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Changes in Testing and Paying for Milk Components as Proposed under the Final Rule of Federal Order Reform: Implications for Dairy Producers

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Introduction

Since November 1,1995, federal milk marketing orders that impact Wisconsin producer pay prices have been amended to implement multiple component pricing (MCP). Dairy producers shipping Grade A milk to a milk plant regulated under an order has been paid on the basis of three milk components—butterfat, protein and other solids (lactose and ash). Because of competition among milk dairy cooperatives and other milk buyers, most all Wisconsin dairy farmers are paid on the basis of these milk components. However, MCP programs do vary among milk buyers.

Under provisions authorized by the Federal Agriculture Improvement and Reform Act of 1996 (FAIR ACT), the U.S. Secretary of Agriculture issued on April 4,1999 a final rule for amending all federal milk market orders. The final rule, if implemented, would make major changes in how milk component values are calculated. In addition, the final rule makes a major change in how the protein composition of milk is determined. Historically, the Kjeldahl method has been used to test for milk protein. Milk protein is not measured directly by the Kjeldahl. The test instead measures the nitrogen content of milk. To convert the Kjeldahl nitrogen reading to milk protein, the nitrogen measurement is multiplied by a factor of 6.38. The Kjeldahl assumes all nitrogen found in milk is contained in protein. However, this is not the case. A portion of the nitrogen in milk comes from non-protein sources, such as urea and uric acid. These other protein sources are called non-protein nitrogen (NPN). The Kjeldahl method actually measures what is termed "total" protein. The final rule would change this procedure and test for "true" protein in milk, the total nitrogen minus the NPN, multiplied by 6.38.

This paper briefly describes the current MCP program, its associated issues, and the proposed changes in MCP under the final rule with specific implications to dairy producers of testing for "true" protein in milk.

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Existing MCP

The existing MCP program under federal orders is really not a true multiple component program. This is because the monthly Basic Formula Price (BFP), as reported by USDA is used in the calculation of monthly component values.[2] This monthly BFP price is actually de-composed into component values as follows:

First, the price per pound of butterfat is determined from a formula based on the yield on butter from 100 pounds of milk and the CME wholesale butter price.

Second, the price per pound of protein is determined from a formula based on the yield of cheese from 100 pounds of milk as protein composition changes and the USDA monthly average U.S. NASS 40 pound cheddar cheese survey price.

Third, the price per pound for the other solids is a residual value determined as follows:
The announced BFP "at Test" (the average milk composition tests for the BFP)
Minus the Butterfat value (butterfat price/lb. X butterfat test)
Minus the protein value (protein price/lb. X protein test)
This remaining residual is divided by the other solids test to get the other solids price per pound.

As can be seen, the sum of the component values per 100 pounds of milk cannot exceed the announced BFP "at test" for the month. This procedure has raised questions among many producers as to why their component values fluctuate so much from month to month, and in fact, at times, the other solids component had no value. Relatively high butter prices the summer and fall of 1998, accounted for the major share of the value of the announced BFP. Not only was there no residual value left for the other solids value, but the protein price per pound had to be reduced so that the sum of the component values did not exceed the announced BFP "at test". Dairy producers were confused as to why their protein price had gone down when cheese prices were relatively high. Table 1 summarizes the changes in component values during May through December of 1998.

The Announced BFP and Component Values Per Pound, Chicago Federal Order, 1998

Month	Announced BFP	Butterfat Price Per Pound	Protein Price Per Pound	Other Solids Price Per Pound
May	$10.88	$1.7976	$1.4524	$0.0000
June	$13.10	$2.2251	$1.6953	$0.0000
July	$14.77	$2.2997	$2.0666	$0.0688
August	$14.99	$2.5142	$2.0014	$0.0000
September	$15.10	$3.2873	$1.1214	$0.0000
October	$16.04	$2.7949	$1.8947	$0.0000
November	$16.84	$1.8861	$2.4178	$0.4090
December	$17.34	$1.4472	$2.4693	$0.7556

A related problem to MCP is the announced BFP. The BFP is based on the price paid dairy producers by Minnesota and Wisconsin manufacturing milk plants for Grade B milk. This announced BFP is used a mover of the class prices under all federal milk marketing orders. But little Grade B milk remains in Minnesota and Wisconsin. For both states, 93 percent of the milk is now Grade A. So a replacement for the current BFP is needed for federal order pricing. A replacement will impact how component values are determined.

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[2] See USDA's Final Decision on Multiple Component Pricing for Midwest Federal Milk Marketing Orders, Marketing and Policy Briefing Paper, No 53, Department of Agricultural and Applied Economics, University of Wisconsin-Madison for details on component calculations.

Proposed MCP

The proposed Final Rule for federal order reform makes two major changes in MCP. First, is the change in testing for protein in milk from testing for "total" protein to testing for "true" protein. Second, the procedure for calculating the component values. The change in how component values would be calculated is explained first.

MCP under the proposed final rule would be a true MCP program. No longer would there be a BFP announced each month and then decomposed into component values with the "other solids" component value being a residual. Instead producers will still be paid for the pounds of butterfat, protein and other solids sold, but each of these component values would be based upon a formula that considers the wholesale values of dairy products, the yield of these products as component composition changes, and the cost to make the respective dairy products (make allowance). There no longer will be any residual values for determining component prices. High butter prices will no longer reduce the protein or other solids component values. Each of the component values would be determined independently as follows:[3]

> The butterfat price per pound will be based off of the NASS Grade AA survey butter price.
>
> The protein price per pound will be based off of the NASS 40-pound cheddar block and 500 pound cheddar cheese survey prices.
>
> The other solids price per pound will be based off of the NASS dry whey survey price.

This change in MCP will more accurately reflect the value of milk components because each is based on the actual market value of dairy products produced from the components. While the current MCP program is revenue neutral, that is, the sum of the component values cannot exceed the announced BFP "at test", the final rule MCP will not have this revenue limitation. The component values will still be variable simply because the prices of butter, cheese and dry whey vary considerably from month to month and from year to year. But the final rule MCP does impact component values. The three charts below demonstrate how changes in milk pricing have affected component values. The first chart is prior to January 1996 when dairy producers were not paid on components, but rather on a fat-skim milk basis. As you can see, 60% of the milk value per hundredweight was water, 34% was butterfat, just 2% was protein and 4% other solids.

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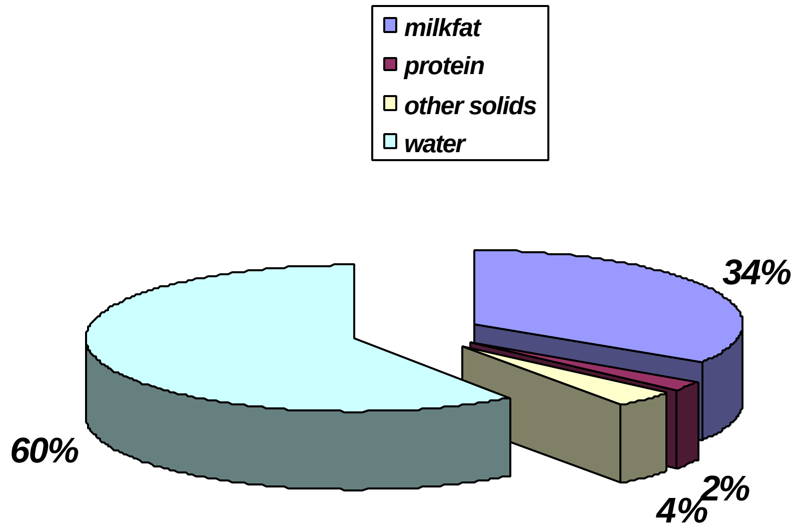
[3] For details of the pricing formulas see "Federal Order Reform: The Final Rule", marketing and policy briefing paper No. 68, Department of Agricultural and Applied Economics, University of Wisconsin-Madison.

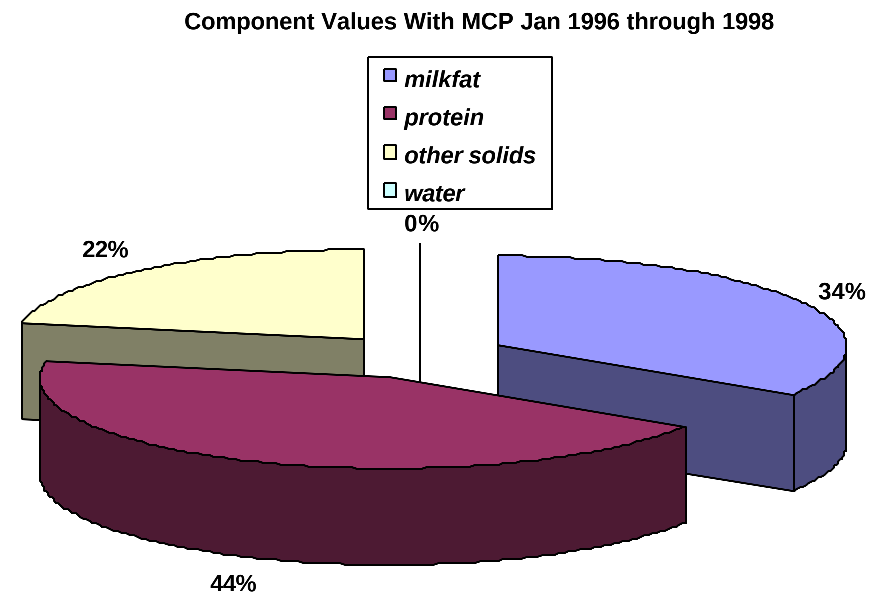
BFP Component Values under fat-skim pricing, prior to Jan. 1996

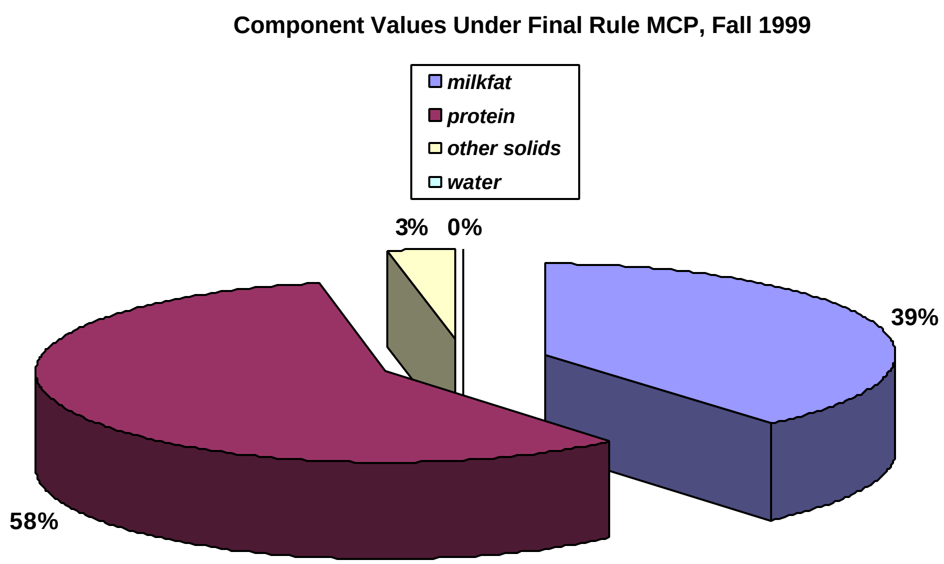


The second chart shows component values when MCP was implemented to present (Jan. 1996 through 1998). With MCP programs water has a zero value. Protein accounted for 44% of the value per hundredweight of milk, butterfat 34% and other solids 22%.

The third and final chart shows component values the fall of 1999, if the final rule MCP were implemented. As can be seen, on the average, protein accounts for 58% of the value per hundredweight of milk, butterfat 39% and other solids 3%.

Protein accounts for the largest share of the per hundredweight milk value under the current and final rule MCP programs. Thus, accurate testing for protein is critical to dairy producers. Testing for "true" protein as proposed in the final rule is a move in the direction of more accurate protein testing.


Component Values With MCP Jan 1996 through 1998
milkfat
protein
other solids
water
0%
22%
34%
44%


Component Values Under Final Rule MCP, Fall 1999
milkfat
protein
other solids
water
3%
0%
39%
58%

Implications of "True" Protein Testing

Breed of Cow

The NPN portion of milk represents approximately 5% of the total milk N so true protein values would be about 95% of total protein values. However, there are distinct differences in the NPN content of milk from different breeds of dairy cattle. Holstein and Ayrshires average about 4.9% of the total N as NPN while Jersey and Guernsey have below average NPN and Brown Swiss and Milking Shorthorns have above average NPN. Accordingly, Jersey and Guernsey herds would show a higher percentage of true protein than other breeds. The NPN percentage within breeds may vary considerably from 2.8 to 10.6% of total milk N. Therefore, selection of genetics in breeding programs is critical for increasing true protein levels in the milk supply.

Seasonal Variation

NPN levels decrease rapidly after calving to a low at about 5-10 weeks into the lactation, followed by a gradual increase to the end of lactation. High seasonal temperatures tend to increase the NPN and reduce the true protein in milk. Highest levels of true protein were obtained in milk produced during the winter months.

Milk Quality

Mastitic milk is lower in casein and higher in NPN than milk from normal udders. Researchers have reported a small but significant relationship between SCC and NPN. Plasmin in mastitic milk can breakdown up to 20% of the β-casein in milk prior to processing. Also, proteolytic enzymes from psychrotrophic bacteria can also breakdown casein and increase the NPN content of milk. For this reason, PI counts on raw milk should be kept to a minimum.

Testing Procedures

Currently, most milk protein testing is done with infrared milk analyzers using Kjeldahl total N as a basis for total protein calibration. In 1991, the Assn. of Official Analytical Chemists approved a procedure for determining true protein (TP) and NPN in milk. TP could either be determined indirectly by determining total Kjeldahl protein and subtracting the NPN or precipitating the proteins with trichloroacetic acid and determining the TP content of milk directly.

In the present analytical procedure for total protein, there are analytical errors caused by the variation in the NPN % of total N in one set of calibration samples to the next and differences in the NPN% of milk samples within each calibration set. With the current total protein procedure, calibration samples are including both TP nitrogen and NPN in the estimation of total Kjeldahl protein. Since NPN is generally not measured using infrared analyzers, there is a bias toward assuming all milk samples being analyzed during one laboratory period all have the same concentration of NPN.

Conversely, the assumption is that the TP percentages are also consistent between samples. By changing the calibration of analyzers to TP instead of total protein, any systematic bias in mean protein test results caused by differences in NPN% of total N would be eliminated. True protein concentrations determined by infrared analyzers would represent an accurate measurement of the usable protein constituents of milk and would be a fairer basis for determining true value of milk constituents for both producers and processors.

Feeding

Diet affects milk composition and component yields in dairy cows. Adequate neutral detergent fiber (NDF) is needed in the ration to maintain normal cud chewing and rumen pH and 3.5% milk fat test. Forage and ration particle length is an important part of the fiber adequacy equation. Rapid and extensive ruminal non-fiber carbohydrate (NFC; starch, sugars, and pectin) degradation and the over-feeding of rumen-non-inert fat can also make it difficult to maintain 3.5% milk fat test.

Generally, feeding lower NDF-higher NFC diets, grain sources with greater ruminal NFC degradation (i.e. high-moisture corn, fine-ground corn, barley), or supplemental fat increases milk production. So, nutritionists and dairy producers are constantly striving to improve milk yield without eliciting major depression of milk fat test. Evaluating changes in both milk yield and fat test that result from diet interventions is extremely important because producers are paid for their yield of fat.

Diet also influences milk protein. However, the potential for diet-induced variation in milk protein test is lower than for milk fat test (.1-.3% units versus .5-1% units).

Increasing energy intake from NFC generally increases total milk protein percent and yield. This increase in total milk protein content would likely come in the form of milk true protein.

Increasing energy density using supplemental rumen-non-inert fat or rumen-inert fat reduces total milk protein percent, but generally increases total protein yield because of improved milk yield. The proportion of NPN in total milk protein is higher for cows fed supplemental fat, which narrows any protein yield benefits from supplemental fat feeding.

Diet crude protein (CP) concentration has little influence on total milk protein percent unless it is severely restricted (i.e. under about 17% CP for high producing or early lactation cows). Yield of total milk protein can be expected to increase in relationship to any milk yield response from feeding higher protein diets.

Increasing the proportion of rumen-undegraded protein (UIP) relative to rumen-degraded protein (DIP) in the diet can increase milk yield and total milk protein content and yield. Altering diet UIP and DIP may or may not increase milk true protein. Diets excessive in DIP, UIP, or both, or with an imbalance of DIP and UIP, may increase total milk protein and NPN contents, but not milk true protein content. Supplementing rumen-protected amino acids has frequently increased total milk protein content and yield in research trials, and with the proper amino acid balance relative to requirements this increase comes in the form of milk true protein.

The other-solids (OS) components, lactose and ash, are contained in milk at a fairly constant percentage (5.5%). Yield of OS can be increased through diet interventions that increase milk yield.

Analyzing milk for true protein rather than total protein will lower protein test .1 to .2% units. This should not lower the milk price if the dollar value of protein is increased enough to compensate for the drop in protein content.

There are differences in how diet intervention impacts milk true protein versus total milk protein. Focusing on milk true protein provides a better framework for evaluating the adequacy of diet formulation, efficiency of protein utilization, and the economics of feeding programs.

Summary:

Since November 1,1995, federal milk marketing orders that impact Wisconsin producer pay prices have been amended to implement multiple component pricing (MCP). Dairy producers under the

MCP program have been paid for three components—butterfat, protein and other solids (lactose and ash). However, this has not been a true MCP program. The monthly announced BFP “at test” is decomposed into component values. The price per pound of butterfat and per pound of protein are determined from wholesale dairy product prices, but the price per pound of other solids is determined from the residual value remaining from the BFP after subtracting the butterfat and protein values. This procedure has raised questions among many dairy producers as to monthly changes in component values, particularly the other solids value, which at times has a zero value. Further, the Kjeldahl method has been used to test for the protein content of milk. Kjeldahl does not test directly for protein, but rather measures nitrogen content and converts this to milk protein. Errors in this procedure do occur because a portion of nitrogen in milk comes from non-protein sources.

The U.S. Secretary of Agriculture is in the process of federal milk marketing order reform, as required by the 1996 FAIR ACT. Out of this reform two major changes in MCP may occur. First, it will be true MCP program since the value of each component value will be determined independently from wholesale prices of dairy products. Second, testing for “true” protein will be direct rather than estimated from testing of total nitrogen in milk. Both changes will more accurately reflect the component values in milk marketed by dairy producers. The change in testing for and estimating total protein to testing directly for true protein will decrease a dairy producers protein test .1 to.2% units, but it will not lower their milk price. This is because the component pricing formula for protein will be changed to reflect cheese yield from true protein test. The protein price per pound is actually increased to compensate for the slightly lower producer protein test. So the change in protein testing as recommended is revenue neutral. But since protein will, on the average, account for more than half of the per hundredweight value of milk, dairy producers need to be concern about milk protein composition. While protein test is not as easily influenced as is butterfat test by breeding and feeding decisions, dairy producers need to consider the impact of these management decisions not only on the per hundredweight value of milk, but on total net revenue from milk marketed. These proposed changes in MCP would more accurately reward dairy producers for the value of milk marketed.