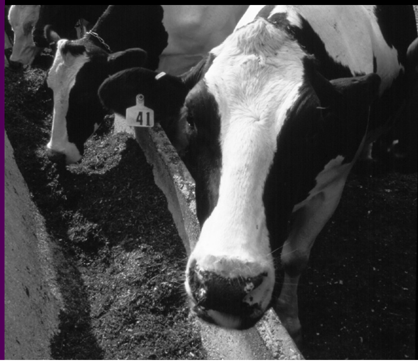

Economic Returns Under Multiple-Component Pricing

U.S. dairy producers shipping milk into federal milk marketing orders faced a new milk pricing system effective January 1, 2000, as a result of federal order reforms implemented by USDA and initiated by U.S. Congress. Seven of the 11 federal orders that were created employed a multiple-component pricing system that paid dairy producers on the basis of milk fat, true protein, and other dairy solids. The new pricing system derives component values from surveyed prices for manufactured dairy products (cheese, butter, nonfat dry milk, and dry whey), which rise and fall with changing market conditions. Thus, producers in federal orders now receive pricing signals from both the wholesale and retail markets

The implications of this new pricing system on farm profitability are not clearly understood. For example, is it more profitable to expand overall production by increasing productivity per cow? Or is it more profitable to maintain milk production per cow, but improve component levels for milk fat and/or protein by changing the feeding system or altering the genetic base of the herd? These are important factors to consider since (1) producers in federal milk marketing orders that use a multiple-component pricing plan receive a substantial portion of their gross income from milk components; (2) producers have the ability to alter milk component levels to some degree; and (3) the relative price for milk fat and protein changes frequently with alternative market conditions, creating income risk for producers.

This study analyzed actual monthly component data from herds participating in the Mideast Federal Milk Marketing Order. Based on a study published in the *Journal of Dairy Science*,[1] it focused on how varied component data was from farm to farm and its implications for profitability and evaluated the profitability for Holstein and Jersey herds under the current multiple-component pricing system, although those results are not reported here.

Seasonality of Milk Components

This study analyzed milk component and somatic cell count (SCC) levels for producers participating in the Mideast Federal Order Number 33 from January 2000 through December 2002. Of interest were the seasonality of component production and the monthly mean and standard deviations for protein, milk fat, other solids, and SCC.[2] The strength of these data is that they contain observations for every participant in the federal order by month. The weakness of the dataset, however, is that it is not differentiated by breed or by milk productivity per cow.

Preliminary analysis of the USDA data from Federal Order 33 is presented in Table 1. The results indicate that milk fat and protein component levels vary seasonally, as expected. In addition, there is a sizeable variation from farm to farm in any given month in component and SCC levels.[3] These results imply that there are large differences in the farm value of milk components (i.e., the Class III value) among producers in the Mideast Federal Order in any given month and that there is a strong seasonal pattern for component production.

The seasonal variation in milk composition derived from the data provides important input for analysis of economic returns to milk production. The data in Table 1 and Figure 1 indicate that milk fat and protein percentages were highest in the fall, winter, and spring months and lowest in the summer months. These seasonal changes in milk composition are consistent with previous reports of milk component variation in the Northeast. In addition, variation in milk composition between herds in any given month was large, indicating that many herds have an opportunity for improving component production.

1. Bailey, K. W., C. M. Jones, and A. J. Heinrichs. 2005. "Economic Returns to Holstein and Jersey Herds Under Multiple Component Pricing." *Journal of Dairy Science* 88:2,269–2,280.
2. The "mean" is the average of the entire dataset (e.g., average fat level). The "standard deviation" is a measure of variation around the mean (e.g., the average fat level was 3.67 percent, but there was a lot of variation from farm to farm).
3. The standard deviation for milk fat (0.32 percent) is roughly double that of either protein (0.19 percent) or other dairy solids (0.12 percent). The standard deviation for SCC is 55.5 percent of the mean, indicating a large dispersion around the mean.

Table 1. Three-year average amount shipped and milk composition for dairy producers in Mideast Federal Order 33 from January 2000 through December 2002.

	n	Milk shipped (lbs/farm) MEAN	Milk shipped (lbs/farm) SD	Fat (%) MEAN	Fat (%) SD	True protein (%) MEAN	True protein (%) SD	Other solids (%) MEAN	Other solids (%) SD	SCC (1,000 cells/ml) MEAN	SCC (1,000 cells/ml) SD
January	29,693	130,315	260,785	3.90	0.32	3.11	0.19	5.64	0.12	326	181
February	29,693	125,733	283,722	3.87	0.31	3.09	0.18	5.65	0.12	334	185
March	29,694	138,613	310,451	3.85	0.30	3.07	0.18	5.66	0.11	331	178
April	29,692	138,730	310,952	3.79	0.29	3.03	0.17	5.68	0.12	334	178
May	29,694	142,134	311,288	3.68	0.30	3.02	0.17	5.70	0.11	334	173
June	29,695	135,313	296,254	3.62	0.28	2.97	0.16	5.68	0.11	353	177
July	29,695	136,203	300,563	3.56	0.26	2.92	0.16	5.66	0.12	393	191
August	29,694	131,579	291,000	3.57	0.27	2.94	0.16	5.64	0.12	415	201
September	29,693	129,847	288,725	3.66	0.28	3.04	0.16	5.63	0.13	382	183
October	29,694	132,843	306,969	3.81	0.31	3.13	0.18	5.63	0.13	342	169
November	29,694	128,752	302,244	3.89	0.32	3.16	0.19	5.63	0.13	318	163
December	29,691	132,808	321,339	3.93	0.33	3.14	0.19	5.64	0.13	334	177
All months	356,322	133,573	299,121	3.76	0.32	3.05	0.19	5.65	0.12	350	182

Figure 1. Monthly average component levels for producers in the Mideast Federal Order, 2000–2002.

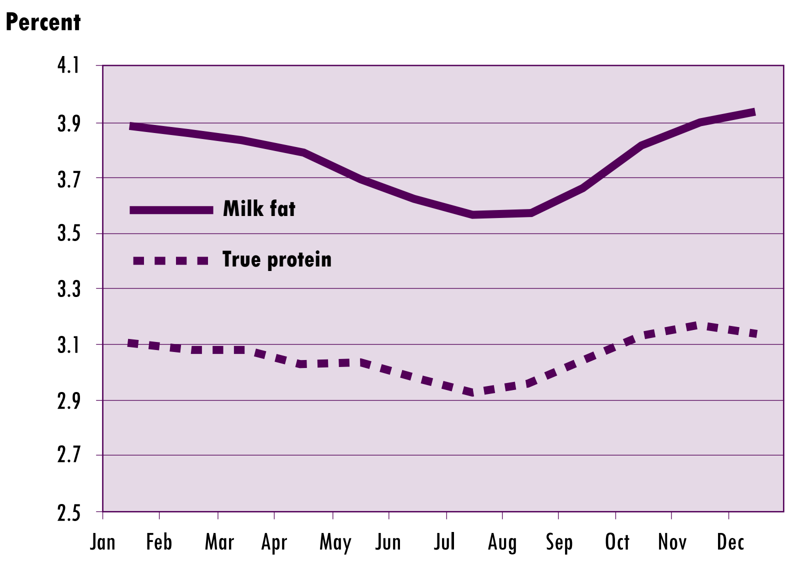

Table 2. Three-year average monthly amount shipped, milk composition, and Class III values for producers in Mideast Federal Order 33 from January 2000 through December 2002.

Category[1]	n	Milk shipped (lbs/mo)		Fat (%)		True protein (%)		SCC (1,000 cells/ml)		Class III value ($/cwt)	
		MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD	MEAN	SD
Less than 50,000	112,534	31,172	11,609	3.83	0.38	3.08	0.23	389	215	$11.70	$2.16
50,001 to 100,000	110,766	72,006	14,115	3.75	0.31	3.04	0.18	359	179	$11.61	$2.09
100,001 to 500,000	121,001	190,090	87,858	3.72	0.27	3.03	0.15	313	145	$11.53	$2.03
Greater than 500,000	12,021	1,090,598	1,220,788	3.61	0.23	3.00	0.12	268	108	$11.40	$1.98

1. Categorized by pounds of milk shipped per month.

Impacts of Herd Size and Management

The study evaluated the effects of herd size on milk components and SCC. In other words, were larger (smaller) farms doing a better or worse job when compared to smaller (larger) farms? To do that, each observation was assigned to one of the following categories, based on amount of milk shipped per month: less than 50,000 pounds, 50,001 to 100,000 pounds, 100,001 to 500,000 pounds, or greater than 500,000 pounds. The data were then summarized by these categories of milk shipped (Table 2). The results indicate that smaller producers had higher levels of milk fat and protein and, thus, a higher Class III value ($/cwt) than larger producers. On the other hand, SCC levels were much higher for smaller producers than for larger producers. In addition, the standard deviation was greater for milk fat, protein, and Class III value for smaller producers than for larger producers.

Next, the USDA federal order dataset was analyzed to determine the percentage of herds that were consistently low in terms of milk fat, protein, and SCC. These herds were arbitrarily divided into two classes: short-term herds that deviated by more than one standard deviation from the monthly mean for one to three months out of a year; and persistent herds that deviated by more than one standard deviation from the monthly mean for nine or more months out of a year. In particular, we were interested in quantifying how many herds in the dataset had low levels of milk fat, protein, and Class III value and high SCC. Regardless of the cause, these conditions negatively impact farm revenues.

The study indicated that over a three-year period 4.8 and 4.4 percent of the herds consistently had low milk fat or protein levels for nine or more months of the year. Low component production for a majority of a year could result from herd genetics or management factors including nutrition or disease. In addition, 9.7 percent of all herds had a SCC higher than one standard deviation above the mean for nine or more months of the year. Although the exact cause is not known, consistently high SCC most likely resulted from mastitis infection in the herd. Regardless of their origin, these consistent problems cost producers money and present opportunity for improved profitability.

The study also determined the number of herds with short-term low performance; these herds had low milk fat and protein and/or high SCC for a one- to three-month period in any year. The analysis suggests that 37.8 and 35.7 percent of all herds that shipped milk into the Mideast Federal Order fit this description for low levels of milk fat and protein, respectively. These herds were average or above average in milk component levels for a majority of the year, which indicated that herd genetics were not responsible for short-term below average performance. Instead, it is likely that management changes or oversights allowed performance to falter. These producers likely could benefit from monitoring systems and/or improved management practices that would identify and correct milk component and SCC problems earlier, thus providing an opportunity to enhance profitability.

Impact of Low Component Levels on Milk Prices

A final question addressed using the USDA federal order data was quantification of the loss in Class III value for a typical producer with milk fat and protein levels one standard deviation below the mean. An average Class III value was produced using Equation 1 and average component levels and prices computed over the three-year period from the federal order dataset (see Table 1). This equation was recalculated after reducing milk fat and protein levels by one standard deviation. The results indicated that during this three-year period, producing milk with milk fat one standard deviation below average reduced the Class III value by $0.46/cwt, or 4.02 percent. Milk with low protein was worth $0.36/cwt or 3.07 percent less. Finally, milk with both milk fat and protein one standard deviation below the mean reduced the Class III value by $0.82/cwt or 7.09 percent.

$$\textit{Class III value}^i = (\beta^i_{mf} \times P^i_{mf} + \beta^i_{pr} \times P^i_{pr} + \beta^i_{os} \times P^i_{os}) \quad [1]$$

where β_k = percentage of component k for delivered milk (k is equal to: *mf* = milk fat, *pr* = protein, and *os* = other solids) and P_k = price of component k per pound.

Conclusions

Analysis of the USDA federal order data indicates that milk component and SCC levels are highly seasonal. The standard deviation for SCC is large relative to the mean, implying opportunities for producers to capture higher quality premiums (or avoid quality deductions) by taking management steps to improve udder health. These data also indicate that 37.8 and 35.7 percent of all herds in the order experienced short-term depressions of milk fat and protein, respectively. In addition, 17.5 percent of herds had a one- to three-month depression of both milk fat and protein, and 36.4 percent of herds had a short-term problem with high SCC. These herds lost revenue as a result.

This study concludes that the most important factor affecting gross profitability is the total amount of milk fat and protein produced. Although milk price is determined in part by the percentage of each component, it is the volume of milk components sold each month that results in higher levels of gross revenue. Regardless of breed, increasing milk volume improves gross profit more than increasing component levels. Thus, a logical management strategy would be to set a target level for milk fat, protein, and daily milk production for each month of the year based on herd genetics, past performance, seasonality, and goals. If component levels and/or daily milk production drop below the target level, corrective action should be implemented quickly to minimize economic losses.

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