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

2009 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 2009. 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 2009 there were 8,210 producers associated with the Mideast marketing area that were included in this analysis. Milk was pooled on the order from 19 states. The geographical area captured by the data population includes Iowa, Illinois, Indiana, Kentucky, Maine, Massachusetts, Maryland, Michigan, Minnesota, 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 2009. 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 2009.

2009 Summary

The producers included in this study marketed approximately 18.3 billion pounds of milk in 2009, and the average annual delivery volume was 2.2 million lbs.

Table 1. Milk Component Statistics FMMO 33, Mideast Marketing Area 2008 - 2009

	2009	2008
Weighted Average		
Butterfat Test	3.69	3.70
Protein Test	3.05	3.06
Other Solids Test	5.70	5.70
Somatic Cell Count (000)	231	259
Milk Component Value ($/cwt)	11.81	18.09
Simple Average		
Butterfat Test	3.84	3.84
Protein Test	3.10	3.10
Other Solids Test	5.64	5.65
Somatic Cell Count (000)	294	316
Milk Component Value ($/cwt)	12.07	18.40

For 2009 the weighted average butterfat test was 3.69 percent, a decrease of 0.27 percent from 2008. The mean butterfat test for 2009 was 3.84 percent. The range of butterfat tests within one standard deviation of the mean was 3.48 to 4.20 percent.

For 2009 the weighted average protein test was 3.05 percent, a decrease of 0.33 percent from 2008. The mean protein test for 2009 was 3.10 percent. The range of protein tests within one standard deviation of the mean was 2.89 to 3.31 percent.

For 2009 the weighted average other solids test was 5.70 percent. The mean other solids test for 2009 was 5.64 percent. The range of other solids tests within one standard deviation of the mean was 5.53 to 5.75 percent.

For 2009 the weighted average SCC was 231, a decrease of 10.81 percent from 2008. The mean SCC for 2009 was 294. The range of SCC within one standard deviation of the mean was 134 to 454.

For 2009 the aggregate milk component value for producers included in this analysis was $2.2 billion dollars; per cwt the weighted average milk component value was $11.81 per cwt, a decrease of 34.7 percent from 2008. The mean milk component value for 2009 was $12.07 per cwt. The range of milk component values within one standard deviation of the mean was $9.89 to $14.25 per cwt. When considering the milk component value ranges it is important to note that for 2009 Class III milk prices ranged from a low of $9.31 per cwt in February to a high of $14.98 in December. 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 high of 3.81 percent in January to a low of 3.54 percent in July.

The weighted average protein test ranged from a low of 2.96 percent in June and July to a high of 3.14 percent in December.

Other solids tests remained steady throughout the year, ranging from a low of 5.69 percent in January through March and August through September, to a high of 5.71 percent in June and December.

The variations in somatic cell counts were opposite that of butterfat and protein, with higher SCCs in the summer months and lower SCCs in the fall and winter months. Weighted average SCCs ranged from a high of 255 in August to a low of 211 in December.

A convenient aspect of computing the milk value using the 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 $9.86 per cwt in February to a high of $15.94 per cwt in December. Meanwhile the CPD ranged from a low of $0.06 in July (when BF and Protein were at their lowest) to a high of $0.96 per cwt in December.

Figure 1. Weighted Average Component Tests by Month, Mideast Marketing Area 2009

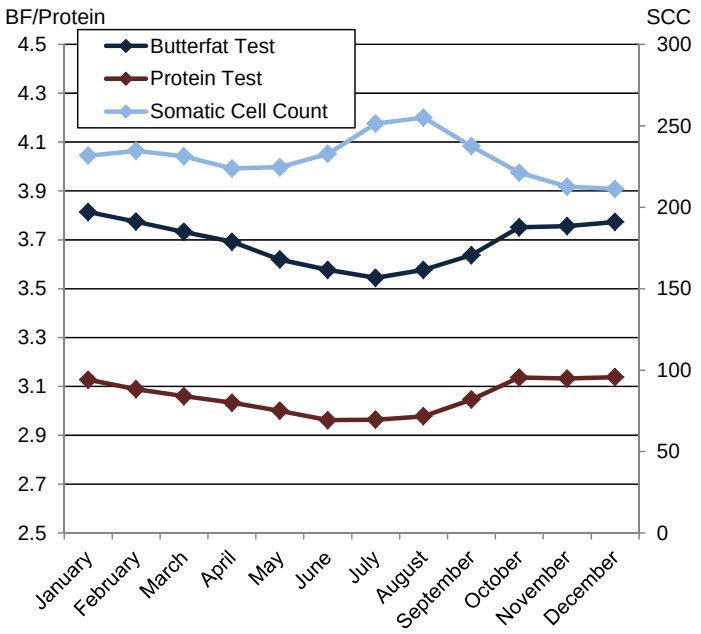


Table 2. Weighted Average Component Tests by Month, Mideast Marketing Area 2009

Month	Butterfat Test	Protein Test	Other-Solids Test	Somatic Cell Count	Milk Component Value	Component Price Difference
	%	%	%	(000)	$/cwt	$/cwt
January	3.81	3.13	5.69	232	11.52	0.74
February	3.77	3.09	5.69	235	9.86	0.55
March	3.73	3.06	5.69	231	10.93	0.49
April	3.69	3.03	5.70	224	11.18	0.40
May	3.62	3.00	5.70	225	10.08	0.24
June	3.58	2.96	5.71	233	10.09	0.12
July	3.54	2.96	5.70	251	10.03	0.06
August	3.58	2.98	5.69	255	11.33	0.13
September	3.64	3.05	5.69	238	12.49	0.38
October	3.75	3.14	5.70	221	13.60	0.78
November	3.76	3.13	5.70	213	14.93	0.85
December	3.77	3.14	5.71	211	15.94	0.96
Weighted Average	3.69	3.05	5.70	231	11.81	0.47

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 2009 delivery pounds ranged from a low of 259 thousand pounds for Vermont producers, to a high of 7.3 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 3.37 percent in Utah to a high of 4.13 percent in Maine. For states located within the Mideast marketing area the weighted average butterfat test ranged from a low of 3.63 percent in Michigan to a high of 3.93 percent in West Virginia.

The weighted average protein test for producers pooling on the Mideast order ranged from a low of 2.94 percent in Iowa to a high of 3.19 percent in West Virginia. For states located within the Mideast marketing area the weighted average protein tests were as low as 3.04 percent in both Michigan and Indiana.

The weighted average other solids test for producers pooling on the Mideast order ranged from a low of 5.59 percent in North Carolina to a high of 5.85 percent in Iowa. For states located within the Mideast marketing area the weighted average other solids tests ranged from a low of 5.61 percent in Kentucky to a high of 5.71 percent in Michigan.

The weighted average SCC for producers pooling on the Mideast order ranged from a low of 176 in Iowa to a high of 391 in North Carolina. For states located within the Mideast marketing area the weighted average SCC ranged from a low of 201 in Michigan to a high of 384 in Kentucky.

The weighted average milk component value for producers pooling on the Mideast order ranged from a low of $10.85 per cwt in Utah to a high of $13.37 per cwt in Vermont. For states located within the Mideast marketing area the weighted average milk component value ranged from a low of $11.74 per cwt in Michigan to a high of $12.19 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 2009 2/3/

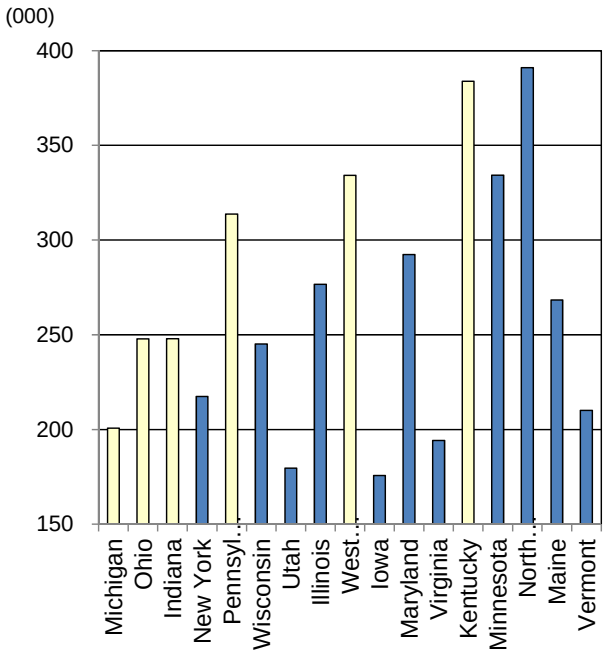


Table 3. Weighted Average Component Tests by State, Mideast Marketing Area 2009

State	Butterfat Test	Protein Test	Other-Solids Test	Somatic Cell Count	Milk Component Value	Component Price Difference
	%	%	%	(000)	$/cwt	$/cwt
Indiana	3.72	3.04	5.69	248	11.77	0.47
Kentucky	3.70	3.08	5.61	384	11.85	0.47
Michigan	3.63	3.04	5.71	201	11.74	0.39
Ohio	3.74	3.08	5.68	248	11.93	0.59
Pennsylvania	3.79	3.09	5.66	314	11.97	0.63
West Virginia	3.93	3.19	5.65	334	12.19	1.00
Illinois	3.67	3.03	5.73	277	10.92	0.36
Iowa	3.43	2.94	5.85	176	11.30	-0.06
Maine	4.13	3.18	5.72	268	11.97	1.19
Maryland	3.92	3.12	5.66	292	12.18	0.86
Minnesota	3.83	3.08	5.67	334	12.09	0.66
New York	3.67	3.05	5.70	217	11.80	0.45
North Carolina	3.76	3.09	5.59	391	12.22	0.58
Utah	3.37	3.05	5.72	180	10.85	0.06
Vermont	4.07	3.18	5.65	210	13.27	1.25
Virginia	3.58	3.05	5.68	194	11.66	0.37
Wisconsin	3.67	3.01	5.76	245	11.75	0.34
Weighted Average	3.69	3.05	5.70	231	11.81	0.47

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 8,210 producers included in this study, so each percentile group had 821 producers. Percentile group one 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 low of 3.61 percent for producers in percentile group ten to a high of 3.98 percent for producers in percentile group one.

The weighted average protein test ranged from a low of 3.04 percent for producers in percentile group ten to a high of 3.16 percent for producers in percentile group one.

The weighted average other solids test ranged from a low of 5.56 percent for producers in percentile group one to a high of 5.72 percent for producers in percentile group ten.

The weighted average SCC ranged from a low of 199 for producers in percentile group ten to a high of 354 for producers in percentile group one.

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 producer size. 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 low of $11.71 per cwt for producers in percentile group ten to a high of $12.30 per cwt for producers in percentile group one.

Delivery statistics varied considerably among the percentile groups. The largest percentile group (ten) accounted for more than 11 billion pounds of milk, representing approximately 60 percent of the milk that was included in this analysis.

The average annual delivery volume ranged from a low of 111,043 pounds for producers in the smallest percentile group to 13.4 million pounds of milk for producers in the largest percentile group, with the average annual delivery volume among all groups at 2.2 million lbs. Figure 3 details average annual delivery volume by percentile group.

Figure 3. Average Annual Delivery Volume by Percentile Group, Mideast Marketing Area 2009

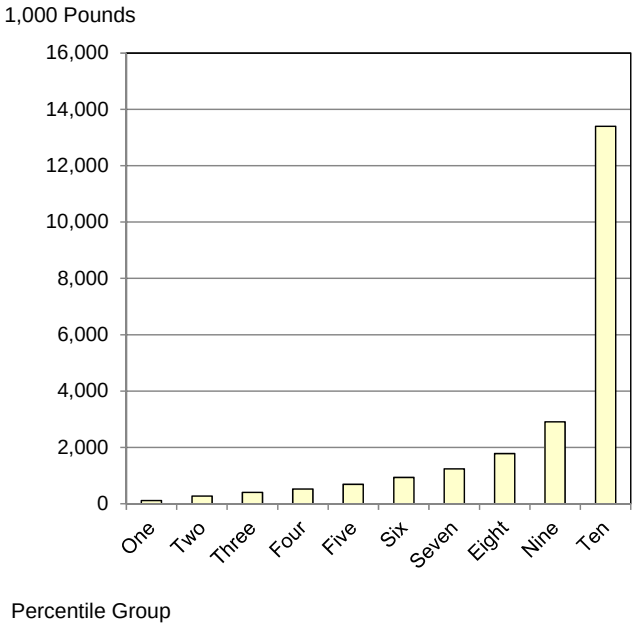


Table 4. Weighted Average Component Tests by Producer Size, Mideast Marketing Area 2009

Percentile Group	Butterfat Test	Protein Test	Other-Solids Test	Somatic Cell Count	Milk Component Value	Component Price Difference
	%	%	%	(000)	$/cwt	$/cwt
One	3.98	3.16	5.56	354	12.30	0.99
Two	3.94	3.13	5.60	325	12.19	0.90
Three	3.90	3.12	5.61	328	12.10	0.82
Four	3.87	3.11	5.63	316	12.06	0.77
Five	3.84	3.10	5.64	317	12.00	0.70
Six	3.83	3.09	5.65	306	12.01	0.69
Seven	3.80	3.08	5.66	284	11.96	0.65
Eight	3.78	3.08	5.68	270	11.93	0.62
Nine	3.73	3.06	5.69	246	11.87	0.54
Ten	3.61	3.04	5.72	199	11.71	0.36
Weighted Average	3.69	3.05	5.70	231	11.81	0.47

Regression Analysis 4/

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.

The model used in the 2008 analysis incorporated interaction terms among the component level variables. This introduced multicollinearity, which was not a problem in previous analyses. As a result, interaction terms will no longer be used in the component models.

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 0.53 percent increase in the butterfat test, holding all else constant.

Protein is positively correlated with the butterfat and other solids level (p-value of 0.49), and negatively correlated with milk pounds, holding all else constant. 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 0.31 percent increase in the milk protein, holding all else constant.

Other solids are positively correlated with the protein level (p-value of 0.49) and milk pounds, and negatively correlated with the butterfat, holding all else constant. 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 –0.02 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 decreases, resulting in lower test percentages, holding all else constant.

Table 5. OLS Regression Results

Dependent Variable	Butterfat	Protein	Other-Solids
Intercept	3.153 * (0.07)	2.186 * (0.04)	5.925 * (0.02)
Protein	0.656 * (0.01)		0.002 (0.00)
Butterfat		0.248 * (0.00)	-0.033 * (0.00)
Other-Solids	-0.193 * (0.01)	0.004 (0.01)	
Pounds	-6E-08 * (0.00)	-2E-08 * (0.00)	4E-08 * (0.00)
R-Squared	0.865	0.850	0.759

1/ Approximated standard errors in parenthesis; *p < 0.01; (N=73,384)

Table 6. Computed Elasticities

Computed Elasticities	**2009**	**2008**
Butterfat		
$E_{bf,pr}$	0.531	0.596
$E_{bf,os}$	-0.284	
$E_{bf,lbs}$	-0.003	
Protein		
$E_{pr,bf}$	0.306	0.347
$E_{pr,os}$	0.007	
$E_{pr,lbs}$	-0.001	
Other-Solids		
$E_{os,bf}$	-0.022	-0.018
$E_{os,pr}$	0.001	
$E_{os,lbs}$	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.

4/ The 2008 Component Analysis used random entity effects; results of a fixed two-way test indicate that the appropriate estimation procedure is fixed entity effects. Variance inflation factors computed using 2009 data indicated the presence of multicollinearity stemming from the use of interaction variables; interaction variables will be omitted from this and future research.

Figure 4. Weighted Average Butterfat Test by State and County, Mideast Marketing Area 2009 5/

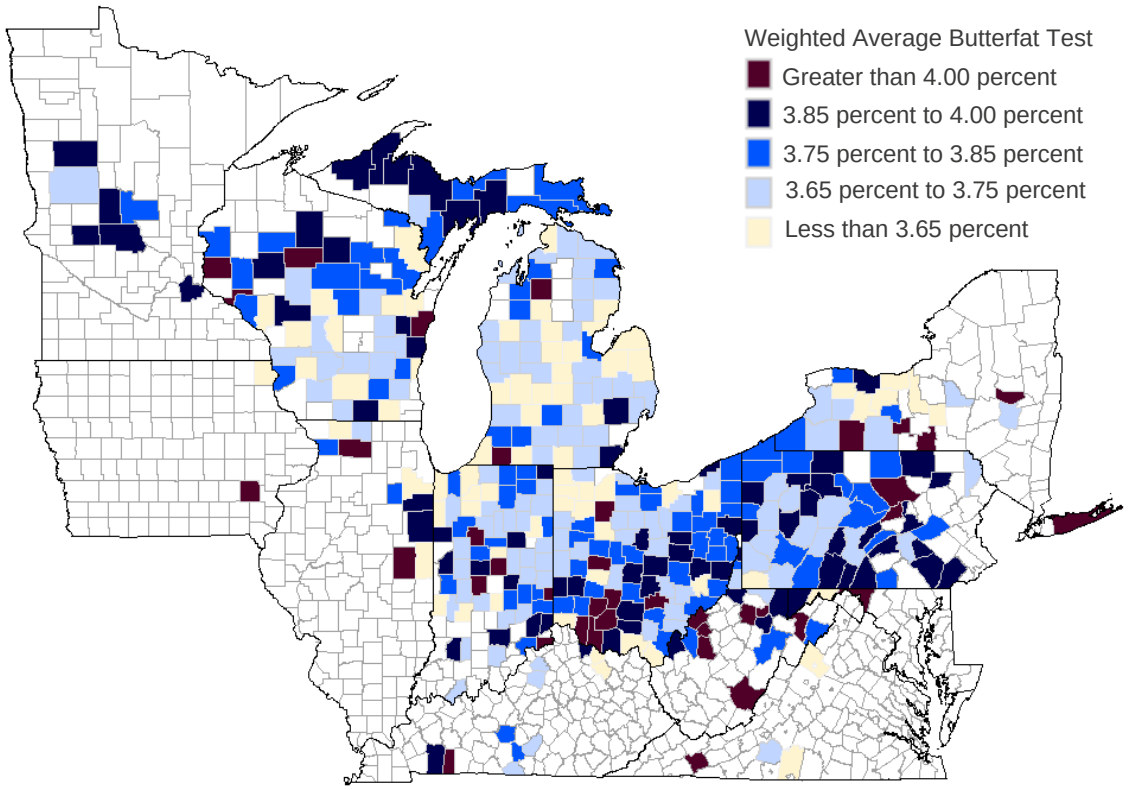
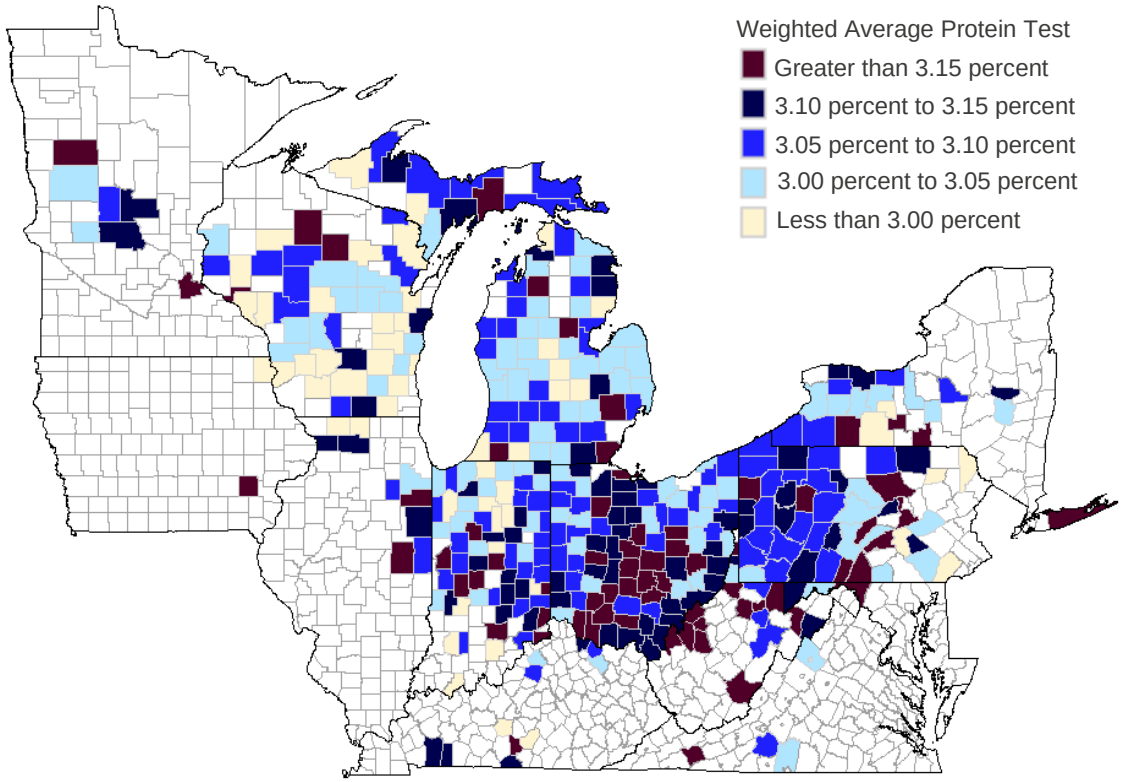
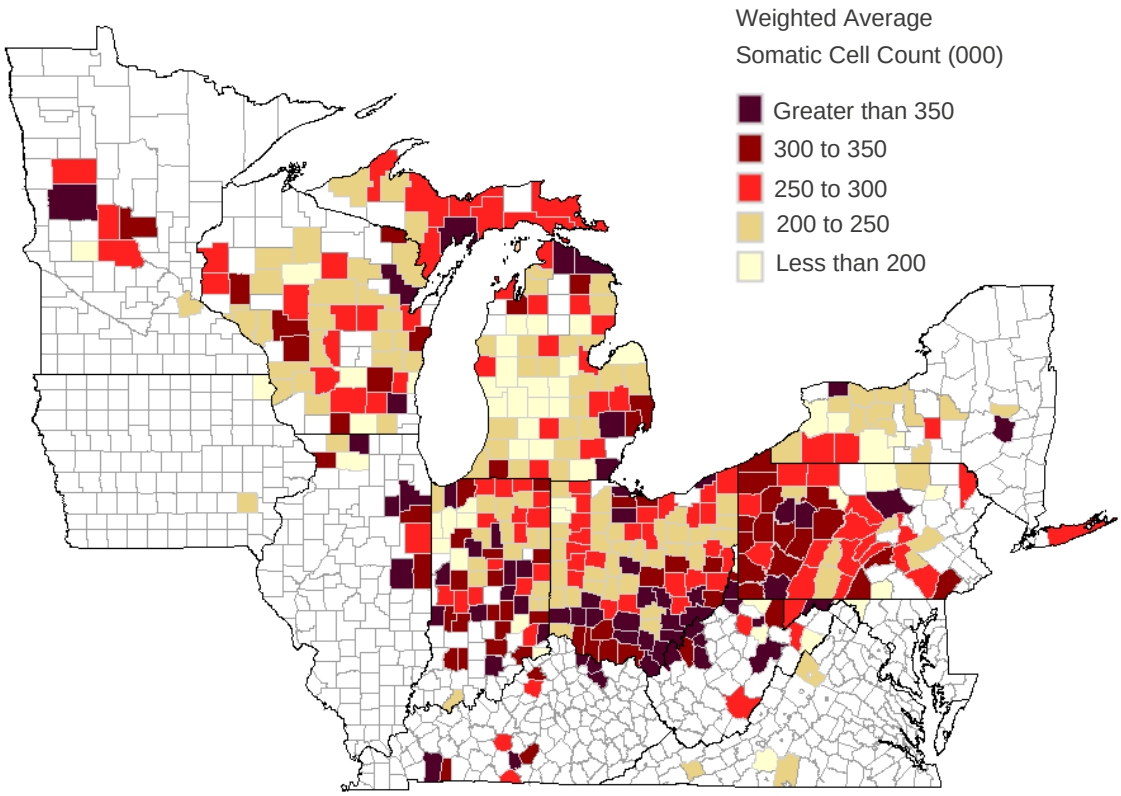


Figure 5. Weighted Average Protein Test by State and County, Mideast Marketing Area 2009 5/



5/ Milk from Maine, Massachusetts, North Carolina, Texas and Utah not shown.

Figure 6. Weighted Average Somatic Cell Count Test by State and County, Mideast Marketing Area 2009 5/



5/ Milk from Maine, Massachusetts, North Carolina, Texas and Utah not shown.