United States Department Of Agriculture
Agricultural Marketing Service - Dairy Programs
Mideast Marketing Area - Federal Order 33

2010 Milk Component Analysis

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Methodology

This study analyzes the component levels of milk marketed by producers associated with the Mideast marketing area, Federal Order 33, for 2010. The milk components analyzed in this study include butterfat, protein, other solids and somatic cell count (SCC). These components were selected because the Mideast marketing area uses multiple component pricing (MCP) as the basis for establishing the value of milk pooled on the order. Under MCP, producer milk is priced on the cumulative value of butterfat, protein and other solids pounds with an adjustment for the somatic cell count.

Producer payrolls were analyzed to determine how component levels and milk values varied relative to production region, producer size and season. Econometric models were also estimated to capture the relationship among components in milk.

Data

For 2010 there were 8,401 producers associated with the Mideast marketing area that were included in this analysis. Milk was pooled on the order from 20 states. The geographical area captured by the data population includes Iowa, Illinois, Indiana, Kentucky, Maine, Massachusetts, Maryland, Michigan, Minnesota, Missouri, North Carolina, New York, Ohio, Pennsylvania, Texas, Utah, Virginia, Vermont, Wisconsin, and West Virginia. Of those states, Indiana, Kentucky, Michigan, Ohio, Pennsylvania and West Virginia are located or partially located within the Mideast marketing area.

For the purpose of calculating representative weighted averages, milk from producers with depooled milk, and who pooled milk on multiple orders were included in this analysis provided they also pooled milk on FMMO 33 during 2010. As a result, there is a difference in the number of producers, milk volume and component tests in this study and the number of producers, milk volume and component tests as pooled on FMMO 33 during 2010.

2010 Summary

The producers included in this study marketed approximately 19.0 billion pounds of milk in 2010, and the average monthly delivery volume per producer was 218,992 lbs.

Table 1. Milk Component Statistics FMMO 33, Mideast Marketing Area 2010 - 2009

	2010	2009
Weighted Average		
Butterfat Test	3.65	3.69
Protein Test	3.05	3.05
Other Solids Test	5.71	5.70
Somatic Cell Count (000)	223	231
Milk Component Value ($/cwt)	14.90	11.81
Simple Average		
Butterfat Test	3.82	3.84
Protein Test	3.11	3.10
Other Solids Test	5.65	5.64
Somatic Cell Count (000)	286	294
Milk Component Value ($/cwt)	15.30	12.07

For 2010 the weighted average butterfat test was 3.65 percent, a decrease of 1.08 percent from 2009. The mean butterfat test for 2010 was 3.82 percent. The range of butterfat tests within one standard deviation of the mean was 3.43 to 4.21 percent.

For 2010 the weighted average protein test was 3.05 percent comparable to 2009 protein levels. The mean protein test for 2010 was 3.11 percent. The range of protein tests within one standard deviation of the mean was 2.89 to 3.33 percent.

For 2010 the weighted average other solids test was 5.71 percent. The mean other solids test for 2010 was 5.65 percent. The range of other solids tests within one standard deviation of the mean was 5.54 to 5.76 percent.

For 2010 the weighted average SCC was 223, a decrease of 3.5 percent from 2009. The mean SCC for 2010 was 286. The range of SCC within one standard deviation of the mean was 135 to 437.

For 2010 the aggregate milk component value for producers included in this analysis was $2.8 billion dollars; per cwt the weighted average milk component value was $14.90 per cwt, an increase of 26.2 percent from 2009. The mean milk component value for 2010 was $15.30 per cwt. The range of milk component values within one standard deviation of the mean was 13.40 to $17.20 per cwt. When considering the milk component value ranges it is important to note that for 2010 Class III milk prices ranged from a low of $12.78 per cwt in March to a high of $16.94 in October. The milk component value does not include premiums or deductions other than FMMO SCC adjustments.

The aggregate milk component value includes milk pooled on other orders and milk not pooled due to unusual price relationships.

Component Analysis by Month

Dairy cows, when exposed to high temperature coupled with high humidity or radiant energy (sunlight) traditionally respond with reduced milk yield and lower butterfat and protein tests.

The weighted average butterfat test ranged from a low of 3.49 percent in July to a high of 3.86 percent in December.

The weighted average protein test ranged from a low of 2.92 percent in July to a high of 3.18 percent in November and December.

Other solids tests remained steady throughout the year, ranging from a high of 5.73 percent in May to a low of 5.69 percent in August.

The variations in somatic cell counts were opposite that of butterfat and protein, with higher SCCs in the late summer months and lower SCCs in the fall and winter months. Weighted average SCCs ranged from a high of 262 in August to a low of 198 in November.

A convenient aspect of computing the milk value using milk components is that a comparison can be drawn between the component milk value and the announced class III price. In this study that difference is referred to as the component price difference (CPD). Positive (negative) values are a result of component tests that are greater (less) than the standard component tests used to calculate the Class III price.1/

The milk component value ranged from a low of $13.26 per cwt in April to a high of $17.99 per cwt in October. Meanwhile the CPD ranged from a low of -$0.10 in July (when BF and Protein were at their lowest) to a high of $1.22 per cwt in November.

Figure 1. Weighted Average Component Tests by Month, Mideast Marketing Area 2010

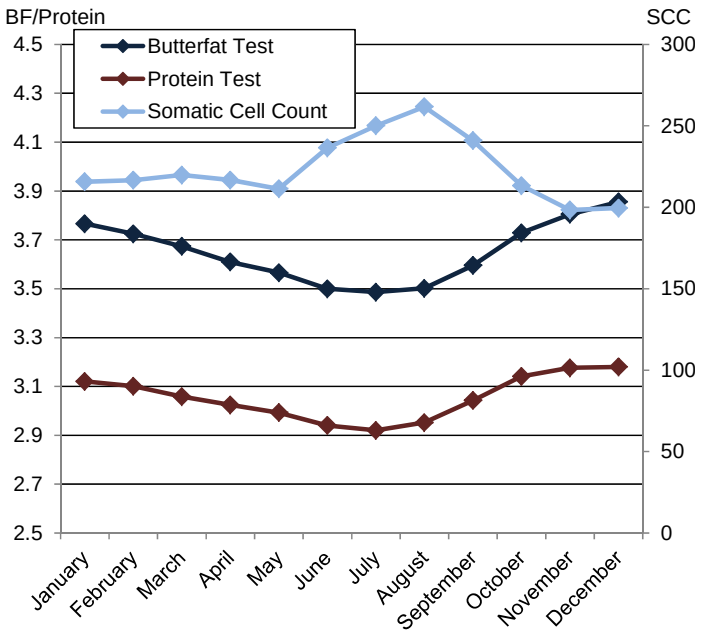


Table 2. Weighted Average Component Tests by Month, Mideast Marketing Area 2010

Month	Butterfat Test	Protein Test	Other-Solids Test	Somatic Cell Count	Milk Component Value	Component Price Difference
	%	%	%	(000)	$/cwt	$/cwt
January	3.77	3.12	5.71	216	15.35	0.85
February	3.72	3.10	5.70	217	15.00	0.72
March	3.67	3.06	5.71	220	13.28	0.50
April	3.61	3.02	5.72	217	13.26	0.34
May	3.57	2.99	5.73	211	13.60	0.22
June	3.50	2.94	5.72	237	13.59	-0.03
July	3.49	2.92	5.71	250	13.64	-0.10
August	3.50	2.95	5.69	262	15.15	-0.03
September	3.60	3.04	5.70	241	16.71	0.45
October	3.73	3.14	5.70	213	17.99	1.05
November	3.80	3.18	5.71	198	16.66	1.22
December	3.86	3.18	5.71	200	14.99	1.16
Weighted Average	**3.65**	**3.05**	**5.71**	**223**	**14.90**	**0.52**

1/ Class III milk price is calculated using the formula: 2.99(Protein price) + 5.69(Other solids price) + 3.5(Butterfat price).

Component Analysis by State

Of the states included in this analysis, total 2010 delivery pounds ranged from a low of 1.5 million pounds for Georgia producers, to a high of 7.6 billion pounds for Michigan producers. Milk from Michigan producers accounted for approximately 40.2 percent of the milk included in this analysis.

The weighted average butterfat test for producers pooling on the Mideast order ranged from a low of 3.23 percent in Georgia to a high of 3.90 percent in West Virginia. For states located within the Mideast marketing area the weighted average butterfat test was the lowest in Michigan at 3.59 percent.

The weighted average protein test for producers pooling on the Mideast order ranged from a low of 2.90 percent in Georgia to a high of 3.19 percent in West Virginia. For states located within the Mideast marketing area the weighted average protein tests was the lowest in Michigan at 3.04 percent.

The weighted average other solids test for producers pooling on the Mideast order ranged from a low of 5.63 percent in Georgia and Kentucky to a high of 5.82 percent in Iowa. For states located within the Mideast marketing area the weighted average other solids tests was the highest in Michigan at 5.71 percent.

The weighted average SCC for producers pooling on the Mideast order ranged from a low of 189 in Virginia to a high of 489 in Georgia. For states located within the Mideast marketing area the weighted average SCC ranged from a low of 190 in Michigan to a high of 352 in Kentucky.

The weighted average milk component value for producers pooling on the Mideast order ranged from a low of $12.84 per cwt in Georgia to a high of $15.93 per cwt in Illinois. For states located within the Mideast marketing area the weighted average milk component value ranged from a low of $14.80 per cwt in Michigan to a high of $15.56 per cwt in West Virginia. The value of the milk in this section is related to when the milk was pooled. During some months more or less milk may be pooled on the order from a particular state resulting in higher or lower milk value approximations.

Figure 2. Weighted Average Somatic Cell Count, Mideast Marketing Area 2010 2/3/

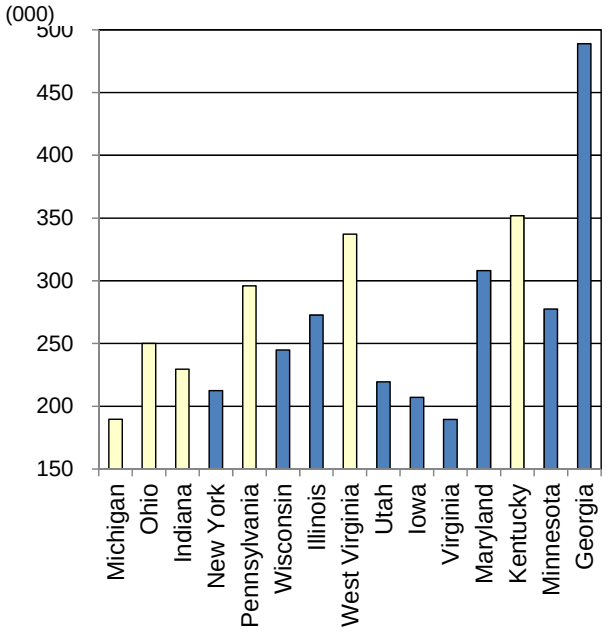


Table 3. Weighted Average Component Tests by State, Mideast Marketing Area 2010

State	Butterfat Test	Protein Test	Other-Solids Test	Somatic Cell Count	Milk Component Value	Component Price Difference
	%	%	%	(000)	$/cwt	$/cwt
Indiana	3.66	3.06	5.70	230	15.01	0.54
Kentucky	3.77	3.11	5.63	352	15.54	0.79
Michigan	3.59	3.04	5.71	190	14.80	0.41
Ohio	3.71	3.08	5.69	250	15.04	0.68
Pennsylvania	3.75	3.08	5.68	296	14.97	0.71
West Virginia	3.90	3.19	5.65	337	15.56	1.22
Georgia	3.23	2.90	5.63	489	12.84	-0.78
Illinois	3.73	3.09	5.73	273	15.93	0.77
Iowa	3.51	2.94	5.82	207	14.38	0.02
Maryland	3.87	3.12	5.67	308	15.39	1.03
Minnesota	3.85	3.09	5.77	277	15.45	0.94
New York	3.65	3.05	5.72	213	14.85	0.52
Utah	3.34	3.03	5.73	219	14.03	-0.12
Virginia	3.54	3.02	5.71	189	13.80	0.24
Wisconsin	3.63	3.02	5.80	245	14.85	0.40
Weighted Average	**3.65**	**3.05**	**5.71**	**223**	**14.90**	**0.52**

2/ States sorted from left to right in descending order based on aggregate milk delivery volume.
3/ Yellow shaded states denotes states located within the Mideast marketing area.

Component Analysis by Producer Size

In order to examine the impact producer size has on the component levels of herd milk, producers associated with the Mideast market were divided into ten groups with the same number of producers based on average monthly delivery volume. In total there were 8,401 producers included in this study, so each percentile group had 840 producers. Percentile group one includes an extra producer to balance and represents producers with the smallest delivery volume, while percentile group ten represents producers with the highest delivery volume.

The weighted average butterfat test ranged from a high of 3.99 percent for producers in percentile group one to a low of 3.57 percent for producers in percentile group ten.

The weighted average protein test ranged from a high of 3.17 percent for producers in percentile group one to a low of 3.03 percent for producers in percentile group ten.

The weighted average other solids test ranged from a low of 5.58 percent for producers in percentile group one to a high of 5.73 percent for producers in percentile group ten.

The weighted average SCC ranged from a high of 341 for producers in percentile group one to a low of 193 for producers in percentile group ten.

The data suggests that component levels of butterfat, protein and SCC are negatively correlated with producer delivery volume, while other solids tests are positively correlated with delivery volume. The negative correlation between SCC and delivery volume indicate that as producer delivery volume increases the SCC decreases. Low SCC is considered an indicator of high quality milk.

The weighted average milk component value ranged from a high of $15.65 per cwt for producers in percentile group one to a low of $14.76 per cwt for producers in percentile group ten.

Delivery statistics varied considerably among the percentile groups. The largest percentile group (ten) accounted for more than 11 billion pounds of milk, representing approximately 62 percent of the milk that was included in this analysis. The smallest percentile group (one) accounted for 108 million pounds of milk, representing less than one percent of the milk that was included in this analysis.

The average annual delivery volume ranged from a low of 128,853 pounds for producers in the smallest percentile group to 14.0 million pounds of milk for producers in the largest percentile group, with the average annual delivery volume among all groups at 2.3 million lbs. Figure 3 details average annual delivery volume by percentile group.

Figure 3. Average Annual Delivery Volume by Percentile Group, Mideast Marketing Area 2010

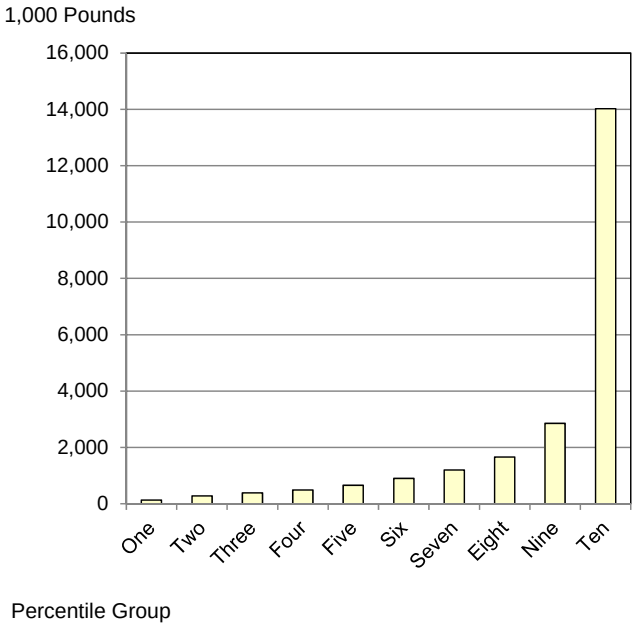


Table 4. Weighted Average Component Tests by Producer Size, Mideast Marketing Area 2010

Percentile Group	Butterfat Test	Protein Test	Other-Solids Test	Somatic Cell Count	Milk Component Value	Component Price Difference
	%	%	%	(000)	$/cwt	$/cwt
One	3.99	3.17	5.58	341	15.65	1.29
Two	3.94	3.14	5.61	322	15.52	1.16
Three	3.92	3.13	5.63	306	15.47	1.12
Four	3.85	3.11	5.63	310	15.29	0.95
Five	3.82	3.10	5.65	305	15.21	0.87
Six	3.81	3.10	5.66	296	15.21	0.86
Seven	3.78	3.09	5.68	282	15.15	0.80
Eight	3.75	3.08	5.69	264	15.09	0.73
Nine	3.70	3.06	5.70	241	14.98	0.62
Ten	3.57	3.03	5.73	193	14.76	0.37
Weighted Average	**3.65**	**3.05**	**5.71**	**223**	**14.90**	**0.52**

Regression Analysis

OLS regression analysis was used to estimate the linear relationship among milk components including fixed time and entity effects (panel). Including entity and time effects allows for the models to account for omitted variables without actually observing them. For example, entity effects provide to ability to capture different farm management practices that are unobservable yet impact component levels. Time effects provide the ability to capture the seasonal variation in milk components.

Model Results

OLS regression results are presented in Table 5. The estimated coefficients from each of the models were used to estimate component elasticities. The elasticities (Table 6) are the ratio of the percent change in one variable to the percent change in another variable. For example the elasticity of butterfat with respect to protein is:

$$E_{bf,pr} = \frac{\partial bf}{\partial pr} \times \frac{pr}{bf}$$

As demonstrated in the regression results and the computed elasticities butterfat is positively correlated with the protein level, and negatively correlated with the other solids level and milk pounds, holding all else constant. The protein level had the most significant impact on the butterfat level. The computed elasticity indicated that a one percent increase in the protein level resulted in a 0.54 percent increase in the butterfat test, holding all else constant.

Protein is positively correlated with the butterfat and negatively correlated with milk pounds, holding all else constant. Other solids did not statistically influence the protein test. The butterfat level had the most significant impact on the protein level. The computed elasticity indicated that a one percent increase in the butterfat resulted in a 0.29 percent increase in the milk protein, holding all else constant.

Other solids are positively correlated with milk pounds and negatively correlated with the butterfat, holding all else constant. Protein did not statistically influence the other solids test. Butterfat had the most significant impact on the other solids level. The computed elasticity indicated that a one percent increase in the butterfat resulted in a –0.03 percent decrease in other solids, holding all else constant.

The elasticity of the components to milk pounds validates the relationship among milk output and component output. When the milk yield increases, the composition of butterfat and protein in the milk decrease, resulting in lower test percentages, holding all else constant.

Table 5. OLS Regression Results

Dependent Variable	Butterfat	Protein	Other-Solids
Intercept	4.13 * (0.08)	2.39 * (0.05)	5.90 * (0.02)
Protein	0.66 * (0.01)		0.00 (0.00)
Butterfat		0.23 * (0.00)	-0.04 * (0.00)
Other-Solids	-0.32 * (0.01)	0.00 (0.01)	
Somatic-Cell Count			
Pounds	-2E-07 * (0.00)	-8E-08 * (0.00)	-8E-08 * (0.00)
R-Squared	0.881	0.866	0.788

1/ Approximated standard errors in parenthesis; *p < 0.01; (N=69,252)

Table 6. Computed Elasticities

Computed Elasticities	**2010**	**2009**
Butterfat		
$E_{bf,pr}$	0.536	0.531
$E_{bf,os}$	-0.474	-0.284
$E_{bf,lbs}$	-0.009	-0.003
Protein		
$E_{pr,bf}$	0.286	0.306
$E_{pr,os}$	0.000	0.007
$E_{pr,lbs}$	-0.006	-0.001
Other-Solids		
$E_{os,bf}$	-0.029	-0.022
$E_{os,pr}$	0.000	0.001
$E_{os,lbs}$	-0.003	0.002

Conclusion

The data included in this analysis indicates that component levels vary significantly with respect to producer size, production region and season. The observed variations in component tests are likely caused by multiple factors including but not limited to herd demographics, lactation stage, climate conditions and farm management. Additionally, other factors likely impacting milk component tests could be mechanical issues such as sampling problems, agitation problems or tank temperature.

Figure 4. Weighted Average Butterfat Test by State and County, Mideast Marketing Area 2010 4/

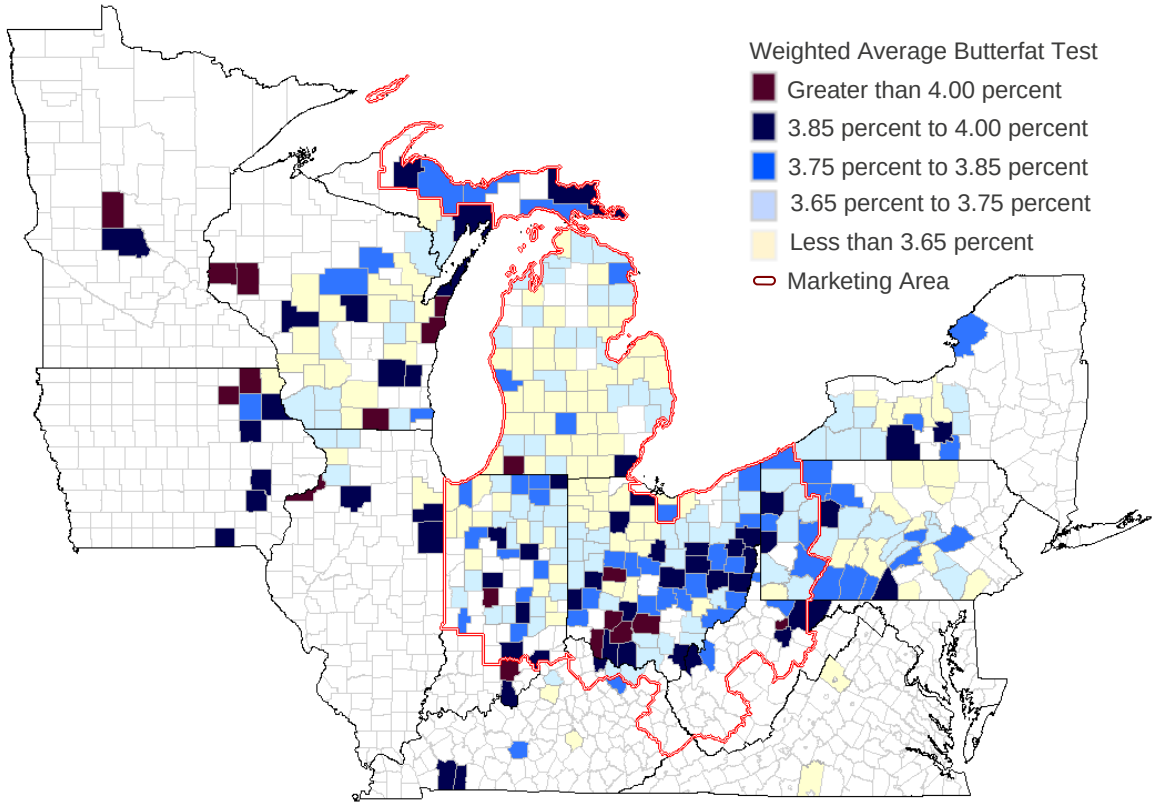
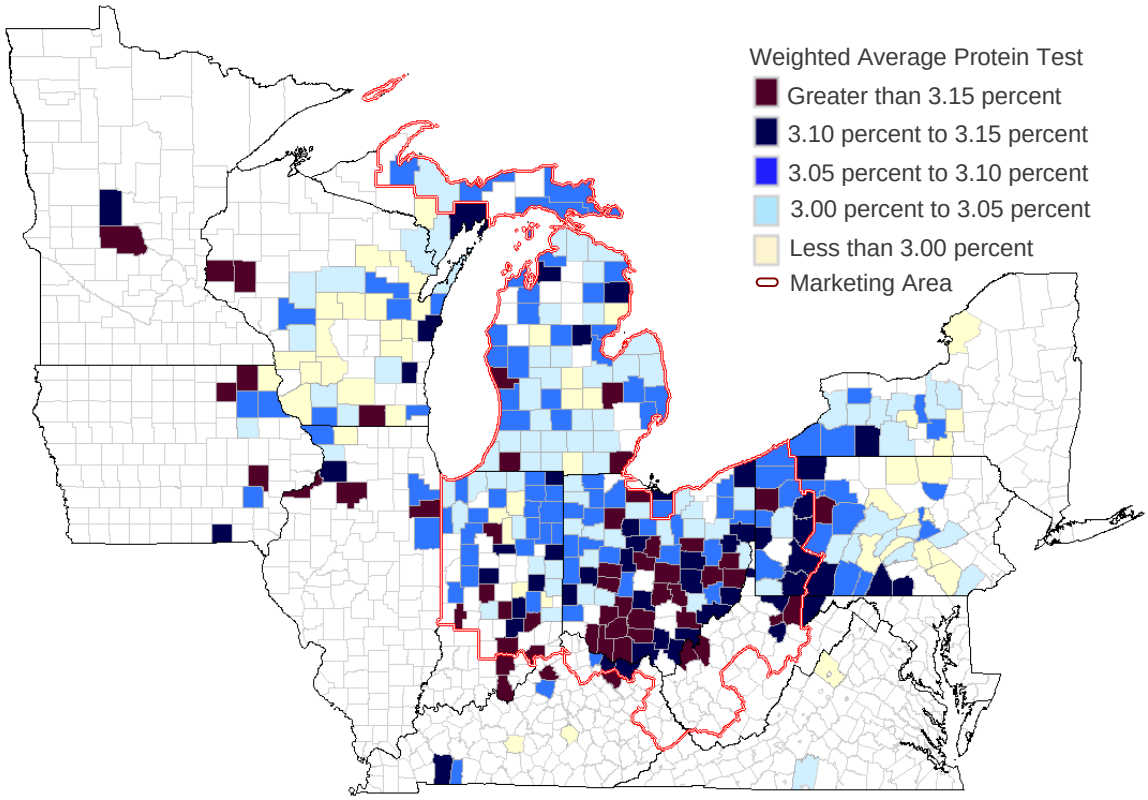
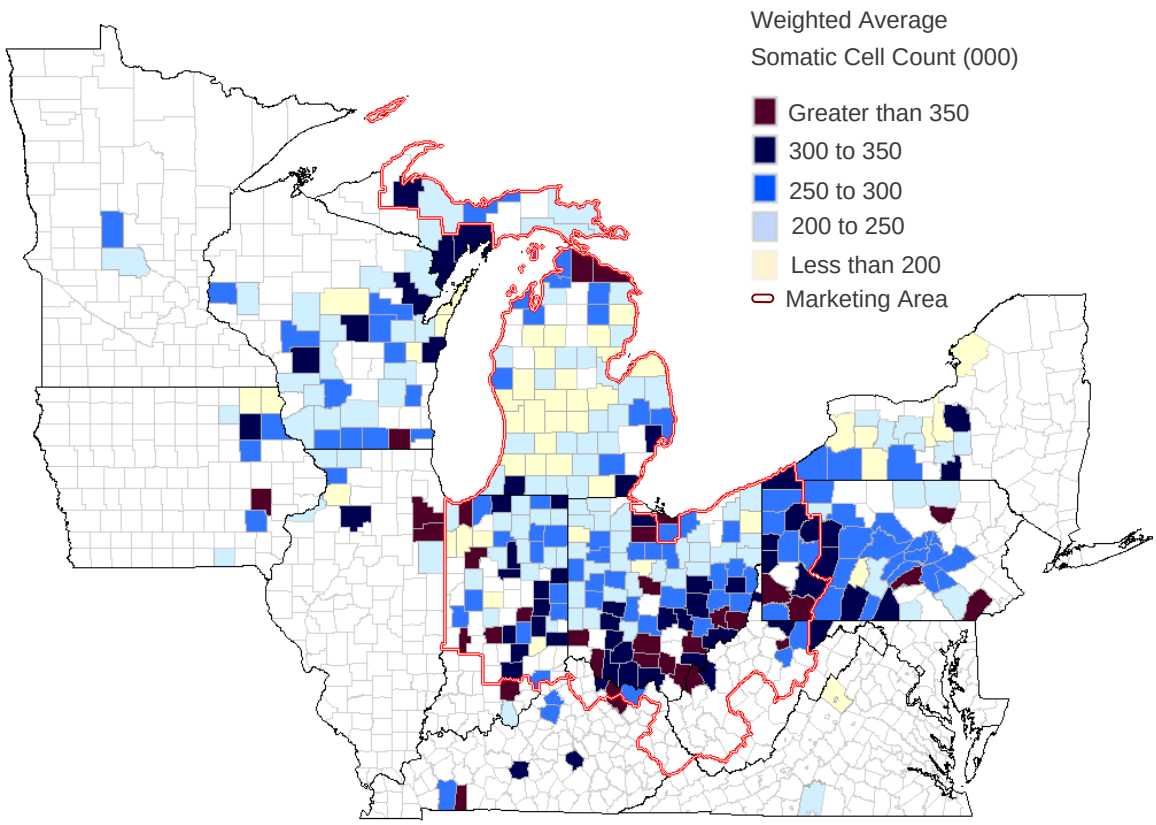


Figure 5. Weighted Average Protein Test by State and County, Mideast Marketing Area 2010 4/



4/ Milk from Georgia and Utah not shown, excludes restricted data.

Figure 6. Weighted Average Somatic Cell Count Test by State and County, Mideast Marketing Area 2010 4/



4/ Milk from Georgia and Utah not shown, excludes restricted data.