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# **EFFECTS OF CHANGING MILK AND FEED PRICES ON MANAGEMENT PRACTICES AND INCOMES**

## **New York Dairy Farms 1974-1978**

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## Foreward

This publication is part of a study supported by a special grant to the Agricultural Experiment Station at Cornell University by Agway Inc. of Syracuse, New York.

Data used in this study came from three sources; New York Crop Reporting Service monthly releases, Dairy Herd Improvement (DHI) records, and Cornell Farm Business Management Project records. Information for the years 1974 through 1978 was used in the analysis.

Martin L. Young, a Senior in The College of Agriculture and Life Sciences, Cornell University and Social Sciences Honors Program Candidate, conducted the study under the supervision of C. A. Bratton, Professor Emeritus in the Department of Agricultural Economics.

The author wishes to acknowledge the encouragement given by Dr. L. S. Mix of Agway Inc. to pursue the investigation of the effects of changes in milk and feed prices on management practices and incomes on dairy farms.

## Introduction

Dairy farmers experience large fluctuations in prices paid and received. Inflation, uncertainty in the amount of milk produced, weather, and other factors combine to suggest that price fluctuations will continue to be an important issue for dairy farmers and related businesses. The average price received for milk increased 25 percent from 1974 to 1978 while the index of prices paid by New York farmers increased 28 percent. Feed prices fluctuated during this time period but there was virtually no increase in the 1978 average price over the 1974 average price, there was a six percent difference between the high and low years.

Average labor and management incomes did not increase substantially during this period but the variation in incomes among farms increased. This led some farmers to leave the business but relatively few of the farms went out of production. Generally, they have either been operated by a more efficient manager or combined with another farm to create a more efficient farm unit. A certain level of turnover in farm operators helps maintain an efficient agriculture by allowing new farmers to enter the business and allow existing farms to expand and utilize new technologies.

There is little that an individual farmer can do about the price received for milk and the price paid for grain but he or she does have control over feeding practices in their herd. Grain feeding is more profitable during some time periods than others. Successful managers collect and analyze price information and make feeding decisions based on this information. Correct decisions on feeding practices offer significant potential for increasing income.

### Purpose of the Study

The purpose of this study was to observe and quantify the effects of changing milk and feed prices and the resulting milk-feed price ratios on labor and management incomes, concentrates fed per cow, concentrates fed per pound of milk produced, and other management practices. A secondary purpose was to observe the differences in these same variables by herd size, production level and management income level.

Farm managers can use this information in deciding on adjustments in feeding levels with changing prices. Agribusinesses, farm organizations, and other policy makers should find this information valuable when grappling with the effect of changing prices on quantities of grain fed, milk produced, and farm incomes.

### Research Objectives

To observe the effects of changing feed and milk prices on management practices and farm operator incomes the following research objectives were established:

1. Analyze and graph monthly data on milk price, feed price, milk-feed price ratio, pounds of grain fed, milk produced, and resulting ratios using New York State Crop Reporting Service information for the years 1974 through 1978.
2. Determine the impact of changes in the milk price, concentrate price and the resulting ratio on management factors and income using merged New York Farm Business and Dairy Herd Improvement records for 1974 to 1978.
3. Observe the effect of size of herd on response to changing prices by dividing the sample data into seven herd size groups and generating mean values for management factors and income for each group.
4. Observe the effects of production level on response to changing prices by dividing the sample into eight production levels and generating mean values for income and management factors at each production level.
5. Observe how different levels of management ability, as measured by labor and management income, respond to changing prices by dividing the sample into five income levels and generating mean values for management factors and income for each labor and management income level.
6. Develop useful measures of the sensitivity of management factors to changing milk and feed prices.

### Methodology

Data on monthly feed price, milk price, milk-feed price ratio, daily milk production per cow, and daily grain feeding was obtained from the monthly New York Crop Reporting Service publications. The milk price was for average test milk from all locations. The feed price was for a 16 percent protein dairy ration. Other factors were calculated from these data and then all the information was graphed.

Studies on dairy management practices and New York dairy farm incomes for the years 1974 through 1978 have been made by the Department of Agricultural Economics at Cornell University. Individual farm business records and dairy herd improvement records were merged on computer tape in these studies. These data were sorted into various groups and means generated by computer. The results of these studies were published in A.E. Res. 77-20, A.E. Res. 78-19, A.E. Res. 79-5, and A.E. Res. 80-1. These published data and one additional computer sort for the years 1975 through 1978 of the same raw data comprise the data base for this analysis.

Analysis of the Economic Environment

The general economic environment has a major impact on dairy farmers. The Consumer Price Index (CPI) rose at a relatively constant rate from 1974 through 1977 and then increased at a faster rate in 1978 (Figure 1). The prices paid index for farm inputs ran parallel to and about 20 points above the CPI. However, the prices paid index was more variable than the CPI with small periodic increases and decreases above the trend.

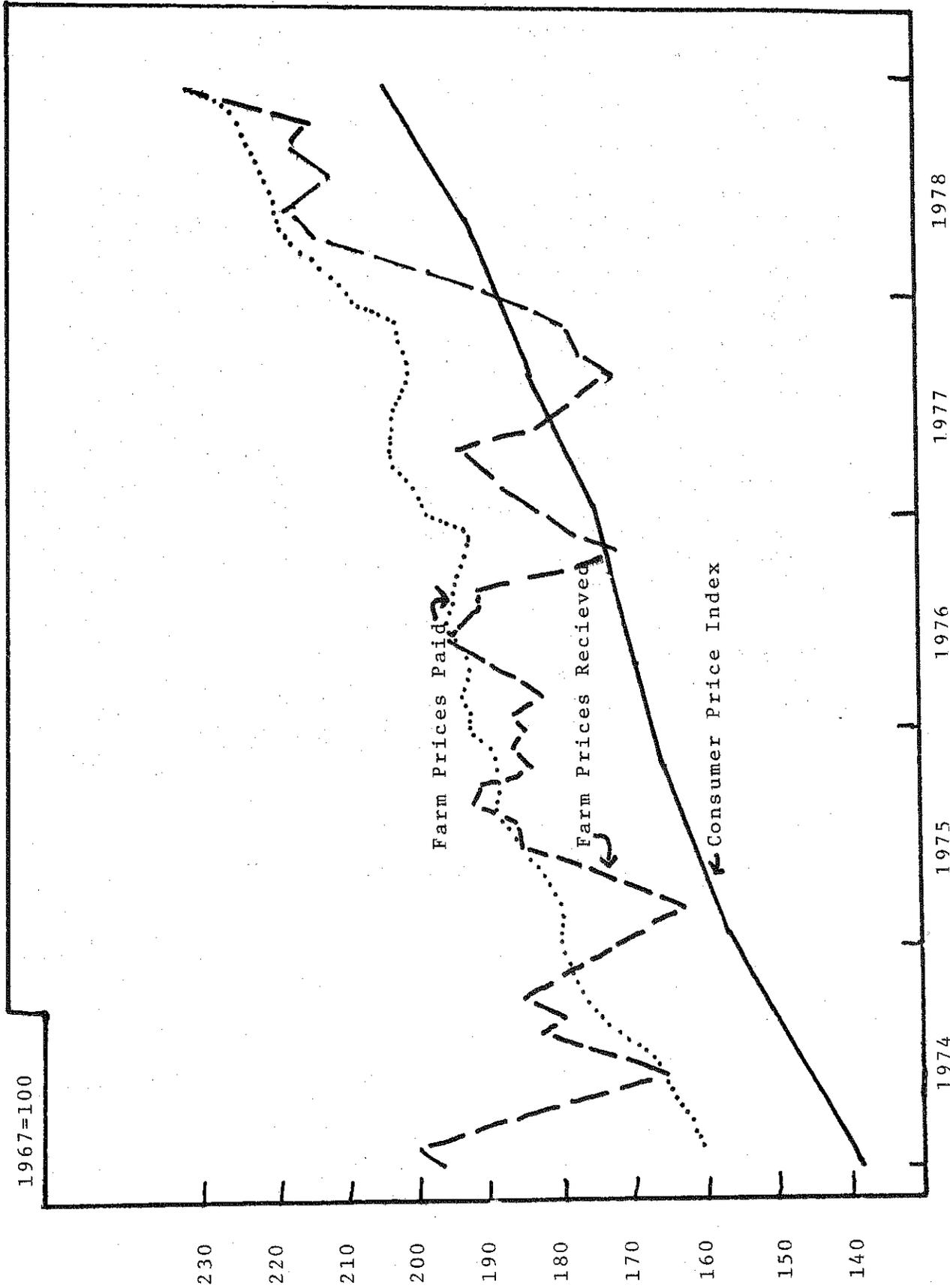
The prices received index for farm products was volatile with frequent sharp increases and decreases. The trend for this index from 1974 through 1977 was to remain at a rather constant level. In 1978 this index increased 46 points, or 25 percent. The prices received index was generally below the prices paid index for all but the beginning of 1974. However, both farm indexes were above the CPI during all five years except for a short period in 1977 when prices received were below the CPI. The prices paid index is influenced to a small degree by the prices received index since some items, like grain, are both an output and input for agriculture.

Over the five years 1974 through 1978 the feed price varied considerably but there was no long term upward trend (Figure 2). During this same period, milk prices increased substantially with large seasonal variations. Consequently, the milk-feed price ratio trended upward with wide seasonal swings. Generally, the milk price had a greater effect on the milk-feed price ratio than the feed price.

As the milk-feed price ratio increased over the five-year period, the pounds of milk produced per pound of grain sold decreased (Figure 3). These two factors were inversely related. When one factor peaked the other factor bottomed out. The high milk-feed price ratio certainly altered this relationship to decrease seasonal differences.

The grain expense as a percent of milk receipts  $[(\text{pounds grain fed} \times \text{grain price per pound}) \div (\text{pounds milk produced} \times \text{milk price per pound})]$  was variable, and had an inverse correlation with the milk-feed price ratio (Figure 4). As the milk-feed price ratio increased over the five years the feed expense as a percent of milk receipts decreased.

Figure 1.  
Indices of Consumer Prices, Farm Prices Paid, and Farm Prices Received  
United States 1974-1978



1978

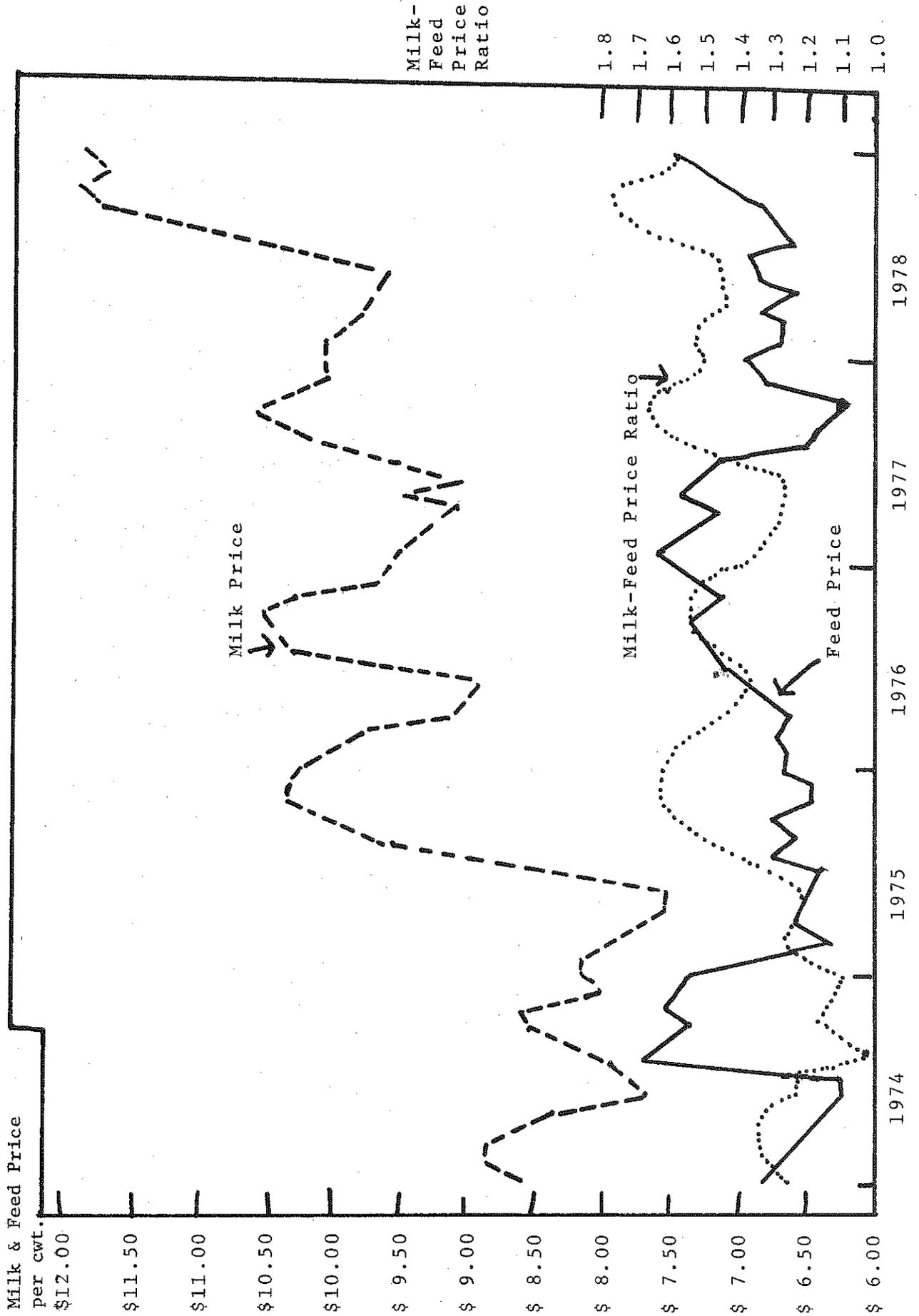
1977

1976

1975

1974

Figure 2.  
New York Milk Price Received by Farmer, Feed Price, and Milk-Feed Price Ratio  
1974-1978



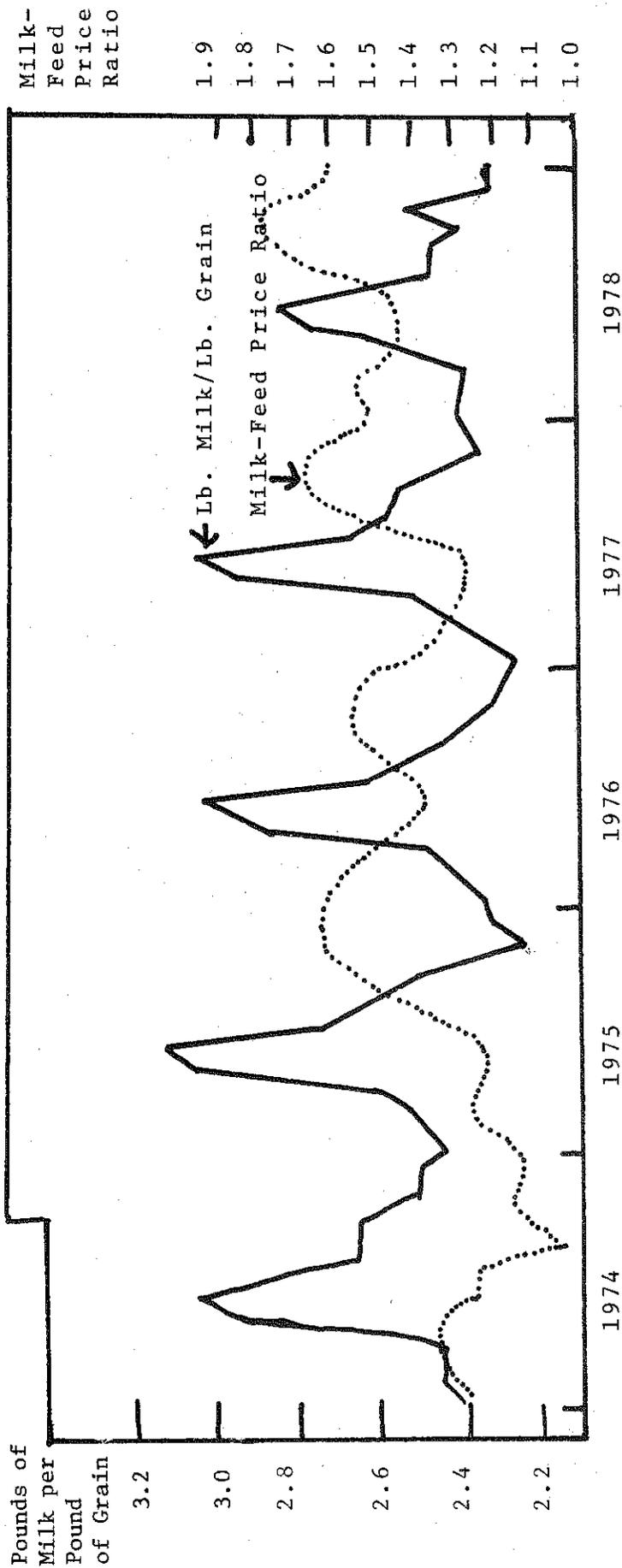


Figure 3.

Milk-Feed Price Ratio and Pounds of Milk Produced per Pound of Grain Fed  
New York Dairy Farms 1974-1978

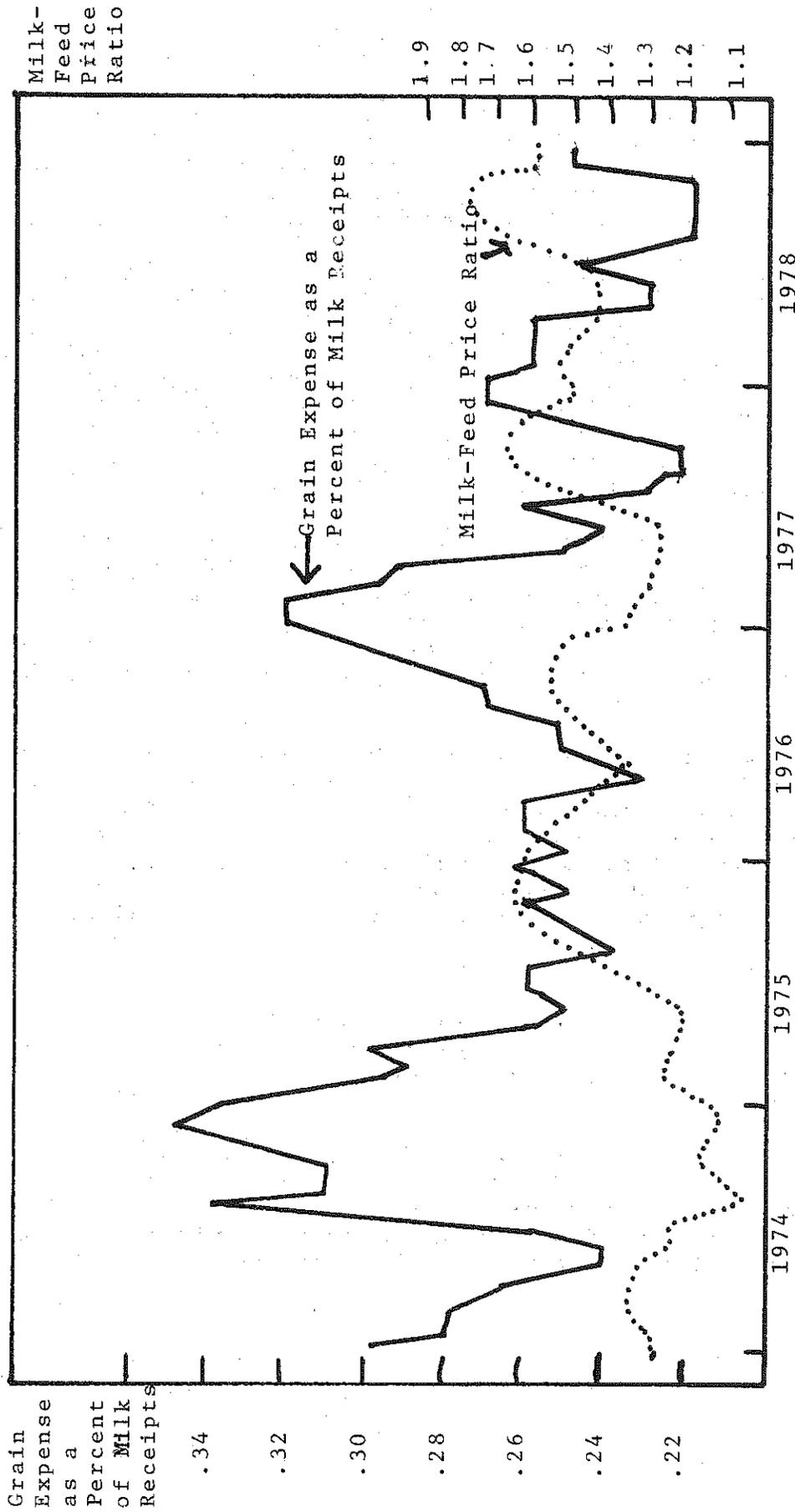


Figure 4.  
Milk-Feed Price Ratio and Grain Expense as a Percent of Milk Receipts  
New York Dairy Farms 1974-1978

### Seasonal Variation

Although milk is produced and consumed throughout the year the industry is subject to significant seasonal variation. This can be attributed to three factors. The major factor affecting milk price is the seasonal increase in total milk production which peaks in May and June. A decrease in consumption during the summer also depresses the price during this period. Feed prices are also seasonal in nature. The feed does not always follow the theoretical pattern of harvest price plus storage cost equals current month's price. For the period 1974 through 1978 the five-year average monthly feed price was highest during the harvest period of August through January and lowest March through July. For each of the individual years, the highest feed price was during the period of October through February and the low during the period of April through October. This points out that this unexpected price relationship for the five-year average was not entirely due to the high price of feed in the second half of 1974 (Figure 5).

For the period studied the milk price and the milk-feed price ratio were lowest in June and highest in October. In general, the milk-feed price ratio closely followed the milk price but was somewhat lower. The milk-feed price ratio was lowest in June when the most milk was produced per day and highest in October when production was close to its average annual low of November (Figure 6). These two factors appear to have had definite inverse relationships.

More grain was fed per cow during the first half of the year when the milk-feed price ratio was lower than in the second half of the year when milk-feed price ratio was higher (Figure 7). This may seem illogical but more milk was produced in the first half of the year due to the freshening pattern and farmers feed more grain at the beginning of a lactation than at the end. Figure 8 clarifies this point and shows the inverse relationship between milk-feed price ratio and pounds of milk sold per pound of grain fed. This suggests that feeding decisions were influenced by price.

The seasonal patterns for milk production and grain feeding on a per cow basis were similar, both were high in the spring and low in the fall. However, there was a two month lag between grain feeding and milk production (Figure 9).

Both the milk-feed price ratio and the feed expense as a percent of milk sales declined during the first half of the year (Figure 10). Logically, these two factors should be inversely related. However, the high volume of milk produced and lower milk production per pound of grain fed during the low point in milk-feed price ratios outweighs the effect of lower prices.

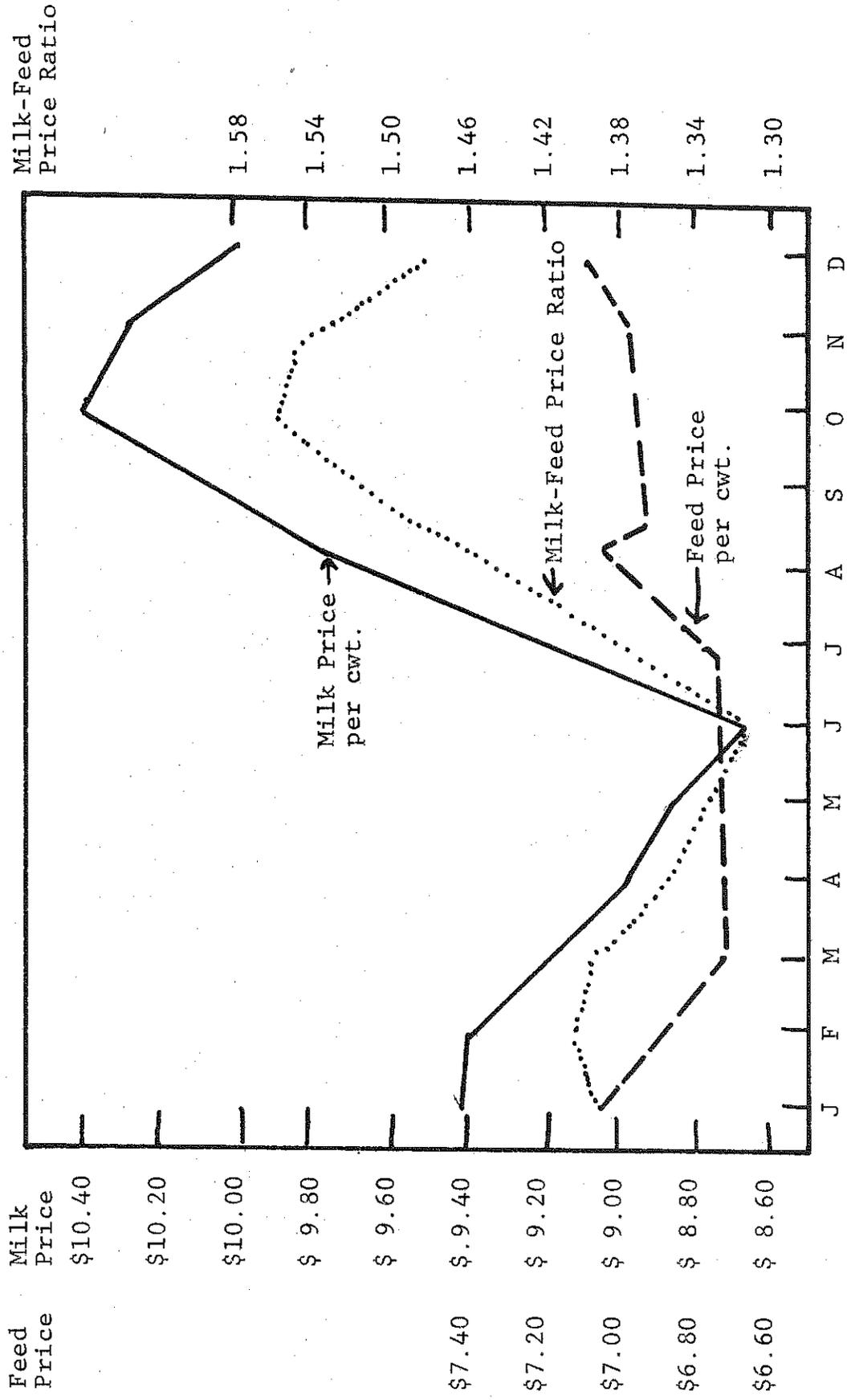


Figure 5.

Milk Price, Feed Price, and Milk-Feed Price Ratio

Five Year Monthly Averages 1974-1978

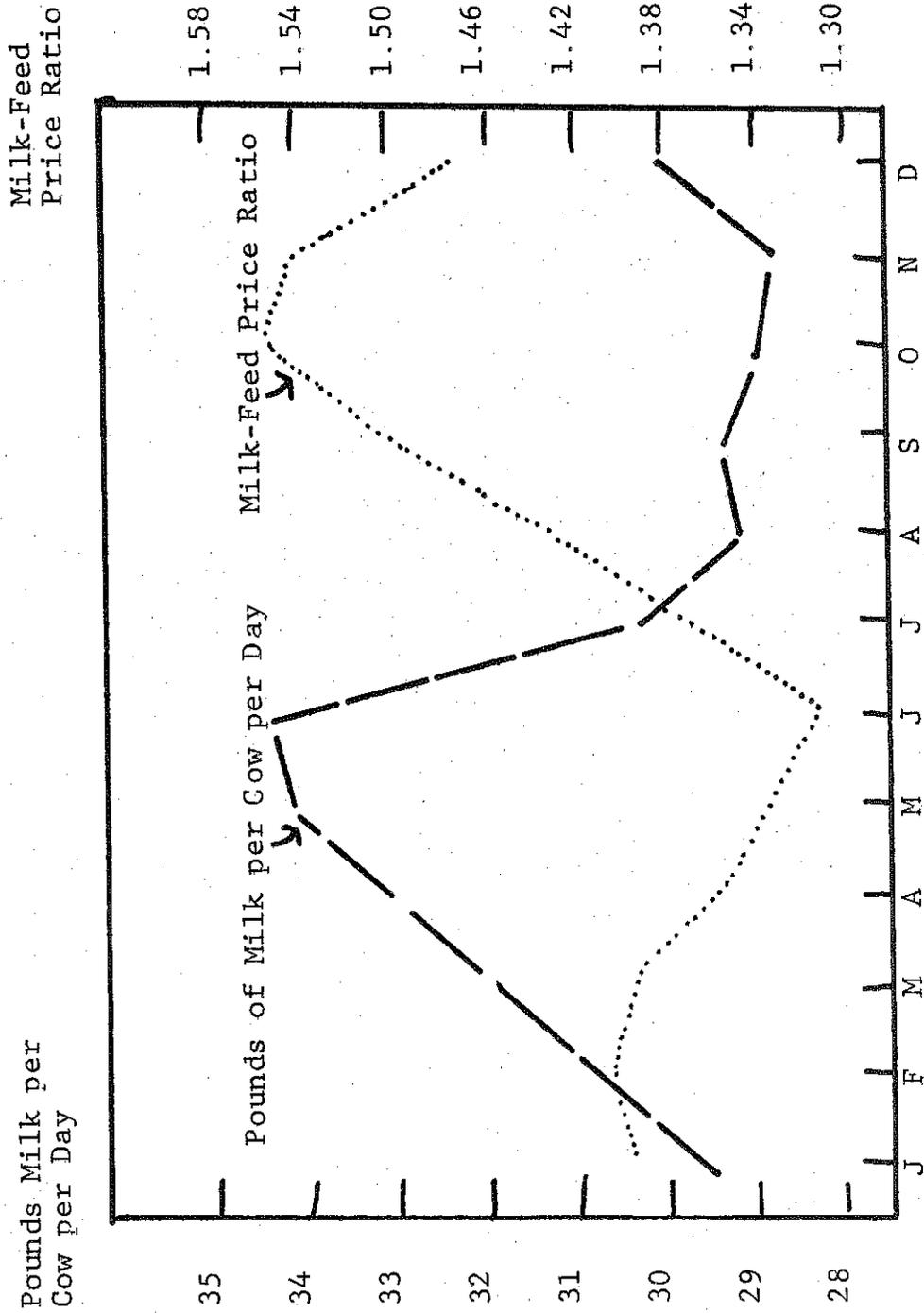


Figure 6.  
Milk-Feed Price Ratio and Daily Milk Production per Cow  
Five Year Monthly Averages 1974-1978

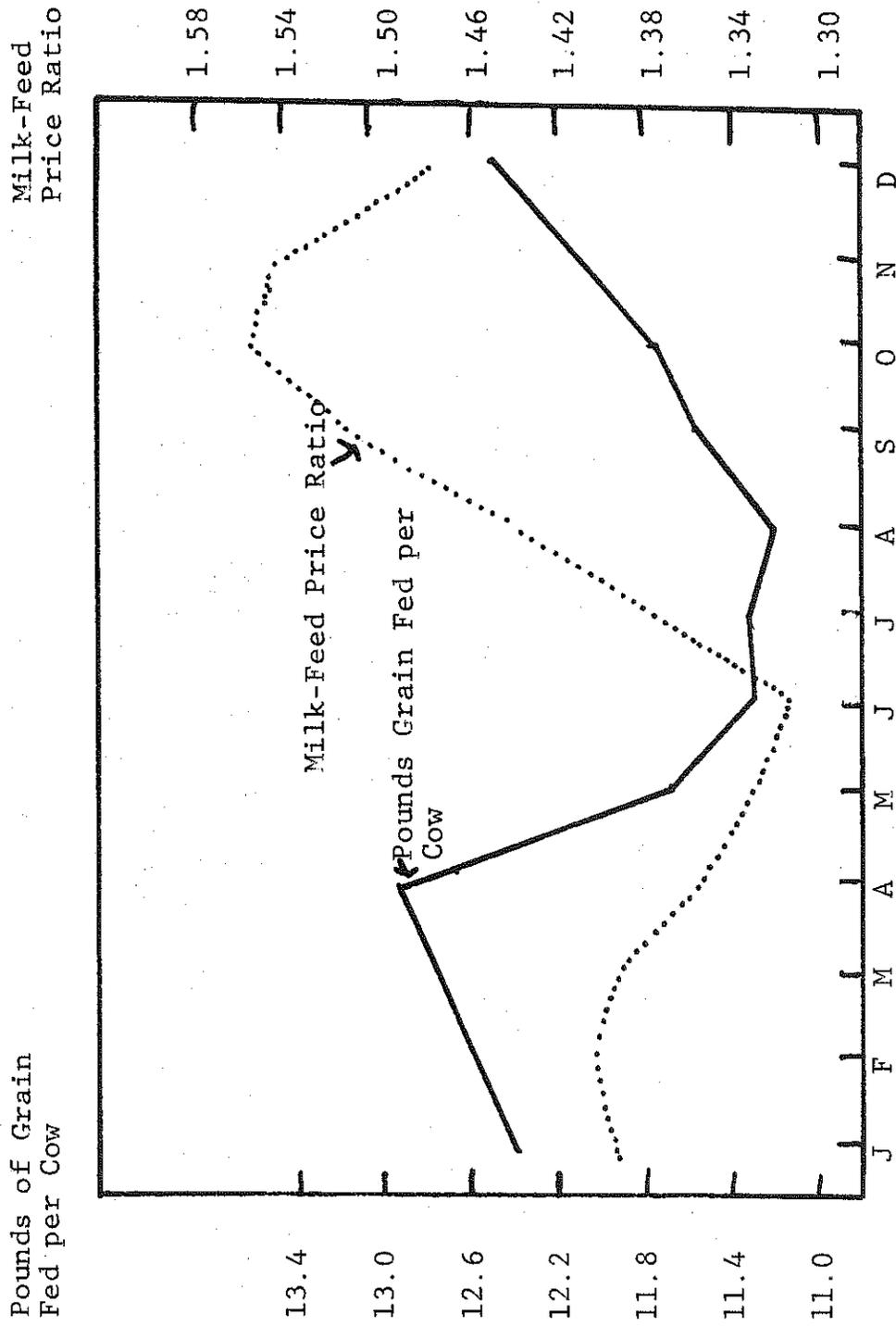


Figure 7.  
Milk-Feed Price Ratio and Pounds of Grain Fed per Cow  
Five Year Monthly Averages 1974-1978

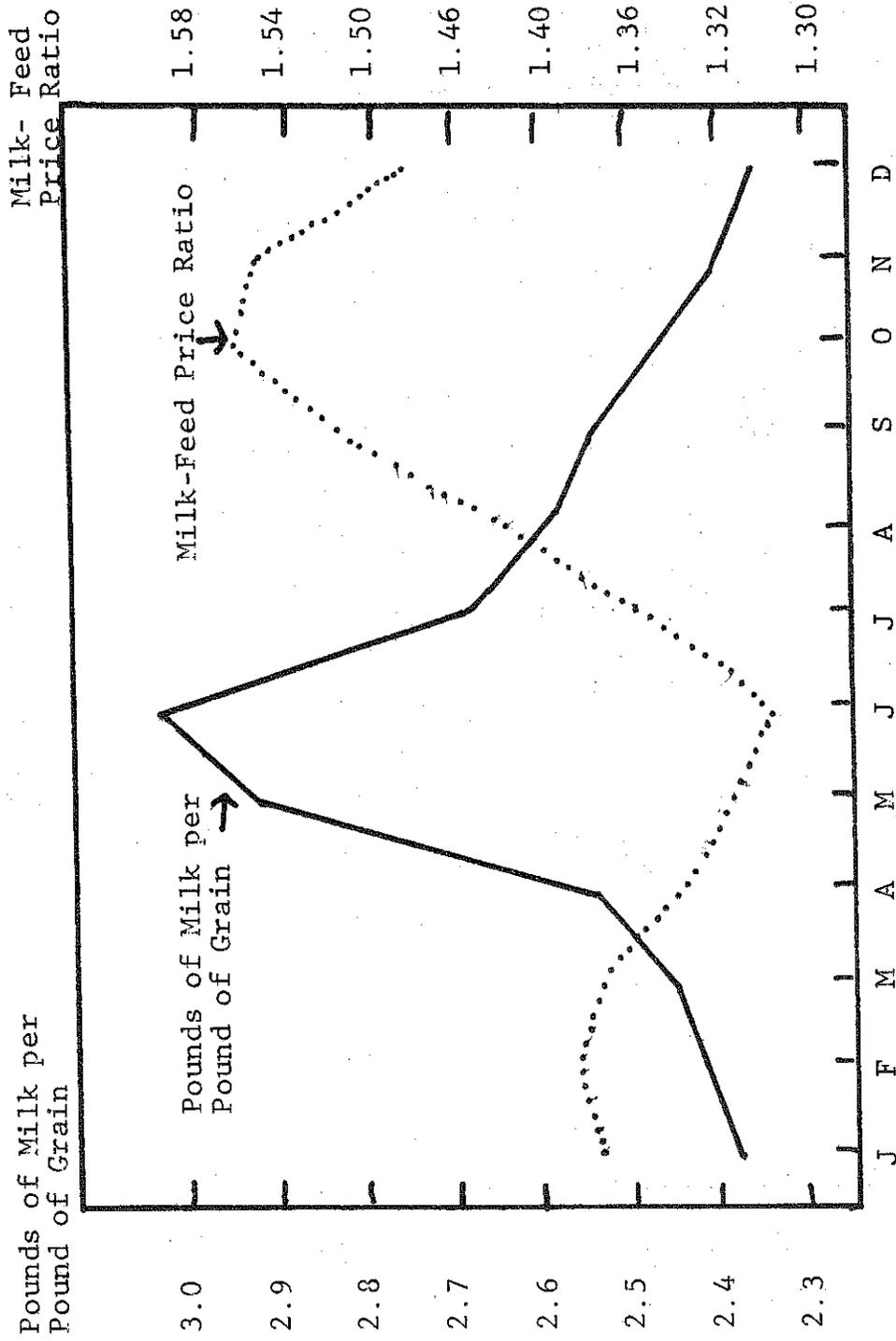


Figure 8.  
Milk-Feed Price Ratio and Pounds of Milk per Pound of Grain  
Five Year Monthly Averages 1974-1978

Pounds of Grain Fed per Cow

Pounds of Milk Produced per Cow

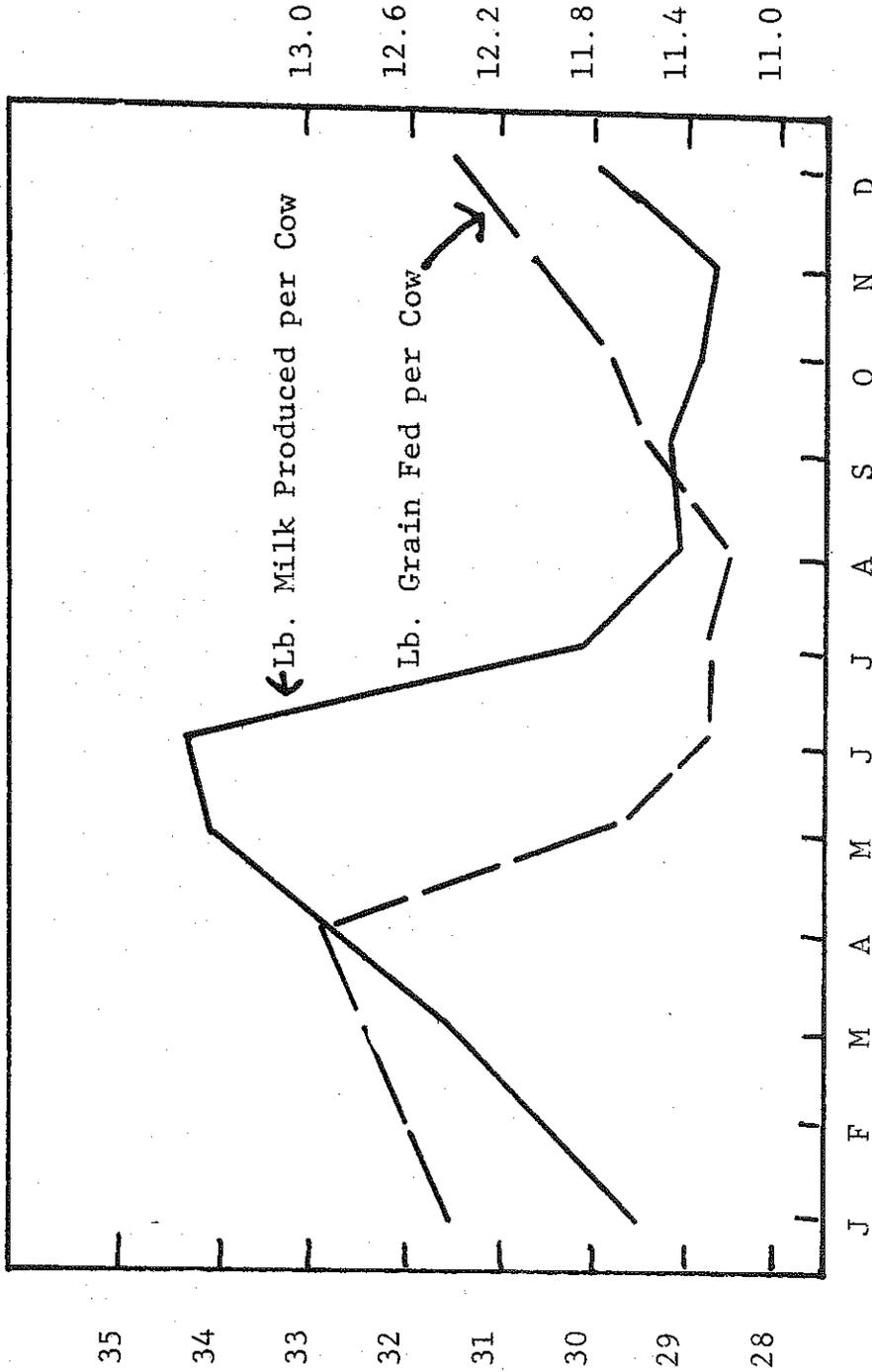


Figure 9.

Pounds of Milk Produced per Cow and Pounds of Grain Fed per Cow  
Five Year Monthly Averages 1974-1978

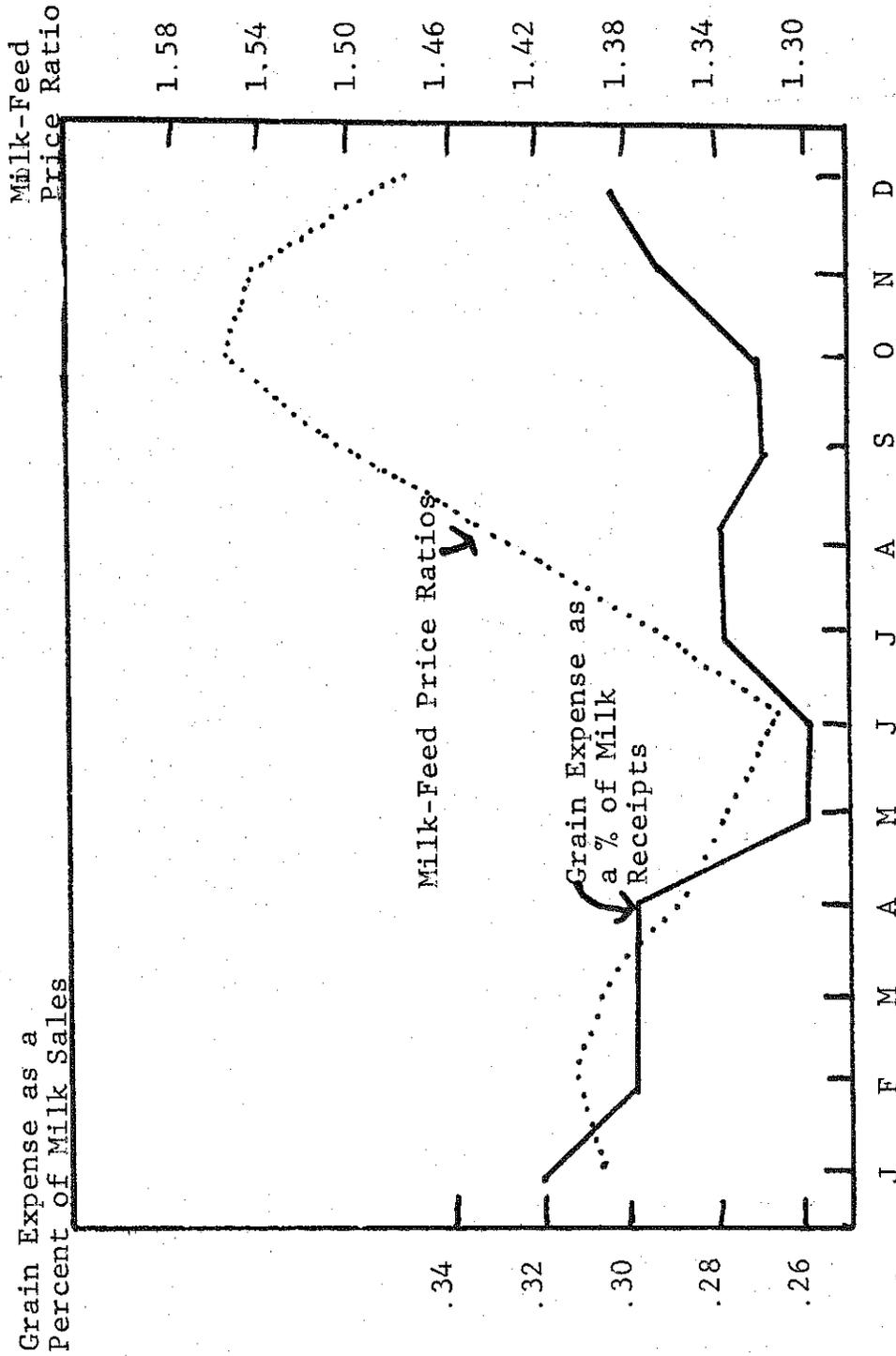


Figure 10.

Five Year Monthly Averages 1974-1978

Milk-Feed Price Ratio and Feed Expense as a Percent of Milk Receipts

Analysis of Dairy Management Practices

The price of milk increased each year from 1974 through 1978 except for 1977. In that year the milk price was eight cents lower per cwt. than the previous year and followed a record increase of more than \$1.00 per cwt. in 1976. There was a definite upward trend in the milk price. However, the feed price in 1978 was actually lower than the price in 1974. The average annual price fluctuated within a narrow 37 cent price range. The constant trend of feed prices combined with an upward trend in milk price resulted in a rising milk-feed price ratio. The ratio rose from a low of 1.21 in 1974 to a high of 1.54 in 1978 (Table 1). Logically, this suggests that since the price of feed was falling relative to the price of milk, farmers would feed more grain to increase production and maximize net income.

Table 1. AVERAGE ANNUAL PRICES FOR MILK AND SIXTEEN PERCENT DAIRY RATION AND MILK-FEED PRICE RATIO  
New York State 1974 to 1978

Year	Average Milk Price*	Average Feed Price*	Milk-Feed Price Ratio
1974	\$ 8.38	\$6.90	1.21
1975	8.75	6.60	1.33
1976	9.83	6.95	1.41
1977	9.75	6.97	1.40
1978	10.50	6.83	1.54

\*Source: New York Agricultural Statistics, 1978, Release 52.

The average labor and management income per operator for the dairy farms studied varied from year to year (Table 2). The high average income in 1978 was largely due to an unprecedented increase in the average value of a dairy cow and her replacement. The average increase in livestock inventory values for 1978 was \$18,514. In 1976, the second highest increase during the study period, the increase was only \$3,715. The correlation between income and milk-feed price ratios is weak. The management income tends to be higher in years when there was a large increase in price of milk which exceeded the increase in cost of farm inputs. There was a much stronger correlation between milk-feed price ratios and the rate of grain feeding and milk production per cow.

Table 2. LABOR AND MANAGEMENT INCOME, PRODUCTION PER COW,  
AND CONCENTRATES FED PER COW  
New York Dairy Farms, 1974 to 1978

Year	Labor & Management Income per Operator	Pounds of Milk Sold per Cow	Pounds of Concentrate Fed per Cow
1974	\$ 5,032	12,904	4,811
1975	3,946	13,457	5,059
1976	8,080	13,694	5,433
1977	3,178	14,083	5,595
1978	20,980	14,401	6,009
5-Year Average	\$ 8,243	13,708	5,381

From 1974 through 1978 the average pounds of concentrate fed per cow annually increased 1,200 pounds (Table 2). In 1977, when the milk-feed price ratio was down slightly from the year before, there was an increase of only 162 pounds of grain fed compared with increases of nearly 400 pounds in 1976 and 1978. Over this same 5-year period milk production increased 1,500 pounds per cow. The annual increase varied between 250 and 550 pounds and was less responsive to changes in the milk-feed price ratio than was grain feeding. In 1977, when the milk-feed price ratio was slightly below the previous year and the increase in feed consumption was lower than other years the annual increase in milk production per cow was the second highest in the study. There are many factors that affect the increase in milk production per cow besides the milk-feed price ratio and the resulting level of concentrate feeding. A constantly improving genetic base and new management technology and practices are important factors underlying this trend.

Table 3. POUND OF MILK SOLD PER POUND OF  
CONCENTRATE FED AND FEEDING PRACTICES  
New York Dairy Farms, 1974 to 1978

Year	Lb. Milk Sold per Lb. Grain	Percent of Net Energy From			
		Concentrates	Succulents	Dry Hay	Pasture
1974	2.7	43	33	14	9
1975	2.7	45	34	12	9
1976	2.5	47	32	12	9
1977	2.5	48	32	13	8
1978	2.4	49	32	12	7
5-Year Average	2.5	46	33	13	8

While both milk sold per cow and pounds of concentrate fed per cow increased, the ratio of pounds of milk sold per pound of grain fed decreased (Table 3). This situation reflects the general upward trends in both levels of feeding and of milk production, and indicates that dairy farmers do respond to changes in the relative prices of milk and feed. There was a definite trend to increase the percent of net energy from concentrates in a cows diet at the expense of succulents, dry hay, and pasture.

The above section dealt with the averages for all farms in the study. However, farms are not all the same and responses differ from farm to farm. Three major differences in dairy farms are: size of the herd, milk production per cow, and the management ability of the operator. Differences in these three factors are examined in the following section.

Differences by Herd Size

Size of the dairy herd has been shown by research over the years to have a significant effect on management income. In general, the larger herds have the higher incomes. However, the common belief that larger herds have lower levels of production is false. Table 4 clearly shows that production per cow increased with herd size. The rate of concentrate feeding also increased with herd size and was undoubtedly a major reason for the higher production in the larger herds.

Table 4. FIVE-YEAR AVERAGES OF LABOR AND MANAGEMENT INCOME, MILK SOLD PER COW, AND CONCENTRATE FEEDING BY HERD SIZE  
New York Dairy Farms, 1974 to 1978

Herd Size	Labor & Management Income Per Operator	Lb. Milk Sold per Cow	Lb. Concentrate Fed per Cow
Less than 40	\$ 3,755	13,311	5,148
40 - 54	6,106	13,507	5,188
55 - 69	6,757	13,496	5,161
70 - 84	7,901	13,782	5,596
85 - 99	11,291	13,866	5,677
100 - 149	13,219	13,971	5,830
150 or more	16,433	14,092	6,198
All farms	\$ 8,243	13,708	5,381

In the small herds less pounds of grain were fed per pound of milk produced than in the large herds (Table 5). Herds of less than 70 cows produced 2.6 pounds of milk per pound of grain fed while herds of over 150 cows produced only 2.3 pounds of milk per pound of grain which was 12 percent less. The smaller farms fed less succulents and more dry hay and pasture than the larger farms.

Table 5. FIVE-YEAR AVERAGES OF FEEDING PRACTICES AND POUNDS OF MILK PER POUND OF CONCENTRATE FED  
New York Dairy Farms, 1974 to 1978

Herd Size	Lb. Milk per Lb. Concentrate	Percent of Net Energy From			
		Concentrates	Succulents	Dry Hay	Pasture
Less than 40	2.6	46	21	20	13
40 - 54	2.6	46	29	15	10
55 - 69	2.6	45	34	13	8
70 - 84	2.5	47	36	11	6
85 - 99	2.4	47	39	9	5
100 - 149	2.4	49	41	7	3
150 or more	2.3	52	44	4	0
All farms	2.5	46	33	13	8

In the tables above the effects of herd size on the 5-year average were observed. This provides a good general guide to the effects of size on various factors such as income and feed fed.

A second consideration is the relative changes in factors over the five-year period for the different size herds, in brief did they change at different rates? To study this the percent change from 1974 through 1978 was calculated and is shown in Tables 6 through 10. A limitation in using percentage changes is that of the size of the base year, 1974, may be above or below the typical year. Both percent change and actual change should be considered when interpreting these data.

Labor and management incomes increased more on a percentage basis for small herds than for large herds (Table 6). However, on an absolute dollar basis income increased more for the large farms. The relative improvement in income tended to be greater for the smaller herds but the actual change was bigger for the larger herds.

Table 6. CHANGES IN LABOR AND MANAGEMENT INCOME  
BY HERD SIZE  
New York Dairy Farms, 1974 and 1978

Herd Size	1974	1978	1978 as a Percent of 1974
Less than 40	\$ 2,540	\$12,083	476%
40 - 54	2,698	16,859	625
55 - 69	2,482	18,234	735
70 - 84	3,841	21,355	560
85 - 99	10,539	27,945	265
100 - 149	7,308	30,181	413
150 or more	14,853	38,659	260

From 1974 through 1978 the amount of milk sold per cow increased between eight percent and 14 percent among the various size herds (Table 7). There was no consistent pattern in the rate of increases among the various size herds. In brief all herd sizes tended to be increasing their milk production per cow at about the same rate.

Table 7. CHANGES IN POUNDS OF MILK SOLD PER COW  
BY HERD SIZE  
New York Dairy Farms, 1974 and 1978

Herd Size	1974	1978	1978 as a Percent of 1974
Less than 40	12,788	13,853	108%
40 - 54	12,765	14,015	110
55 - 69	12,707	14,354	113
70 - 84	12,823	14,637	114
85 - 99	13,156	14,597	111
100 - 149	13,236	14,337	108
150 or more	12,965	14,702	113

There were significant increases in concentrates fed per cow from 1974 through 1978 (Table 8). These increases ranged from 18 percent to 35 percent by herd size. Both the percentage increase and the absolute increase were greatest for the middle size herd of 70 - 84 cows and least for the under 40 cow herds. Herds of over 150 cows had the second

smallest percentage increase but was the median in absolute terms. This suggests that small herds do not increase concentrate feeding as rapidly as other herds. This may be because of informational and managerial barriers for the small farm operator.

Table 8. CHANGES IN POUNDS OF CONCENTRATE FED PER COW  
BY HERD SIZE  
New York Dairy Farms, 1974 and 1978

Herd Size	1974	1978	1978 as a Percent of 1974
Less than 40	4,661	5,505	118%
40 - 54	4,634	5,745	124
55 - 69	4,668	5,879	126
70 - 84	4,892	6,588	135
85 - 99	5,064	6,411	126
100 - 149	5,056	6,425	127
150 or more	5,441	6,709	123

This pattern of a smaller response for the smallest and largest herds is also evident in pounds of milk produced per pound of grain (Table 9). Between 1974 and 1978 the amount of milk produced per pound of grain decreased eight percent for herds under 40 cows or over 150 cows. The largest decrease in pounds of milk produced per pound of grain was 15 percent for herds with 70 - 84 cows and 100 - 149 cows.

Table 9. CHANGES IN POUNDS OF MILK PRODUCED PER POUND OF GRAIN  
FED BY HERD SIZE  
New York Dairy Farms, 1974 and 1978

Herd Size	1974	1978	1978 as a Percent of 1974
Less than 40	2.74	2.52	92%
40 - 54	2.75	2.44	89
55 - 69	2.72	2.44	90
70 - 84	2.62	2.22	85
85 - 99	2.60	2.28	88
100 - 149	2.62	2.23	85
150 or more	2.38	2.19	92

All herds increased the percent of net energy from concentrate by nine percent to 15 percent (Table 10). There are no consistent patterns by herd size for this factor.

Table 10. CHANGES IN PERCENT NET ENERGY FROM CONCENTRATES  
BY HERD SIZE  
New York Dairy Farms, 1974 and 1978

Herd Size	1974	1978	1978 as a Percent of 1974
Less than 40	42	48	114%
40 - 54	44	48	109
55 - 69	42	48	114
70 - 84	44	50	114
85 - 99	44	49	113
100 - 149	45	51	113
150 or more	47	54	115

Differences by Production Level

Herd averages of milk produced per cow are a well known, publicized and talked about measure of dairy management. Commonly it is assumed that a higher herd average means a bigger income for the operator. However, some people wonder if there is a point beyond which a higher herd average does not increase profit but will actually lower income. This appears to be the case in Table 11 where the 5-year average income increased with production regularly in all but the highest level of production. This observation ignores the fact that herds producing 16,000 or more pounds of milk had ten percent less cows than the 15,000 to 15,999 pound level while income was less than eight percent lower for the 16,000 pound and above level. It seems that the point of diminishing returns had not been met at the 16,000 pound level.

Table 11. FIVE-YEAR AVERAGES OF LABOR AND MANAGEMENT INCOME,  
MILK SOLD PER COW AND CONCENTRATE FEEDING BY  
PRODUCTION LEVEL  
New York Dairy Farms, 1974 to 1978

Lb. Milk Sold per Cow	Labor & Management Income Per Operator	Lb. Milk Sold Per Cow	Lb. Concentrate Fed per Cow
Less than 10,000	\$-1,814	8,915	3,612
10,000 - 10,999	- 199	10,732	4,638
11,000 - 11,999	6,428	11,699	4,689
12,000 - 12,999	5,759	12,699	4,973
13,000 - 13,999	9,413	13,599	5,411
14,000 - 14,999	10,735	14,552	5,693
15,000 - 15,999	12,481	15,501	6,117
16,000 or more	11,590	16,898	6,570
All farms	\$ 8,243	13,700	5,381

There is a strong correlation between milk production and concentrate feeding. There was almost an 8,000 pound difference in milk production between the highest and lowest groups with nearly 3,000 pound difference in concentrates fed per cow. The better producing herds produced more milk by feeding more grain.

Despite the wide variation in both milk produced and concentrate fed the production level had little effect on the pounds of milk produced per pound of grain (Table 12). All but one production level sold either 2.5 or 2.6 pounds of milk for every pound of grain fed. The 10,000 - 10,999 pound level sold only 2.3 pounds of milk for every pound of grain. This group of farms producing 10,000 - 10,999 pounds of milk fed almost as much grain as the 11,000 - 11,999 pound farms while producing almost 1,000 pounds of milk per cow less. Factors other than pounds of concentrates fed limited production for these farms and underscore the fact that production is dependent on more factors than just grain fed.

Table 12. FIVE-YEAR AVERAGES OF FEEDING PRACTICES AND POUNDS  
OF MILK PER POUND OF GRAIN BY PRODUCTION LEVEL  
New York Dairy Farms, 1974 to 1978

Lb. Milk Sold per Cow	Lb. Milk Sold per Lb. Concn.	Percent of Net Energy From			
		Concentrates	Succulents	Dry Hay	Pasture
Less than 10,000	2.5	39	32	18	11
10,000 - 10,999	2.3	45	27	15	13
11,000 - 11,999	2.5	44	30	14	12
12,000 - 12,999	2.6	45	33	14	8
13,000 - 13,999	2.5	47	34	12	7
14,000 - 14,999	2.6	47	34	12	7
15,000 - 15,999	2.5	49	34	10	7
16,000 or more	2.6	50	32	12	6
All farms	2.5	46	33	13	8

There was a strong relationship between the percent net energy from concentrate and production level ranging from 39 percent with the lowest level of production to 50 percent with the highest level of production (Table 12). A higher percent net energy from concentrates does not mean more grain was used to produce a pound of milk if production also increased. There was no trend in percent net energy from succulents by production level. The percent net energy from both dry hay and pasture declined as production level increased.

Table 13. CHANGES IN LABOR AND MANAGEMENT INCOME  
BY PRODUCTION LEVEL  
New York Dairy Farms, 1974 and 1978

Lb. Milk Sold per Cow			1978 as a Percent of 1974
	1974	1978	
Less than 10,000	\$-4,574	\$10,193	*
10,000 - 10,999	300	3,584	1,195%
11,000 - 11,999	143	19,769	13,829
12,000 - 12,999	4,999	18,503	370
13,000 - 13,999	7,052	19,487	276
14,000 - 14,999	8,980	23,752	264
15,000 - 15,999	13,105	22,413	171
16,000 or more	11,045	25,154	228

In 1974 the labor and management income was closely related with production level (Table 13). Income increased with production level in all but two cases. The 11,000 - 11,999 pound production level management income was \$157 lower than the 10,000 - 10,999 production level. The above 16,000 pound group had 19 percent fewer cows and, consequently, had labor and management incomes that were 18 percent lower than the 15,000 - 15,999 pound group. This trend of increasing income in 1974 still held in 1978 but there were much larger variations than in the past. In 1978 there were enormous percentage increases in income for the lower production levels while in absolute dollar terms the increase was about the same for the higher production levels. This large increase in labor and management income was due to the rapid increase of cattle values during 1978.

Table 14. CHANGES IN POUNDS OF CONCENTRATES FED  
BY PRODUCTION LEVEL  
New York Dairy Farms, 1974 and 1978

Lb. Milk Sold per Cow	1974	1978	1978 as a Percent of 1974
Less than 10,000	3,561	4,249	119%
10,000 - 10,999	3,922	5,745	146
11,000 - 11,999	4,359	5,266	121
12,000 - 12,999	4,815	5,147	107
13,000 - 13,999	5,139	5,797	113
14,000 - 14,999	5,380	6,224	116
15,000 - 15,999	5,524	6,504	118
16,000 or more	6,059	6,943	115

The rate of concentrate feeding during 1974 increased with the production level (Table 14). However, by 1978 this relationship had, for some cases, reversed itself. For the three production levels: 10,000-10,999, 11,000-11,999, and 12,000-12,999 an inverse correlation between production and concentrates fed existed. A positive correlation held for the other production levels. Other factors were more important for these mid range production levels than concentrate feeding. The increase in concentrates fed between 1974 and 1978 ranged from seven percent to 46 percent. The three lowest production levels responded the most to increased grain feeding. It should be noted that in 1974 these three lowest production levels accounted for 32 percent of the farms and the three highest production levels accounted for only 25 percent of the farms. This had drastically changed by 1978 with just 11 percent of the herds remaining in the three lowest production groups and 64 percent of the herds were now in the three highest groups. This shift in number of herds in the higher production levels was undoubtedly due to a higher milk-feed price ratio.

Table 15. CHANGES IN POUNDS OF MILK PER POUND GRAIN  
BY PRODUCTION LEVEL  
New York Dairy Farms, 1974 and 1978

Lb. Milk Sold per Cow	1974	1978	1978 as a Percent of 1974
Less than 10,000	2.52	2.04	81%
10,000 - 10,999	2.73	1.88	69
11,000 - 11,999	2.67	2.25	84
12,000 - 12,999	2.61	2.48	95
13,000 - 13,999	2.64	2.36	89
14,000 - 14,999	2.72	2.35	86
15,000 - 15,999	2.80	2.37	85
16,000 or more	2.78	2.42	87

The dramatic increase in concentrates fed per cow from 1974 through 1978 had a definite effect on the pounds of milk produced per pound of grain fed (Table 15). The decrease in pounds of milk per pound of grain ranged from five percent to 31 percent with no trend by production level. In both years, the amount of milk produced per pound of grain is generally lower for the lower production levels than the high production levels.

Table 16. CHANGE IN PERCENT NET ENERGY FROM CONCENTRATE  
BY PRODUCTION LEVEL  
New York Dairy Farms, 1974 and 1978

Lb. Milk Sold per Cow	1974	1978	1978 as a Percent of 1974
Less than 10,000	37	45	122%
10,000 - 10,999	40	48	120
11,000 - 11,999	40	48	120
12,000 - 12,999	43	46	107
13,000 - 13,999	45	48	107
14,000 - 14,999	46	49	107
15,000 - 15,999	46	50	109
16,000 or more	48	53	110

The percent net energy from concentrates increased with production for both 1974 and 1978 (Table 16). The rate of change was much greater for the low production levels than the high production levels. The herds producing less than 10,000 pounds of milk increased the proportion of net energy from concentrates in 1978 by 22 percent from 1974 while those herds producing 14,000-14,999 pounds of milk increased net energy from concentrates only seven percent. With the higher producing herds there is less potential to increase concentrate feeding before biological limits are met.

Difference by Management Income Level

The managerial abilities of farmers varies greatly from individual to individual. One way to measure managerial ability is by labor and management income per operator. In general, the dairy operators with the greatest overall managerial skills will combine all factors in such a way as to get the highest incomes. It is expected that better managers would react to changing milk-feed price ratios differently than farmers with less managerial ability.

Generally, for the period 1975 through 1978, as labor and management income increased both pounds of concentrates fed per cow and pounds of milk sold per cow also increased (Table 17). There is less variation in these factors by labor and management income than by either herd size or milk production level. There are two major reasons: First, there are many factors that are considered in labor and management income such as capital investment per cow and cost control that do not affect milk production or herd size directly. Secondly, the farms were sorted into fewer groups by labor and management income than by herd size or production level.

Table 17.            **FOUR-YEAR\* AVERAGES OF LABOR AND MANAGEMENT INCOME, MILK SOLD PER COW, AND CONCENTRATES FED BY MANAGEMENT INCOME LEVELS**  
New York Dairy Farms, 1975 to 1978

Income Quintile		Labor & Management Income per Operator	Lb. Milk Sold per Cow	Lb. Concentrate Fed per Cow
Lowest	20%	\$- 8,169	13,336	5,411
2nd	20%	3,035	13,466	5,380
3rd	20%	8,231	13,949	5,431
4th	20%	13,882	14,020	5,663
Highest	20%	29,091	14,542	5,739

\* Data not available for 1974.

On the average the pounds of milk produced per pound of concentrate fed varied among income levels and there was a slight trend to increase milk per pound of concentrate fed at higher labor management income levels (Table 18). The percent net energy from concentrates was almost constant across all income levels while the percent net energy from succulents increased with income and there was a corresponding decrease in net energy from both dry hay and pasture.

Table 18. FOUR-YEAR\* AVERAGES OF FEEDING PRACTICES AND POUNDS OF MILK/POUND OF GRAIN BY MANAGEMENT INCOME LEVELS  
New York Dairy Farms, 1975 to 1978

Income Quintile	Lb. Milk/Lb. Concentrates	Percent of Net Energy From			
		Concentrates	Succulents	Dry Hay	Pasture
Lowest 20%	2.47	47	32	13	8
2nd 20%	2.51	47	30	14	9
3rd 20%	2.58	47	32	13	8
4th 20%	2.49	48	33	12	7
Highest 20%	2.54	48	37	10	5

\* Data not available for 1974.

Production increased between five percent and 10 percent for the different management income levels (Table 19). The larger increases tended to be in the lower income levels. There were large increases in concentrate fed ranging from nine percent to 26 percent. The smallest increase in concentrates fed was in the lowest quintile of management income while the highest increase in concentrates fed was with the second to lowest management income quintile (Table 20). There appears to have been little pattern in the percentage change of concentrates by management income level for both 1975 and 1978. The pounds of concentrates fed generally increased as management income increased during both of these years.

Table 19. CHANGES IN POUNDS OF MILK SOLD PER COW BY MANAGEMENT INCOME LEVEL  
New York Dairy Farms, 1975 to 1978

Income Quintile	1975	1978	1978 as a Percent of 1975
Lowest 20%	12,841	13,686	107%
2nd 20%	12,802	14,093	110
3rd 20%	13,393	14,219	106
4th 20%	13,734	14,439	105
Highest 20%	14,101	14,806	105

Table 20. CHANGES IN POUNDS OF CONCENTRATE FED PER COW  
BY MANAGEMENT INCOME LEVEL  
New York Dairy Farms, 1975 to 1978

Income Quintile	1975	1978	1978 as a Percent of 1975
Lowest 20%	5,109	5,556	109%
2nd 20%	4,790	6,038	126
3rd 20%	5,099	5,997	118
4th 20%	5,065	6,253	123
Highest 20%	5,225	6,205	119

In 1975 the general trend was for more milk to be produced per pound of grain as the management income level increased (Table 21). In 1978 this trend was no longer evident. The percentage change ranged from four percent to 15 percent. The smallest change was for the lowest management income level and relatively the same amount of milk was produced per pound of grain among the four remaining management income levels. This suggests that the poorer managers did not adjust to changing price relationships as rapidly as the better managers. The percent net energy from concentrates increased between two percent and 11 percent from 1975 to 1978 (Table 22). Again the smallest change was with the lowest management income level.

Table 21. CHANGES IN POUNDS OF MILK PRODUCED  
PER POUND OF GRAIN FED  
BY MANAGEMENT INCOME LEVEL  
New York Dairy Farms, 1975 to 1978

Income Quintile	1975	1978	1978 as a Percent of 1975
Lowest 20%	2.51	2.46	96%
2nd 20%	2.67	2.33	87
3rd 20%	2.63	2.37	90
4th 20%	2.71	2.31	85
Highest 20%	2.70	2.39	89

Table 22. CHANGES IN PERCENT NET ENERGY FROM CONCENTRATE  
BY MANAGEMENT INCOME LEVEL  
New York Dairy Farms, 1975 to 1978

Income Quintile	1975	1978	1978 as a Percent of 1975
Lowest 20%	46	47	102%
2nd 20%	44	49	111
3rd 20%	45	49	109
4th 20%	45	50	111
Highest 20%	46	49	107

A commonly quoted rule of thumb for grain feeding is to feed a cow to the point where the cost of the last pound of grain fed is just offset by the value of the increase in milk produced. It appears that the best managers did follow this principle (Table 23). As milk-feed price ratio increased from 1975 to 1978 farmers increased concentrate feeding levels and milk production. To maximize income a dairyman should increase the marginal amount of grain fed to the point where the increased cost of feed was about equal to the value of the marginal increase in milk production. For the two highest management income levels the value of the increase in production just about offset the increase in cost of grain feeding (-\$7.00 and +\$5.00). The lower the management income level the farther the farm was from reaching the optimum increase in feeding and production.

Table 23. MARGINAL ANALYSIS OF INCREASES IN PRODUCTION  
AND FEEDING  
BY MANAGEMENT INCOME LEVELS  
New York Dairy Farms, 1975 to 1978

Income Quintile	1978 Over 1975		
	Value of Increased Production	Cost of Increase In Grain	Margin
Lowest 20%	\$ 89	\$30	\$59
2nd 20%	136	85	51
3rd 20%	87	61	26
4th 20%	74	81	(7)
Highest 20%	74	67	5

### Summary and Conclusions

The purpose of this project was to study the effects of changing milk price, feed price, and milk-feed price ratios on labor and management income and various feeding practices. Data from two major sources were utilized. Monthly information on milk price, feed price, milk production per cow, and grain feeding from the New York State Crop Reporting Service was used to study both long term and seasonal trends of these factors. Annual production and income data from over 300 New York farms for the years 1974 through 1978 was also used.

General price indicators rose at a relatively constant rate until 1978 when this trend of rising prices accelerated. The milk price for New York farmers has risen faster than the feed price resulting in a higher milk-feed price ratio. As the milk-feed price ratio increased pounds of grain fed increased, milk production rose, pounds of milk produced per pound of grain decreased, and grain expense as a percentage of milk receipts also declined. There has also been a narrowing of the seasonal variation in grain feeding, milk production, pounds of milk produced per pound of grain and grain expense as a percent of milk receipts.

Seasonal variations were large for many of these factors. The milk price and milk-feed price ratio were highest in October after a low in June. Feed prices on the average were lowest from March through July and highest during December and January. Pounds of milk produced are highest in June and lowest in November in an inverse relationship with milk-feed price ratio. There was approximately a two month lag between the peak in grain feeding and the peak in milk production. Pounds of milk per pound of grain peaked in June and was inversely related to the milk-feed price ratio.

Labor and management incomes were variable for the five years studied although there was an upward trend with much of the increase due to a rapid increase in cattle values. Labor and management incomes were moderately related to the milk-feed price ratio. The strongest correlation was between the milk-feed price ratio and pounds of concentrate fed. Pounds of concentrate fed was one of the most important factors affecting increase in pounds of milk produced. An increasing percent of the net energy in the cows' diet was from concentrates, while the amount of dry hay and pasture the cows consumed declined.

Larger herds provided bigger labor and management incomes for the operator. They also produced more milk per cow and fed more concentrate per cow than smaller farms. Smaller farms produced more milk per pound of concentrate fed, fed less succulents and more dry hay and pasture. Between 1974 and 1978 labor and management incomes increased for all farms. Concentrate fed increased significantly during this period with

medium size farms increasing the least due to managerial and informational barriers. The decrease in pounds of milk per pound of concentrate was greatest for the middle size herds and smallest for both the largest and smallest farms.

The higher producing herds produced more milk by feeding more concentrates. There was not a set level of production beyond which it was less profitable for a herd to produce. Production level had almost no effect on the pounds of milk produced per pound of grain. The higher production levels were accompanied by a higher percent of the net energy from concentrate and less from dry hay and pasture. Labor and management income was related to production level. Between 1974 and 1978 the three lowest production levels responded to the milk-feed price ratio by increasing concentrates more than the other production levels. The amount of milk produced per pound of concentrate fed was generally lower for the lower producing herds.

Better managers, measured by labor and management income, had a higher milk production level and fed more concentrates than did the less able managers. There was less variation among the labor and management income levels than with herd size and production level for the previous factors. In 1975 the higher management income levels produced more milk per pound of concentrate than did lower income levels. By 1978 this trend was no longer apparent. The least able managers did not adjust to changing conditions as rapidly as did the better managers. A good guide for grain feeding as demonstrated by the best managers seemed to be to feed cows so that the cost of the last pound of grain was offset by the value of the increase in production due to the last pound of grain fed.

Farmers will continue to face variable milk and feed prices. Farm managers will need to keep informed about seasonal price trends, current prices, and milk-feed price ratio. Farmers will be able to increase milk receipts by altering the freshening pattern of their herd so that they increase the proportion of the milk produced during the favorable milk-feed price ratio months in the fall. Changes in milk and feed prices will require dairymen to modify feeding practices if they are to maximize incomes. This can be achieved by adjusting feeding levels so that the cost of the last unit of grain fed is just offset by the value of the milk produced by this unit of grain.

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Table 24. SELECTED BUSINESS FACTORS BY LABOR AND MANAGEMENT INCOME  
PER OPERATOR BY QUINTILES  
380 New York Dairy Farms, 1975

Factor	Labor and Management Income Per Operator by Quintile				
	Low	Middle	Middle	High	High
Number of farms	76	76	76	76	76
Percent of farms	20%	20%	20%	20%	20%
Labor & Mgt. Inc./Oper.	\$-12,402	\$- 1,573	\$ 3,464	\$ 8,531	\$ 18,751
<u>Barn Type</u>					
% farms with free stalls	34%	26%	26%	39%	50%
<u>Size of Business</u>					
Man equivalent	2.8	2.3	2.1	2.5	2.8
Total crop acres	246	194	170	216	276
Number of cows	80	63	60	76	92
Total capital	\$289,657	\$231,965	\$198,611	\$250,729	\$284,000
<u>Rates of Production</u>					
Lbs. milk sold/cow	12,841	12,802	13,393	13,743	14,101
Tons hay crops/acre(H.E.)	2.6	2.7	2.7	2.8	2.9
Tons corn silage/acre	12.8	13.7	14.2	14.2	15.5
<u>Labor Efficiency</u>					
Lbs. milk sold/man	363,000	346,000	386,000	418,000	472,000
Cows/man	28	27	29	30	33
<u>Feeding Practices</u>					
Feed bought/cow	\$341	\$314	\$339	\$338	\$312
Lbs. concentrate fed/cow	5,109	4,790	5,099	5,065	5,225
Feeding index	121	120	119	117	119
Rate of roughage feeding	2.3	2.4	2.4	2.4	2.4
% NE from concentrates	46%	44%	45%	45%	46%
% NE from succulents	34%	32%	32%	35%	39%
% NE from dry hay	13%	14%	14%	12%	10%
<u>Breeding Practices</u>					
% days in milk	85%	85%	86%	86%	86%
Projtd. calving interv. (mo.)	13.3	13.0	13.0	12.9	13.0
Average days dry	66	66	62	61	62
Breedings per conception	1.8	1.7	1.7	1.7	1.7
Av. age at first calving	29	29	29	29	29
Av. age all cows	56	57	55	55	54
Av. weight first calving	1050	1050	1070	1070	1090
Av. weight all cows	1230	1230	1230	1240	1260
% leaving herd	28%	27%	28%	28%	26%

Table 25. SELECTED BUSINESS FACTORS BY LABOR AND MANAGEMENT INCOME  
PER OPERATOR BY QUINTILES  
337 New York Dairy Farms, 1976

Factor	Labor and Management Income Per Operator by Quintile				
	Low	Middle	Middle	High	High
Number of farms	67	67	67	67	68
Percent of farms	20%	20%	20%	20%	20%
Labor & Mgt. Inc./Oper.	\$- 6,867	\$ 2,696	\$ 6,928	\$ 12,078	\$ 29,558
<u>Barn Type</u>					
% farms with free stalls	27%	34%	24%	27%	50%
<u>Size of Business</u>					
Man equivalent	2.5	2.5	2.3	2.3	2.7
Total crop acres	192	208	193	197	240
Number of cows	63	65	63	65	90
Total capital	\$255,494	\$251,863	\$231,279	\$231,705	\$296,519
<u>Rates of Production</u>					
Lbs. milk sold/cow	12,905	13,569	13,762	14,102	14,556
Tons hay crops/acre(H.E.)	2.8	2.7	2.8	2.9	3.1
Tons corn silage/acre	11.6	11.9	13.6	13.7	14.7
<u>Labor Efficiency</u>					
Lbs. milk sold/man	325,000	353,000	372,000	407,000	491,000
Cows/man	25	26	27	29	34
<u>Feeding Practices</u>					
Feed bought/cow	\$411	\$390	\$351	\$373	\$395
Lbs. concentrate fed/cow	5,255	5,292	5,355	5,553	5,708
Feeding index	122	119	119	119	120
Rate of roughage feeding	2.3	2.4	2.4	2.3	2.4
% NE from concentrates	47%	46%	46%	47%	48%
% NE from succulents	32%	30%	31%	30%	37%
% NE from dry hay	13%	13%	12%	14%	10%
<u>Breeding Practices</u>					
% days in milk	86%	86%	86%	86%	87%
Projtd. calving interv. (mo.)	13.1	12.9	12.9	13.0	12.8
Average days dry	63	63	59	62	59
Breedings per conception	1.7	1.7	1.8	1.7	1.7
Av. age at first calving	30	29	29	30	29
Av. age all cows	57	55	56	55	53
Av. weight first calving	1070	1060	1060	1090	1080
Av. weight all cows	1230	1220	1230	1250	1240
% leaving herd	29%	27%	28%	30%	27%

Table 26. SELECTED BUSINESS FACTORS BY LABOR AND MANAGEMENT INCOME  
PER OPERATOR BY QUINTILES  
363 New York Dairy Farms, 1977

Factor	Labor and Management Income Per Operator by Quintile				
	Low		Middle		High
Number of farms	73		73		72
Percent of farms	20%		20%		20%
Labor & Mgt. Inc./Oper.	\$-13,346	\$- 1,681	\$ 3,541	\$ 7,721	\$ 18,802
<u>Barn Type</u>					
% farms with free stalls	34%	27%	32%	33%	47%
<u>Size of Business</u>					
Man equivalent	2.5	2.4	2.3	2.3	2.6
Total crop acres	219	197	197	201	242
Number of cows	72	61	65	63	84
Total capital	\$322,098	\$251,231	\$250,351	\$239,222	\$306,079
<u>Rates of Production</u>					
Lbs. milk sold/cow	13,910	13,400	14,423	13,797	14,704
Tons hay crops/acre(H.E.)	2.3	2.1	2.3	2.3	2.8
Tons corn silage/acre	14.5	13.1	14.4	14.2	14.7
<u>Labor Efficiency</u>					
Lbs. milk sold/man	401,000	338,000	402,000	386,000	479,000
Cows/man	29	25	28	28	33
<u>Feeding Practices</u>					
Feed bought/cow	\$423	\$371	\$403	\$402	\$406
Lbs. concentrate fed/cow	5,724	5,398	5,273	5,781	5,817
Feeding index	121	120	116	119	120
Rate of roughage feeding	2.3	2.3	2.4	2.3	2.4
% NE from concentrates	48%	48%	46%	48%	48%
% NE from succulents	32%	30%	33%	32%	36%
% NE from dry Hay	13%	13%	14%	12%	11%
<u>Breeding Practices</u>					
% days in milk	86%	86%	86%	86%	87%
Projtd. calving interv.(mo.)	13.1	12.8	13.0	12.9	13.0
Average days dry	63	64	62	61	58
Breedings per conception	1.8	1.7	1.8	1.7	1.7
Av. age at first calving	28	29	29	29	29
Av. age all cows	54	56	54	55	54
Av. weight first calving	1070	1060	1070	1080	1100
Av. weight all cows	1240	1210	1230	1240	1260
% leaving herd	30%	27%	30%	28%	28%

Table 27. SELECTED BUSINESS FACTORS BY LABOR AND MANAGEMENT INCOME  
PER OPERATOR BY QUINTILES  
370 New York Dairy Farms, 1978

Factor	Labor and Management Income Per Operator by Quintile				
	Low	Middle	High	High	High
Number of farms	74	74	74	74	74
Percent of farms	20%	20%	20%	20%	20%
Labor & Mgt. Inc./Oper.	\$- 62	\$ 12,697	\$ 18,989	\$ 27,196	\$ 49,251
<u>Barn Type</u>					
% farms with free stalls	19%	23%	27%	41%	51%
<u>Size of Business</u>					
Man equivalent	2.3	2.2	2.3	2.4	3.0
Total crop acres	178	181	205	223	279
Number of cows	56	57	64	72	93
Total capital	\$276,531	\$245,480	\$276,460	\$285,916	\$376,397
<u>Rates of Production</u>					
Lbs. milk sold/cow	13,686	14,093	14,219	14,439	14,806
Tons hay crops/acre(H.E.)	2.6	2.4	2.3	2.6	2.6
Tons corn silage/acre	13.8	14.1	14.1	14.3	14.3
<u>Labor Efficiency</u>					
Lbs. milk sold/man	341,000	370,000	391,000	430,000	459,000
Cows/man	25	26	27	30	31
<u>Feeding Practices</u>					
Feed bought/cow	\$432	\$429	\$428	\$404	\$414
Lbs. concentrate fed/cow	5,556	6,038	5,997	6,253	6,205
Feeding index	118	122	120	120	121
Rate of roughage feeding	2.3	2.3	2.3	2.3	2.4
% NE from concentrates	47%	49%	49%	50%	49%
% NE from succulents	30%	29%	32%	33%	37%
% NE from dry hay	14%	14%	12%	11%	09%
<u>Breeding Practices</u>					
% days in milk	86%	86%	86%	86%	87%
Projtd. calving interv.(mo.)	12.9	12.8	12.9	13.0	12.9
Average days dry	61	63	61	60	58
Breedings per conception	1.7	1.7	1.7	1.8	1.7
Av. age at first calving	29	29	29	29	29
Av. age all cows	54	55	54	54	53
Av. weight first calving	1,090	1,090	1,100	1,110	1,120
Av. weight all cows	1,240	1,240	1,250	1,270	1,270
% leaving herd	32%	29%	31%	29%	30%