

David Bray Obituary



David Russell Bray passed away on Friday, June 1 at North Florida Regional Medical Center. He was 78 years old. David was born on February 8, 1940 in Remsen, NY and raised by Homer and

Marguerite Bray. He graduated from Remsen High School in 1957. He held bachelors degrees from Cornell University in Ithaca, NY and Delaware Valley University in Doylestown, PA. He received his master's degree from the University of Florida in Gainesville.

David was a researcher in dairy science, focusing on mastitis and heat stress in dairy cattle. His work began at Cornell University, where he worked for 14 years before transferring to the University of Florida to continue his research in Florida's climate. He worked at the University of Florida from 1981 until his retirement in 2013.

He is survived by his wife of 51 years, Joan (Gainesville), his son Duane and his son-in-law Daniel (Brooklyn, NY). As per his wishes, there was no service. In lieu of flowers, the family is requesting donations in David's honor to be made to the University of Florida Foundation, P.O. Box 14425, Gainesville, FL 32604-2425 or the charity of your choice.

Information taken from the obituary published in Gainesville Sun from June 5 to June 7, 2018

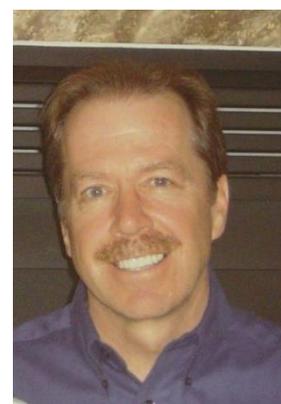


Dairy Extension Agenda

- The 54th **Florida Dairy Production Conference** is being planned for **September 26, 2018**. Program and registration: <http://bit.ly/2018FLDPC> More information: Francisco Peñagaricano, fpenagaricano@ufl.edu
- **Dairy Cattle Genomics and Fertility Workshop, December 5, 2018**. Okeechobee Extension Office, Okeechobee, FL. 10:00 am -2:30 pm. Genomic testing, beef semen, culling: what makes sense? Program details follow later. More information: Colleen Larson, cclarson@ufl.edu, or Albert De Vries, devries@ufl.edu

Charlie Staples Interim Chair

Charlie Staples assumed the position of interim Chair of the Department of Animal Sciences as of July 1. The previous Chair, Geoff Dahl, decided to step down as Chair effective July 1, 2018. Geoff Dahl is returning to a faculty role in the department, working in Extension and research. IFAS leader Dr. Jack Payne has committed to a national search for a new Chair and that process will begin soon.



Charlie Staples is the interim Chair of the Department of Animal Sciences. His email address is chasstap@ufl.edu

Dr. Izabella Toledo Joins UF/IFAS as the Northeast Dairy Regional Specialized Extension Agent

Dr. Izabella Toledo recently joined the faculty in the Institute of Food and Agricultural Sciences at University of Florida as a Northeast Dairy Regional Specialized Extension Agent. She was born and raised in south Brazil, where she received a Doctorate in Veterinary Medicine. As part of her training in veterinary school, she came to the United States for a training program in dairy cattle management. During that period, she had the opportunity to intern at different dairy farms, and acquire field experience in areas such as nutrition, reproduction, production and management.



After graduating in Brazil, she spent a year working at the Clinical Microbiology, Serology, Parasitology service at the University of Florida Veterinary Medical Center. Subsequently, she was offered a scholarship for the Master program in Animal Molecular and Cellular Biology at the Department of Animal Sciences at University of Florida. Her MS program was focused on dairy cattle reproduction. Her PhD program was also completed at the Department of Animal Sciences at University of Florida and it was focused on the effects of heat stress on immunity, production and reproduction of dairy cows during the transition period.

During her MS and PhD programs, Izabella was able to conduct both applied and basic research to better manage and improve both productivity and animal well-being of dairy operations. Her research was conducted at the University of Florida Dairy Unit and also at commercial dairies, where she had the opportunity to actively work and interact with dairy producers.

Besides her interaction with producers, scientists and other graduate students, during her MS and PhD programs, she had the opportunity to teach and interact extensively with undergraduate students. During her PhD, she was a teaching assistant for the Introduction to Animal Sciences and the Reproductive Physiology and Endocrinology in Domestic Animals courses. Furthermore, she was recruited to teach a

Companion Animal Biology and Management course during three semesters.

Prior to starting her current position, she spent two years as a postdoctoral fellow working in lactation biology at the Agriculture and Agri-Food Research and Development Center in Sherbrooke, Quebec, Canada.

Her background has given her a broad and multi-disciplinary view of science and its application to solving agricultural problems.

The goal of her programs is to contribute to the development and improvement of the dairy industry by transmitting knowledge to the scientific community, producers, academic students, and the general public.

Izabella will have an office at the UF/IFAS Extension Building in Mayo, Lafayette County. She can be reached at izathomp@ufl.edu

No Prediction of the Future Florida Mailbox Price and Future All Milk and Feed Prices

Albert De Vries

I have published a table with predicted Florida mailbox prices and all-milk and feed prices since the fall 2014 issue of this Dairy Update newsletter. The source of these data was the Understanding Dairy Markets (UDM) website at the University of Wisconsin (future.aae.wisc.edu). This website had to be shut down on Monday, June 4, due to a security vulnerability. A new website is being developed (dairymarkets.com), but was not ready when this newsletter was finalized. Therefore, no price predictions in this issue. I hope to have new price predictions in the fall issue again.

For more information, contact Albert De Vries at devries@ufl.edu or (352) 392 5594 ext. 227.

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The Value of Milk Fat

José E.P. Santos and Albert De Vries

Introduction

In most US milk marketing orders, milk pricing is based on a multiple component formula that takes into account milk fat, true protein, and associated premiums for somatic cell count and microbiological quality. In the Southeast, milk is priced based on fat and skim milk value, with additional bonuses for somatic cell and bacterial counts. In recent years, butter fat has become more valuable and, in many instances, the fat content in milk might represent more than half of the price paid for milk to the producer.

Numerous animal, dietary, and environmental factors influence milk fat content and yield in dairy cows. Because of the current pricing system, it is critical to re-evaluate some of these factors and consider the economic implications of manipulating milk fat content with the ultimate goal of increasing milk fat yield in a profitable manner. Here we discuss some of the history behind the changes in consumption of milk fat, management factors that influence milk fat content and yield by dairy cattle, and the economic implications of two cases to change fat content through the diet.

Paradigm Shift

In June 2014, Time magazine had its cover page entitled “*Eat Butter; Scientists labeled fat the enemy. Why they were wrong*”. The history of margarine and butter consumption in the United States is a peculiar and cyclic one. Starting in the mid to late 1930’s, per capita butter consumption began to decline at the same time that the vegetable oil industry accelerated production and marketing of margarine. The reduced price for margarine and abundant supply of vegetable oils with expanding oil seed production and the need for protein meals for animal diets favored the adoption of margarine as staple in US households and diets. Concurrently, a wave of mistaken research pointed to the fact that animal fats were associated with increased risk of cardiovascular disease, whereas vegetable oils were expected to reduce the risk of vascular disease. Scientists just got that wrong. From the early 1940’s to its peak availability in the early 1970’s, US per capita consumption of margarine increased from 2.5 to 12 lbs/year, whereas that of butter plummeted from more than 16 lbs/year to only 4 lbs/year (**Figure 1**).

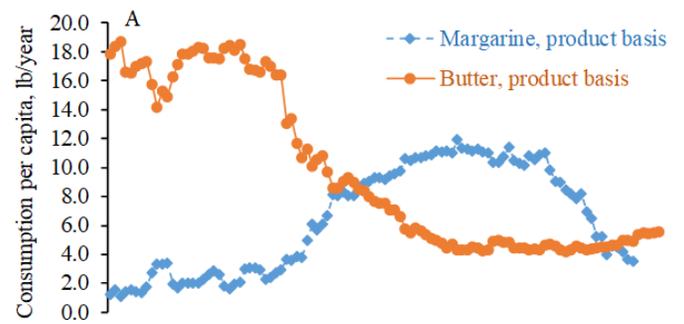


Figure 1. Yearly per capita consumption in pounds of fat products on product basis in the United States from 1909 to 2015. Data from margarine was available until 2010. Source: United States Department of Agriculture, Economic Research Service.

We now have learned that hydrogenated oils present in margarine contain undesirable *trans*-fatty acids that increase the melting point of the fat, but are associated with increased risk of chronic diseases in human, in particular coronary heart disease. On the other hand, science has demonstrated that saturated fatty acids present in dairy products are not linked to cardiovascular disease. In fact, despite their high saturated fatty acids content, extensive systematic reviews of the literature have shown that dairy foods have repeatedly been found to have either no effect or even a beneficial effect on cardiovascular disease. To illustrate this point, the recent Cardiovascular Health Study, a population-based prospective observational study investigated risk factors for coronary heart disease in US adult individuals of at least 65 years of age (Otto *et al.*, 2018). The investigators showed no link between consumption of whole-fat dairy products with cardiovascular disease. In fact, they found no association between fatty acids found primarily in milk fat and coronary heart disease, but showed that high blood concentrations of heptadecanoic acid, also known as margaric acid because of its origin in milk fat, was inversely associated with cardiovascular disease and stroke mortality (i.e. increased concentration of margaric acid in blood resulted in smaller risk of cardiovascular disease), suggesting some potential beneficial effect of this particular fatty acid on cardiovascular health in humans. It is also important to note that dairy fats contain a small amount of naturally synthesized *trans*-fatty acids, and these ruminant-derived *trans*-fatty acids have powerful anti-diabetogenic and anti-carcinogenic effects, as opposed

to industrialized hydrogenated vegetable oils that contain unhealthful *trans*-fatty acids.

Synthesis of Milk Fat by the Mammary Gland

The main building blocks of milk fat are called fatty acids. The mammary gland of a dairy cow synthesizes milk fat by two pathways, one called *de novo* synthesis of fatty acid in which the mammary cells use fatty acids present in blood that have only 2 to 4 carbons originated from rumen digestion of carbohydrates and combine them to make a fatty acid with up to 16 carbons. The second pathway is by simply transferring fatty acids with 16 or more carbons from blood into the mammary cells and then packaging them to be secreted into milk, a process called incorporation of pre-formed fatty acids. Thus, fatty acids with 16 carbons have a mixed origin; they can be derived from *de novo* synthesis or from incorporation of blood pre-formed fatty acids. In a well fed cow past the first month of lactation, approximately 25 to 30% of the fatty acids will be strictly *de novo* synthesized (up to 14 carbons), 30% will be fatty acids with 16 carbons (mixed origin), and approximately 40% will be strictly pre-formed fatty acids containing primarily 18 carbons. When cows lose large amounts of body weight, which is common in early lactation or during disease, then the concentration of fat in milk increases because of incorporation of more pre-formed fatty acids (fatty acids with > 16 carbons) that are in the circulation from body fat loss. On the other hand, when cows undergo milk fat depression induced by diets, then milk fat content drops because of a decline in the *de novo* synthesized fatty acids (fatty acids with < 16 carbons).

Factors Affecting Milk Fat

Genetics. It is well known that breed has a major effect on milk fat synthesis, with Jersey cows synthesizing milk with an average of 5.0% milk fat, whereas Holstein cows typically average 3.70% milk fat. Nevertheless, a large genetic variability exists within breed and milk fat content (%) is one of the traits that is controlled by a few sets of genes. Because of that, heritability of milk fat content is usually high, approximately 0.32 for Holsteins. More important than milk fat content (%), milk fat yield (lbs) also has a somewhat high heritability, approximately 0.20 for Holsteins. Heritability is the estimate of variation in the phenotype in a population that is caused by the genetic variation between individuals in the same population. High heritability usually means high probability of genetic gain from one

generation to the next if selection emphasizes that particular trait. In other words, if producers select sires that have high predicted transmitting ability (PTA) for milk fat yield, the genetic gain from one generation to the next will be appreciable. It is important to keep in mind that in milk markets like in the Southeast, where milk volume still has a value and no penalty is applied (other than hauling cost), producers should favor selection of increased yield of fat, and not necessarily the concentration of fat.

Environment. Environmental factors have marked effects on milk fat content and yield in dairy cows. In particular, high ambient temperature associated with high relative humidity causes dairy cows to suffer from heat stress, which leads to increased body temperature. When ambient temperature remains below approximately 75°F, cows are able to thermoregulate by dissipating heat by radiation, conduction, convection, and evaporation. As the ambient temperature increases above that threshold, the differential between the cow's skin temperature and air temperature becomes smaller, which makes it difficult to lose heat by conduction and convection and the cow becomes more dependent on evaporation. However, if the environment has high humidity such as in the Southeastern states of the United States, then evaporation becomes more limited, which reduces the ability of the cow to maintain body temperature and hyperthermia can occur.

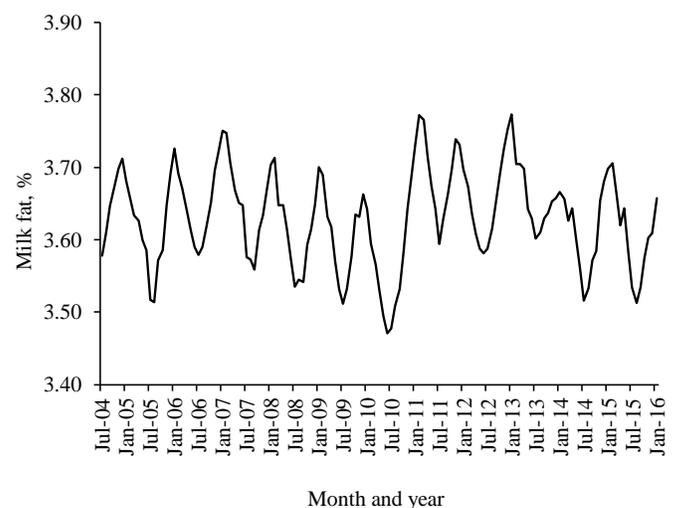


Figure 2. Seasonality of milk fat content in the Florida milk market. Source: http://www.fmmatlanta.com/Statistical_Report.htm

A clear seasonality in milk fat content is present in the US, in particular in the Florida milk market (**Figure 2**). Concentration of fat in milk is greatest in the cooler months of the year, typically January and February, and smallest in the hot months of year, typically July and August. This seasonality is in part mediated by heat stress in the summer months. Therefore, if the goal is to produce more milk and milk with increased components, particularly fat, dairy producers have to make an effort to minimize heat stress in dairy cows.

Stage of lactation. Cows in the first 2 to 6 weeks of lactation usually have elevated milk fat content because of the typical loss of body weight that occurs with the onset of lactation. This elevation can be extended if a cow develops diseases in early lactation. The typical lactation curve shows an inverse relationship between milk yield and milk fat content (**Figure 3**). In very early lactation, production of milk is low at the same time that the concentration of fat is high, whereas as cows pass peak production, then milk yield steadily declines while concentration of fat in milk increases.

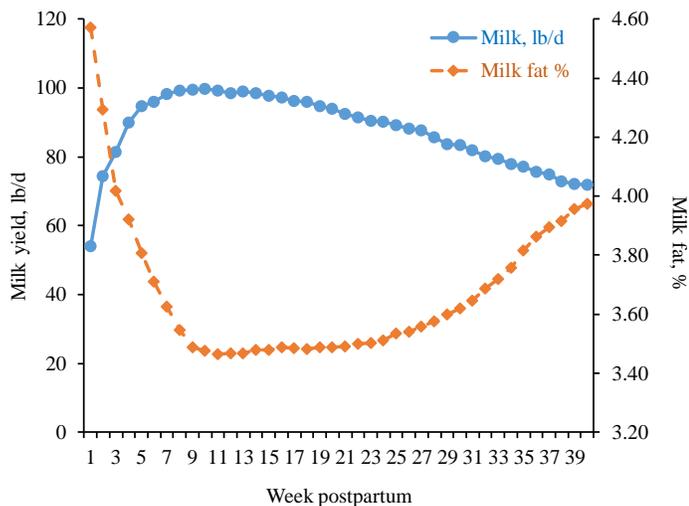


Figure 3. Inverse relationship between milk yield and fat content according to week of lactation at the UF Dairy Unit.

Nutrition and nutritional management. Dietary formulation and feeding management can greatly influence milk composition, in particular milk fat content. It is important to keep in mind that if a dietary change increases the concentration of fat in milk, but results in less milk yield, then the total yield of fat might not increase at the same time that milk volume suffers. Because on farm diet changes are made without a control group, producers and nutritionists have to rely

on comparing before and after the change. In general, bulk tank values are more sensitive to changes in milk composition than to changes in yield per cow. For instance, producers are more likely to perceive a change in milk fat content, than to appreciate a change in daily fat yield per cow. This is particularly important in herds in which the daily variation in production per cow is greater than 3 or 4 lbs/d.

The mechanism by which diet can induce milk fat depression is by altered rumen fermentation with production of specific *trans*-fatty acids that are known to suppress *de novo* synthesis of fatty acids by the mammary gland. In most forages and diets, 50 to 60% of all fatty acids consumed by cows are polyunsaturated, meaning that they have 2 or more double bonds between carbons. Microbes in the rumen have the ability to add hydrogen ions to carbons when they are chemically linked by a double bond in an unsaturated fatty acid. During the process of hydrogenation of unsaturated fatty acids by rumen microbes, *trans*-fatty acids are produced in small quantities, which can leave the rumen and be absorbed into the bloodstream of the cows. Some specific *trans*-fatty acids have the ability to inhibit *de novo* fat synthesis in the mammary gland. Therefore, when diets favor the accumulation of these specific *trans*-fatty acids, usually milk fat content decreases, which can lead to reduced fat yield.

Among the most common dietary factors that increase the risk of diet-induced milk fat depression are: diets with low forage content; diets with low forage fiber content; diets with high content of highly fermentable carbohydrates; diets with high starch content from sources that are extensively processed; diets whose primary forage is corn silage with small particle size; no supplemental dietary buffers; diets with high content of ionophore; diets low in degradable protein; slug feeding; overmixing of diets resulting in forages with very small particle size; and inadequate mixing of forages with concentrates results in selective sorting by cows during eating. Obviously, to increase milk fat yield one must first minimize the dietary and management factors that increase the risk of milk fat depression. Once that is accomplished, then focus on two important components: the dietary forage and the supplemental fats.

Assure that diets contain adequate forage fiber to maintain rumen health. Rumen acidosis is known to

suppress milk fat synthesis and one of the risk factors for rumen acidosis is inadequate dietary forage, more specifically neutral detergent fiber (**NDF**) from forage. For that, not only the concentration of forage fiber is important, but also the particle size of forage. Forages stimulate rumen contractions which is critical for absorption of the volatile fatty acids produced during digestion of carbohydrates and proteins in the rumen. Forages also are needed to stimulate rumination, which results in continuous chewing of feed particles stimulating copious secretion of saliva that buffers the acids produced during digestion in the rumen. Complete diets for lactating cows typically contain 40 to 60% forage and 18 to 24% NDF from forage on a dry matter basis. In general, the greater the forage and the forage NDF fed to cows, the greater the concentration of fat in milk. However, if forage intake limits total dry matter or energy intake, then yield of milk and milk protein can decrease. Nevertheless, pay attention to forage quality. Better quality forages allow for increments in total forage intake without compromising energy intake, which benefits yields of milk and milk fat.

Dietary fats can influence milk fat content, either be neutral, increase or decrease fat content. In most cases, supplementing diets with fat will increase milk fat yield because of the stimulatory effect on milk yield, but also because it can increase milk fat content. When supplementing diets of dairy cows with 1.0 to 1.5% of the dry matter with dietary fatty acids, the expected response in milk yield typically is of 3 to 4 lbs/day. In addition to increasing milk yield, dietary fatty acids can also increase milk fat content. For that, the profile of fatty acids of the supplemental fat source is very important. In general, fat sources rich in unsaturated fatty acids increase milk yield, but they tend to reduce milk fat content, which results in minor effects on milk fat yield. On the other hand, fat sources rich in palmitic acid (fatty acid with 16 carbons, also called C16) stimulate yields of fat and fat-corrected milk (milk yield with a constant fat concentration). Research has shown that supplementing diets of dairy cows with 1 to 1.5% of the diet dry matter with fatty acids from sources rich in palmitic acid can increase milk fat yield by as much as 0.4 to 0.5 lbs/day depending on the level of production of the herd.

Economics of Manipulating Milk Fat Through the Diet

Let us look at the economics of two cases that may change the fat in the milk. Case 1 is a dairy feeding a

high forage diet and producing 80 lbs of milk with 3.80% milk fat. The producer and the nutritionist decided to change the diet in an attempt to increase volume, but they believed milk fat would drop a little. The expectation was that the increase in the volume of milk would make up for the loss in butterfat percent. They agreed to replace a portion of the corn silage in the diet (4 lbs of dry matter) with corn grain (4 lbs of dry matter) to increase the energy content of the ration so cows would make more milk. Feed intake was assumed to remain the same at 50 lbs of dry matter per cow per day. Daily feed cost of the old diet was \$5.52 per cow per day and with the new diet it was \$5.66. Milk was priced at \$8.504 per 100-lbs (**cwt**) skim milk, \$2.569 per lbs of butterfat, and a premium of \$0.65 per cwt of milk was provided based on somatic cell count and bacteriology, both of which were assumed to not change with the dietary manipulation imposed.

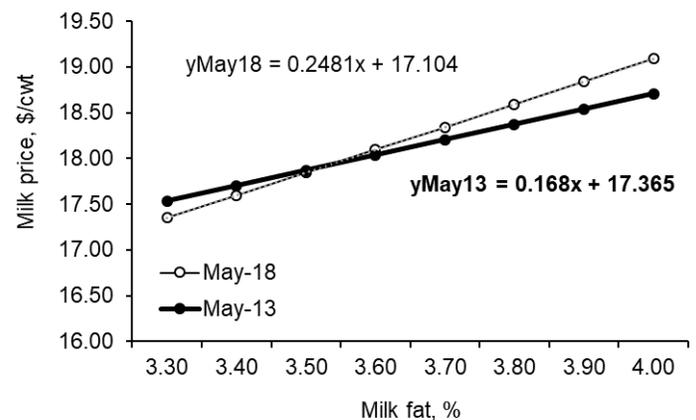


Figure 4. Milk prices for the University of Florida Dairy Unit in May 2013 and in May 2018. The milk price depended on skim milk, butterfat, and premiums. Milk with more fat was worth more today than in 2013 per cwt of milk shipped. The y_{May18} represents the milk price (\$/cwt) paid in May of 2018 according to the fat content. Similarly, y_{May13} represents the milk price (\$/cwt) paid in May of 2013 according to the fat content.

After the change in the diet, milk increased from 80 lbs to 84 lbs, and milk fat decreased from 3.80% to 3.50%. The 3.5%-fat corrected milk yield remained the same at 84 lbs. So was this a good decision? The milk price received depends on the concentration of fat, as shown in **Figure 4**. With the old diet, the milk price was \$18.59 per cwt, or \$14.87 for a cow making 80 lbs. With the new diet, the milk price decreased to \$17.85 per

cwt, or \$14.99 for a cow making 84 lbs. Income minus feed cost with the old diet was \$14.87 - \$5.52 = \$9.35 per cow per day. With the new diet this was \$14.99 - \$5.66 = \$9.33 per cow per day. This was a loss of \$0.02 per cow per day with the new diet, so for the example used, the change in diet was not a good decision.

Back in 2013, butterfat was worth less compared to butterfat today (Figure 4). If we used the 2013 fat and skim milk prices, then the new diet would have a positive income minus feed cost of +\$0.17 per cow per day.

Case 2 is a dairy feeding a high forage diet and producing 80 lbs of milk with 3.65% fat. The producer and nutritionist decided to add 1.5% supplemental fat to the diet, in an attempt to increase the energy density and stimulate more milk and fat yield. The nutritionist replaced 1.5% corn grain with a 1.5% high palmitic acid fat product on a dry matter basis. This fat product was expensive, valued at \$1450 per ton, so the producer wondered if the dairy could afford this expensive ingredient. The dry matter intake was 52 lbs per cow per day and they assumed it would not change.

After the change in the diet, milk increased from 80 lbs to 83 lbs, and milk fat increased from 3.65% to 3.80%. Dry matter intake did not change. Daily feed cost was \$5.608 per cow per day with the old diet and \$6.137 with the new diet. So feed cost increased by \$0.71 per cow per day. Did the value of more milk and higher fat pay for this increase in feed cost? Yes, it did. With the old diet, the milk price per cwt was \$18.22 and at 80 lbs, milk sales were \$14.58 per cow per day. Income minus feed cost was, therefore, \$8.97 with the old diet. With the new diet, milk yield, butterfat, and the milk price per cwt increased. Milk price was now \$18.59, which resulted in milk sales of \$15.43 per cow per day. With the \$6.317 daily feed cost, income minus feed cost was now \$9.11. This was an increase of \$0.14 per cow per day compared to the old diet. Adding the supplemental fat was a good decision.

Making more milk volume means that more milk needs to be shipped. Notice that we did not include an adjustment for hauling cost. If milk goes up from 80 to 83 pounds, and hauling costs are \$1 per cwt, that would add a cost of \$0.03 per cow per day. This would become evident by more loads of milk that need to be shipped in a month. Including hauling costs in the calculations implies that increasing butterfat content is worth even more compared to increasing milk volume.

Fat in milk is worth a lot today. With the low milk prices as they are, it is even more important to consider the fat content in your milk. Check with your nutritionist to see if you have the right fat content and milk volume.

References

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<https://doi.org/10.1093/ajcn/nqy117>

More information: Jose Santos, jepsantos@ufl.edu

