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DAIRY & ANIMAL SCIENCE
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From Dairy and Animal Science at Penn State

COWS HAVE TO WATCH WHAT THEY EAT, TOO!

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More than ever, people are watching what they eat — counting calories, limiting fat and cholesterol, and trying to make healthful food choices.

Nutrition, however, isn't just for people. To lead healthy, highly productive lives, cows also need the right amount of nutrients in their diets. But determining exactly what an animal should eat can be a complex undertaking.

It's hard enough to estimate nutritional requirements for humans, domestic animals, or any mammal with just a simple stomach. Imagine how difficult it must be to balance a diet for an animal with four compartments!

Dairy cattle require nutrients for maintenance, growth, reproduction, and milk production. If a dairy cow does not get the nutrients she needs, it affects the quality and yield of her milk, as well as her health.

As an animal nutritionist, I am looking for ways to help producers give their animals what they need for maximum health and productivity. And that includes watching their calories so they don't get too fat.

Ruminant nutritionists face special challenges, because ruminant stomachs contain billions of bacteria and protozoa, which help cows digest feeds that simple-stomached animals cannot. A symbiotic relationship exists between the cow and her digestive system, enabling her to convert forages and high-fiber plants into meat and milk.

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Before we can give the cow what she requires, we must make sure the microbes also receive their required nutrients. A better understanding of these microbes can help producers control what goes into milk and reduce feed costs.

As part of our ongoing research program, my graduate students and I are trying to better match the availability of carbohydrates and proteins to the rumen microorganisms. The microbes that grow and multiply during the fermentation process become a very important part of the nutritional requirement for dairy cows. These microbes contain 40 percent to 60 percent protein.

A Holstein cow synthesizes up to 5.5 pounds of microbial protein each day, which could account for 40 percent to 60 percent of the total protein needed for daily milk protein production of a high-producing cow.

So where does the cow receive the rest of her daily protein needs? Some of the protein escapes digestion by the rumen microorganisms and is absorbed in the small intestine. The amino acid profile of this protein has to exist in the right quantities and be of excellent quality to meet the demands for high levels of milk protein production.

Another area of our research involves using strategies that get essential nutrients past the rumen without being used by the bacteria for their growth and survival. This research may help farmers produce milk with a higher economic value if protein content is increased. In some cases it may also increase milk production.

When the present federal order pricing system began in the late 1940s, butterfat was the valued component in milk. Today, because consumers want lower-fat dairy products, butterfat is less important. More emphasis is being placed on protein. Some cheese plants in western Pennsylvania also offer a bonus based on protein percentage, because the more protein in fluid milk, the higher the resulting cheese yield. For a Jersey herd with a 3.8 percent average protein, this could mean an extra $.90 to $2.40 per 100 pounds of milk, if 15 to 20 cents per 100 pounds of milk is paid for each .1 percent protein above the 3.2 percent average.

Today's producers commonly add supplemental fat to a dairy cow's ration to increase milk production. But adding fat also causes the percentage of protein in the milk to drop about a tenth of a percent. The biological mechanism that causes this is not clearly understood. However, there appears to be a link between amino acids and milk protein synthesis. So, in markets where milk is priced on protein, dairy farmers may still wind up without a greater dollar return, despite the higher milk yield.

We at Penn State have been studying the use of ruminally protected amino acids since 1986. Larry Muller and I have demonstrated that milk protein percentage can be increased on certain diets. We were also interested in finding out whether feeding rumi-

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