1.52
Total.....	\$55,195	\$1,103.87	\$8.74
<u>Income</u>			
Value of milk produced.....	\$38,905	\$ 778.10	\$6.17
Value of calves and manure.....	3,168	63.36	.50
Total.....	\$42,073	\$ 841.46	\$6.67
<u>Expenses</u>			
Concentrates.....	\$ 6,936	\$ 138.72	\$1.10
Roughages.....	10,467	209.34	1.66
Operating expenses.....	3,252	65.03	.52
Hauling and marketing.....	3,743	74.86	.59
Hired, operator, and family labor.....	10,738	214.75	1.70
Management allowance.....	1,600	32.00	.25
Depreciation - buildings & improvements.....	578	11.55	.09
- machinery & equipment....	815	16.30	.13
Herd replacement.....	2,336	46.71	.37
Interest (7%) - bldgs. & improvements...	975	19.49	.15
- mach. & equipment.....	460	9.20	.07
- land.....	161	3.22	.03
- cow herd.....	1,597	31.95	.25
- quota.....	671	13.42	.11
Bldg. & equip. repair, tax, & insurance.	1,193	23.85	.19
Tax & insurance on cows.....	266	5.33	.04
Total.....	\$45,788	\$ 915.72	\$7.25
NET DAIRY PROFIT.....	\$-3,715	\$ -74.26	\$-.58

Table A-16. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>		
S & E region		Ave. cows in herd.....	115	
Large herd size		Total lbs. milk produced.....	1,285,010	
Pasture grazing system		B.F. test of milk.....	3.86	
Platform milking		Lbs. milk per cow.....	11,174	
Loose housing		Lbs. fat per cow.....	431.3	

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$ 18,124	\$157.60	\$1.41
Machinery & equipment.....	7,940	69.04	.62
Land in corrals.....	3,879	33.73	.30
Cow herd.....	52,483	456.37	4.08
Market quota.....	<u>19,532</u>	<u>169.84</u>	<u>1.52</u>
Total.....	\$101,958	\$886.58	\$7.93
<u>Income</u>			
Value of milk produced.....	\$ 79,286	\$689.44	\$6.17
Value of calves and manure.....	<u>7,286</u>	<u>63.36</u>	<u>.57</u>
Total.....	\$ 86,572	\$752.80	\$6.74
<u>Expenses</u>			
Concentrates.....	\$ 14,135	\$122.91	\$1.10
Roughages.....	21,331	185.49	1.66
Operating expenses.....	7,869	68.43	.61
Hauling and marketing.....	6,230	54.17	.49
Hired, operator, and family labor.....	11,999	104.34	.93
Management allowance.....	2,315	20.13	.18
Depreciation - buildings & improvements.	523	4.55	.04
- machinery & equipment....	784	6.82	.06
Herd replacement.....	5,372	46.71	.42
Interest (7%) - bldgs. & improvements...	1,268	11.03	.10
- mach. & equipment.....	555	4.83	.04
- land.....	271	2.36	.02
- cow herd.....	3,674	31.95	.29
- quota.....	1,367	11.89	.11
Bldg. & equip. repair, tax, & insurance.	1,517	13.19	.12
Tax & insurance on cows.....	<u>613</u>	<u>5.33</u>	<u>.05</u>
Total.....	\$ 79,823	\$694.13	\$6.22
NET DAIRY PROFIT.....	\$ 6,749	\$ 58.67	\$.52

Table A-17. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>	
S & E region		Ave. cows in herd.....	115
Large herd size		Total lbs. milk produced.....	1,285,010
Pasture grazing system		B.F. test of milk.....	3.86
Platform milking		Lbs. milk per cow.....	11,174
Free-stall housing		Lbs. fat per cow.....	431.3

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$ 28,507	\$ 247.89	\$2.22
Machinery & equipment.....	11,168	97.11	.87
Land in corrals.....	3,879	33.73	.30
Cow herd.....	52,483	456.37	4.08
Market quota.....	19,532	169.84	1.52
Total.....	\$115,569	\$1,004.94	\$8.99
<u>Income</u>			
Value of milk produced.....	\$ 79,286	\$ 689.44	\$6.17
Value of calves and manure.....	7,286	63.36	.57
Total.....	\$ 86,572	\$ 752.80	\$6.74
<u>Expenses</u>			
Concentrates.....	\$ 14,135	\$ 122.91	\$1.10
Roughages.....	21,331	185.49	1.66
Operating expenses.....	7,478	65.03	.58
Hauling and marketing.....	6,230	54.17	.48
Hired, operator, and family labor.....	14,673	127.59	1.14
Management allowance.....	2,315	20.13	.18
Depreciation - buildings & improvements.	1,328	11.55	.10
- machinery & equipment....	1,519	13.21	.12
Herd replacement.....	5,372	46.71	.42
Interest (7%) - bldgs. & improvements...	1,995	17.35	.16
- mach. & equipment.....	782	6.80	.06
- land.....	271	2.36	.02
- cow herd.....	3,674	31.95	.29
- quota.....	1,367	11.89	.11
Bldg. & equip. repair, tax, & insurance.	2,309	20.08	.18
Tax & insurance on cows.....	613	5.33	.05
Total.....	\$ 85,392	\$ 742.55	\$6.65
NET DAIRY PROFIT.....	\$ 1,180	\$ 10.25	\$.09

Table A-18. Budget Summary for a Grade A Milk Production Enterprise,
Oregon Milk Marketing Area One, 1971

<u>System Assumptions</u>		<u>General Information</u>		
S & E region		Ave. cows in herd.....		115
Large herd size		Total lbs. milk produced.....	1,604,710	
Drylot feeding system		B.F. test of milk.....		3.49
Platform milking		Lbs. milk per cow.....	13,954	
Free-stall housing		Lbs. fat per cow.....	487.0	

Item	Total per herd	Per dairy cow	Per cwt. milk
<u>Investment</u>			
Buildings & improvements.....	\$ 28,507	\$ 247.89	\$1.78
Machinery & equipment.....	16,306	141.79	1.02
Land in corrals.....	3,879	33.73	.24
Cow herd.....	52,483	456.37	3.27
Market quota.....	24,392	212.10	1.52
Total.....	\$125,567	\$1,091.88	\$7.83
<u>Income</u>			
Value of milk produced.....	\$ 94,197	\$ 819.10	\$5.87
Value of calves and manure.....	7,286	63.36	.45
Total.....	\$101,483	\$ 882.46	\$6.32
<u>Expenses</u>			
Concentrates.....	\$ 22,947	\$ 199.54	\$1.43
Roughages.....	24,071	209.31	1.50
Operating expenses.....	7,478	65.03	.47
Hauling and marketing.....	7,445	64.74	.46
Hired, operator, and family labor.....	15,792	137.32	.98
Management allowance.....	2,315	20.13	.14
Depreciation - buildings & improvements.	1,328	11.55	.08
- machinery & equipment....	1,519	13.21	.09
Herd replacement.....	5,372	46.71	.33
Interest (7%) - bldgs. & improvements...	1,995	17.35	.12
- mach. & equipment.....	1,141	9.93	.07
- land.....	271	2.36	.02
- cow herd.....	3,674	31.95	.23
- quota.....	1,707	14.85	.11
Bldg. & equip. repair, tax, & insurance.	2,610	22.69	.16
Tax & insurance on cows.....	613	5.33	.04
Total.....	\$100,278	\$ 872.00	\$6.23
NET DAIRY PROFIT.....	\$ 1,205	\$ 10.46	\$.09

APPENDIX B

TECHNICAL ASPECTS

APPENDIX B: TECHNICAL ASPECTS

Sample Determination

A total population of 588 dairy enterprises was identified, consisting of 18 subpopulations as indicated in Table 3. The total sample size of 63 was allocated among the subpopulations so as to equate the finite population correction factors: 1/

$$F = \sqrt{(N-n)/(N-1)} \quad ;$$

where

F is the correction factor,
N is the size of the subpopulation, and
n is the size of the sample.

The result of this procedure was that the smaller subpopulations were sampled in larger proportions than the larger subpopulations. For example, 13 percent of the enterprises were sampled where the subpopulation contained a total of 15. With the largest subpopulation of 127, 9 percent were sampled. The number of enterprises sampled in each subpopulation is reported in Table 3.

For each subpopulation the sample of dairymen was drawn at random for interview. To assure that the sample for each subpopulation would represent a range in herd size, each subpopulation was arrayed into a number of strata equal to the sample size. One interviewee and an alternate were drawn from each stratum.

Regression Analysis

The regression coefficients used to project the synthesized budgets presented in Appendix A and to compare the alternative production systems are reported in Table B-2. The data used to measure the variables and estimate the coefficients were the individual observations taken from the sample dairy enterprises. The definitions of the variables are given in Table B-1.

All except the first four equations (Table B-2) were estimated, using the "ordinary least squares" (OLS) method. Because milk production and butterfat test (also roughage cost and concentrate cost) are mutually determined or endogenous variables, their direct inclusion in the regression models as independent variables would tend to bias the coefficients. To avoid this possibility, the method of "two-stage least squares" (TSLS) was used, rather than OLS which was used to estimate the other equations. 2/ The TSLS method for this study involved

1/ Taro Yamane, Statistics: An Introductory Analysis, 2nd ed., Harper and Row, Publishers, New York, 1967, p. 161.

2/ J. Johnston, Econometric Methods, McGraw-Hill Book Company, Inc., New York, 1963, pp. 258-260.

regressing the endogenous variables on the exogenous variables and their interactions, using OLS. The exogenous variables were herd size, herd size squared, location variables, and production system variables. Then the predicted values from this first-stage equation were used as independent variables in the second-stage equations presented in Table B-2. The TSLS method was similarly applied to the roughage and concentrate cost equations.

Budget Projection

The budgets in Appendix A were projected from the regression coefficients (Table B-2) and other variable values (Table B-3) given the size, location, and production systems for the synthesized enterprise. The initial step was the simultaneous solution of the first four equations in Table B-2 to determine the milk production, butterfat test, concentrate cost, and roughage cost for the budget. With these values calculated, the remaining cost and return items were determined to complete the budget.

Table B-1. Definition of Variables Used in Synthesis of Budgets for Alternative Milk Production Systems

Variable number	Description	Variable number	Description
1	Milk production (lbs/cow)	20	Herd size squared (herd size x herd size)
2	Butterfat production (% of milk)	21	Coast location (1 = Coast, 0 = Valley or S & E)
3	Predicted milk production (lbs/cow) ^{a/}	22	S & E location (1 = S & E, 0 = Valley or Coast)
4	Predicted B.F. production (% of milk) ^{a/}	23	Feeding system (1 = Drylot, 0 = Pasture)
5	Concentrate cost (\$/cwt. milk)	24	Milking system (1 = Platform, 0 = Stanchion)
6	Roughage cost (\$/cwt. milk)	25	Housing system (1 = Free-stall, 0 = Loose)
7	Concentrate cost (\$/cow)	26	Milk production (lbs/farm)
8	Roughage cost (\$/cow)	27	Interaction term (herd size x milking system)
9	Predicted concentrate cost (\$/cwt. milk) ^{a/}	28	Interaction term (size squared x milking system)
10	Predicted roughage cost (\$/cwt. milk) ^{a/}	29	Quota milk sales (% of production)
11	Milk value (\$/cwt. produced)	30	Quota investment (\$/cwt. quota milk)
12	Marketing cost (\$/farm)	31	Cow herd investment (\$/cow)
13	Labor cost (\$/cow)	32	Calf and manure value (\$/cow)
14	Land investment (\$/cow)	33	Operating expenses - loose (\$/cow)
15	Building investment (\$/cow)	34	Operating expenses - free-stall (\$/cow)
16	Equipment investment (\$/cow)	35	Herd replacement (\$/cow)
17	Building depreciation (\$/cow)	36	Bldg. & equip. repair, tax & insur. (% of invest.)
18	Equipment depreciation (\$/cow)	37	Tax & insurance on cows (\$/cow)
19	Herd size (number of cows)		

^{a/} These are the predicted values from first-stage equations made up of the exogenous variables, i.e., herd size, herd size squared, location, and production systems, which influence milk production, B.F. test, concentrate, and roughage cost.

Table B-2. Regression Coefficients, "t" Values, and R²'s for Equations Used in Synthesis of Budgets for Alternative Milk Production Systems

Dependent variable	R ² (%)	Constant	Independent variables ^{a/}				
			1	2	3	4	7
1 Milk production (lbs/cow).....	61.5	26290.4060 (6.3173)				-3744.3358 (4.5491)	18.2083 (3.6853)
2 Butterfat production (% of milk) ..	47.1	6.1682 (1.9005)			-0.00011 (3.8348)		
5 Concentrate cost (\$/cwt. milk)....	21.3	2.0259 (3.4018)		0.2597 (2.1366)			
6 Roughage cost (\$/cwt. milk).....	21.9	1.1048 (2.6049)		0.1612 (1.9723)			
11 Milk value (\$/cwt. produced).....	98.2	2.0149 (22.8623)		0.7990 (56.0460)			
12 Marketing cost (\$/farm).....	87.6	320.6922 (1.3195)					
13 Labor cost (\$/cow).....	52.9	262.9369 (7.0280)	0.0035 (1.3052)				
14 Land investment (\$/cow).....	14.2	63.9643 (8.3438)					
15 Building investment (\$/cow).....	17.8	424.7033 (4.5149)					
16 Equipment investment (\$/cow).....	21.0	142.1302 (7.4004)					
17 Building depreciation (\$/cow).....	25.5	10.8228 (4.7059)					
18 Equipment depreciation (\$/cow)....	33.8	9.5067 (3.7705)					

Continued

Table B-2. (Continued)

Dependent variable	Independent variables					
	8	9	10	19	20	21 22
1 Milk production (lbs/cow).....				-35.3259 (2.4026)	0.1080 (2.0145)	-423.8742 (0.7424) -266.7784 (0.5259)
2 Butterfat production (% of milk).	-0.0028 (1.9392)			-0.0084 (2.8513)	0.00003 (2.9600)	
5 Concentrate cost (\$/cwt. milk)...			-1.2909 (2.1689)			-0.0431 (0.3189) 0.2154 (0.9836)
6 Roughage cost (\$/cwt. milk).....		-0.3019 (1.3124)				0.0578 (0.4910) 0.2639 (2.5291)
11 Milk value (\$/cwt. produced).....						-0.0648 ^{b/} (4.0880)
12 Marketing cost (\$/farm).....						523.7035 (1.9132) 1026.3038 (4.1337)
13 Labor cost (\$/cow).....				-1.4253 (3.7304)		-2.9941 (0.1778) -27.0936 (1.8026)
14 Land investment (\$/cow).....				-0.1886 (2.5643)		-14.7715 (1.6234) -8.5466 (1.0303)
15 Building investment (\$/cow).....				-2.3672 (1.5154)		11.0534 (0.2253) -74.2120 (1.5985)
16 Equipment investment (\$/cow).....				-0.5278 (3.0389)		30.0493 (1.5431) -12.4143 (0.6796)
17 Building depreciation (\$/cow)....						-2.3537 (0.8712) -6.2703 (2.4604)
18 Equipment depreciation (\$/cow)...				-0.0475 (2.3024)		3.2815 (1.3937) -2.9038 (1.3054)

Continued

Table B-2. (Continued)

Dependent variable	Independent variables						
	23	24	25	26	27	28	29
1 Milk production (lbs/cow).....							
2 Butterfat production (% of milk).....							
5 Concentrate cost (\$/cwt. milk).....	0.2179 (1.4490)						
6 Roughage cost (\$/cwt. milk).....							
11 Milk value (\$/cwt. produced).....							0.0153 (19.1910)
12 Marketing cost (\$/farm).....				0.0038 (20.1236)			
13 Labor cost (\$/cow).....			23.2511 (1.5113)		-0.5643 (2.1002)	0.0044 (3.5762)	
14 Land investment (\$/cow).....							
15 Building investment (\$/cow).....		-138.8772 (1.3721)	90.2943 (1.9763)		1.8975 (1.1775)		
16 Equipment investment (\$/cow).....	44.6947 (1.6649)		28.0721 (1.5607)				
17 Building depreciation (\$/cow).....			6.9927 (2.9435)				
18 Equipment depreciation (\$/cow).....		5.6754 (2.4428)	6.3957 (2.9216)				

a/ The definitions of all the variables used in the study are indicated in Table B-1.

b/ This result is explained by the differential in the price received by some of the Southern Washington producers. This value was assumed to be zero for projecting the prices in the budget summaries.

Table B-3. Other Variable Values Used in Synthesis of Budgets for
Alternative Milk Production Systems a/

Variable	Value used
29 Quota milk sales (% of production).....	70.000 ^{b/}
30 Quota investment (\$/cwt. quota milk).....	2.171
31 Cow herd investment (\$/cow).....	456.367
32 Calf and manure value (\$/cow).....	63.361
33 Operating expenses - loose (\$/cow).....	68.428 ^{c/}
34 Operating expenses - free-stall (\$/cow).....	65.028 ^{d/}
35 Herd replacement (\$/cow).....	46.713
36 Building and equipment repair, tax & insurance (% of investment).....	5.824
37 Tax & insurance on cows (\$/cow).....	5.331

a/ The unweighted mean values were used for all variables except where otherwise noted.

b/ Assumed value approximately equal to the mean.

c/ Calculated by adding to the average operating cost per cow one-half the difference in bedding costs per cow for loose and free-stall housing systems.

d/ Calculated by subtracting from the average operating cost per cow one-half the difference in bedding costs per cow for loose and free-stall housing systems.