"Tis the Season" for Improving Butterfat Content of Milk

By Donna M. Amaral-Phillips

No matter which federal order you ship milk into, butterfat yield impacts your dairy's milk check. Two components determine butterfat yields- butterfat percentage as well as milk volume. As the butterfat percentage increases with a constant milk volume, butterfat yield increases with a resulting increased pay price for your milk; nothing new for those looking at their monthly milk checks. With quota-type milk payment systems still in place, maximizing the percentage of butterfat is one way to increase milk income. Another piece of this puzzle is; by maximizing fat yields, milk protein yields are also maximized resulting in more income for those on component pricing schemes. Through a better understanding of factors that influence the production of milk fat, one can better anticipate how modifying management and feeding practices can impact milk fat percentages and yield and, ultimately, milk pay price.

Genetic Impact

Over the past 10 years, milk fat content and yield have increased. Genetic improvements have been part of these increases. Butterfat content is a highly heritable trait and, as such, sire selection can impact milk fat percentage and yield. Over the past 10 years, the genetic potential for milk fat has increased by almost 0.17% units and 107 lbs for Holsteins (Jerseys- 0.15% units and 132 lbs increases). Partly due to genetic advances, a butterfat of 3.6-3.7% may not reflect the genetic potential of Holsteins in our dairy herds today. Dr. Kevin Harvatine from Penn State University reported in a recent webinar that Holsteins in the Upper Midwest and Northeast averaged 3.9% over a 12-month period. Thus, we may need to redefine what we think is an acceptable butterfat percentage for a herd. He also noted little genetic difference exists between DHI-tested herds processed through DRMS even with the large genetic variation we see between cows in a herd.

Stage of Lactation Impact

Butterfat percentage does vary by stage of lactation. The lowest butterfat percentages are found in early lactation cows with increases seen in later lactation. Therefore, if a higher percentage of the herd were in early lactation compared to previous years, we would expect a slightly lower butterfat percentage in the bulk tank. Butterfat yield would more than likely be higher in early lactation though, reflecting the increases in milk volume seen in early lactation and peak production.

Seasonal Effects

A seasonal pattern also exists for both butterfat percentage and milk yield. The lowest butterfat percentage is usually seen in July with the highest butterfat percentage seen around the first of January. The magnitude of the difference between the peak and trough are less in the more southern regions of the US compared to the Upper Midwest. For example, the difference in the peak and trough of milk fat were

0.28% units for Minnesota, but only 0.08% difference for Florida (FMMO 5 and 7 were 0.13% unit difference). Milk yield peaks later than the percent milk fat, usually in late March and early April, with milk fat yields peaking between late February and early March. Milk protein percentage and yield follow a similar trend to milk fat. All of these seasonal patterns follow changes seen in day length, and not just environmental temperatures/conditions associated with heat stress. No differences were seen in these seasonal patterns between first-calf heifers, second lactation, or mature cows.

AM vs PM Milking

Daily milk composition and yield vary from the morning versus evening milkings. In a study evaluating production in 14 herds over 5 days, herds milked twice daily had higher milk fat percentage at the evening versus morning milking. Milk yield followed the opposite pattern with yield greater at the morning milking. Other studies have seen the same direction of differences between milkings. When testing on a DHI AM/PM program, these differences in milk yield are accounted for when reporting daily milk production for the current test day.

Feeds and Feeding Management

The actual feeds in lactating cow diets, as well as how feeding programs are managed, impact milk fat percentages, milk yields, and, thus, milk component yields. Milk fat is composed of fatty acids that come from two different sources. A little over a half of the fatty acids found in milk fat are made by milk-synthesizing cells in the mammary gland from products produced by the rumen bacteria (process known as *de novo* fatty acid synthesis). The remaining fatty acids are absorbed by the milk-synthesizing cells preformed from the blood and mainly come from the cow's diet. Essentially, what occurs or does not occur in the rumen of the cow impacts milk fat percentage and milk yield. For example, feeding cows more than once daily and providing adequate bunk and resting space helps stimulating cows to eat multiple, smaller meals over the day. This management practice helps to stabilize rumen fermentation, minimize drops and bigger swings in rumen pH, and more products are produced by the rumen microbes for the cow to make milk and butterfat.

Forage quality, amount and source of carbohydrates (carbs) and sugars, and amount and source of NDF fiber in a cow's diet impact the types and amounts of products produced by the rumen bacteria. Remember that the products made by the rumen bacteria, in turn feed the cow and relate to the amount of milk and butterfat content produced. As we learn more about the needs of rumen bacteria and what occurs in the rumen, we can redefine what feeds and balance of feeds are needed or are detrimental in a cow's diet when it comes to milk fat synthesis. For example, not all fat sources are equal and some feedstuffs may pair better than others in heavy corn silage-based diets. Also, these feedstuff pairings may change from year-to-year even with no major changes in forage type.

Milk Yield versus Milk Fat %

One may ask, with today's milk prices, how much additional milk production do I need to replace a drop in income if butterfat percentage decreases? The obvious answer is to prevent drops in either production or butterfat content to maximize my financial return. Nevertheless, let's look at this question from a simple gross income standpoint. For this example, let's use a herd currently averaging 80 lbs of milk.

Federal Milk Marketing Order	Change in production/cow needed to offset drop in gross income seen with a decrease of 0.2% units of butterfat (i.e. 4.2 vs 4.0%) *			
	"Lower" Butterfat Prices		"Moderate" Butterfat Prices	
5 (fluid market)	Skim=$13.16/cwt BF=$1.90/lb	~1.25 lb milk	Skim=$10.87/cwt BF=$2.54/lb	~2 lb milk
7 (fluid market)	Skim=$12.66/cwt BF=$1.91/lb	~1.5 lb milk	Skim=$11.24/cwt BF=$2.54/lb	~2 lb milk
30 Upper Midwest (Multicomponent pricing)	Protein=$5.63/lb BF=$1.96/lb Other solids = $0.15	~1 lb milk	Protein=$2.40/lb BF=$2.69/lb Other solids = $0.17	~2.5 lb milk
*Herd averages 80 lbs milk and calculations do not account for changes in milk check deductions for hauling, PPD etc.				

If the average butterfat dropped from 4.25 to 4.0%, how much additional milk would I need to equal the gross income lost from milk fat yield? Using the uniform prices for skim and butterfat shown in the table, we can see that the answer depends on the value of butterfat in relation to skim (see table). For an "average" uniform pricing for butterfat, the gross income associated with 2 more pounds of milk would replace the lost income from a drop of 0.2% units in butterfat for a cow averaging 80 lbs milk. As expected with the decrease in butterfat, less total yield or milk volume is needed to replace the income associated with a drop in butterfat percentage. However, regardless of butterfat yield pricing, milk yield is still the biggest driver of gross income in the milk check with butterfat income being "the cherry on the top". The same trends are true in a Federal Milk Marketing Order based on multi-component pricing.

Take Home Message

Butterfat content does influence pay price, but at the end of the day, milk yield has a greater influence on butterfat yield and thus pay price. Many factors influence butterfat content. Some of these factors are related to the biology of the cow herself, such as stage of lactation and time of the year. As managers, these factors are not under our control and we must expect these variations and adjust accordingly. Use and/or limiting specific feeds and the management of feeding programs allow one to provide for the best environment and nutrients for over 500 species of rumen bacteria, protozoa, and fungi. These rumen microbes are important since they produce a majority of the nutrients the cow uses to make milk fat and protein. Thus, managing and designing feeding programs that stabilize rumen fermentation and optimize the production of precursors needed to make milk fat and protein is essential to maximize income. Ultimately, the rumen microbes and their products feed the cow and have a major influence on milk yield and pay price.

Reference: 2020 Four State Dairy Nutrition and Management Conference– Kevin Havatine