# Take care of the bugs first

By Thomas Quaife

## Rumen bugs provide the cow with the best – and cheapest – form of protein.

Eric Clifford must be doing something right: His rolling herd average is running close to 30,000 pounds, with 3.2 percent protein and 3.4 percent milkfat in a milking herd that averages 140 head.

Anyone with that type of production is actually doing a lot of things right. But one of the things that distinguish the Starksboro, Vt. producer from most other is found in a simple, yet profound, principle that most people overlook or ignore.

*Instead of feeding cows, he's actually feeding rumen bugs.*

Kelly Cunningham, dairy nutritionist at Consolidated Nutrition in Omaha, Neb., couldn't agree more. "The majority of our nutrients are going to come as a result of a healthy population of (rumen) bugs. When we balance our diets, we need to keep that in mind," he says.

Feeding the rumen bugs first will allow you to feed your cows in the most efficient and economical manner possible.

**Majority of protein**

Over the past couple of years, producers have been hearing a lot about protein that bypasses the rumen bugs or microbes. But, some people are now recognizing that you can go overboard on bypass protein.

Many times, producers don't put enough rumen-degradable protein in the diet because they're also adding bypass protein. The total amount of protein delivered to the small intestines may be the same, but the portion from microbial protein production is less because bypass protein has taken up the slack.

No one's suggesting that your cows get all of their protein from microbial sources. In most cases, it is necessary to supplement microbial protein with bypass. But the emphasis should be on maximizing microbial protein production first, then thinking about bypass.

"If you feed the rumen properly, you will almost always get more than half the total protein coming from rumen microbes," says Will Hoover, dairy scientist at West Virginia and a noted expert on rumen microbial efficiency. "Most people get about 60 percent."

Marshall Stern, ruminant nutritionist at the University of Minnesota, has calculated this in the following chart:

**Meeting a cow's protein needs**

Theoretical contribution of microbial protein to total protein requirement for a 1,320-pound cow in her second lactation:

| **Efficiency of microbial protein synthesis** (grams N/kg of organic matter* truly digested) | **Daily milk yield** | | |
|---|---|---|---|
| | **55 lbs** | **77 lbs** | **99 lbs** |
| | % of protein from microbes | | |
| 20 | 49 | 42 | 39 |
| 30 | 73 | 64 | 59 |
| 40 | 98 | 85 | 79 |

*Organic matter refers to fat, carbohydrate and protein digested

A couple of key points: The average cow will convert about 30 grams of nitrogen per kilogram of organic matter digested. If you increase efficiency to 40 grams N/kg digested, and you take what we consider to be a low-producing cow – 55 pounds per day – microbial protein synthesis will meet nearly 100 percent of her protein requirement. Or, nearly 80 percent for the high-producing cow at 99 pounds of milk per day.

**High-quality**

*And, microbial protein is of extremely high quality.*

"It's ideal protein for a lactating cow," with the right balance of amino acids, says Hoover.

Several years ago, Paul Chandler, nutritional consultant in Dresden, Tenn., and a regular contributor to *Feedstuffs*, compared the different protein sources of essential amino acids. Using milk protein as the perfect source of amino acids, he ranked them as follows:

| Protein source | Value of amino acids (% of milk protein) |
|---|---|
| Milk protein | 100 |
| Microbial protein | 82 |
| Soybean meal | 71 |
| Fish meal | 68 |
| Blood meal | 60 |
| Distiller's grain | 54 |
| Corn gluten meal | 52 |

This also helps to illustrate the amino acid balance between the protein sources. Corn gluten meal ranks low on Chandler's list because it's low on lysine. Yet, it has an abundance of methionine. So, a bypass protein supplement that's high in lysine is needed to balance it.

The rumen microbes have among the highest digestibility of any protein source – they're generally considered 80 to 85 percent digestible in the small intestine. Very few proteins come close to that.

Rumen microbes provide several pounds of high-quality protein to the cow each day. The bugs, themselves, become the protein source as they get caught in the flow of fluid out of the rumen into the omasum and abomasum – and eventually the small intestine. Their bodies consist of about 50 to 55 percent protein.

In that respect, you are essentially feeding another animal – a microbe or bacterium – first, then the cow. The microbes break down the feed particles and recombine the nutrients into their own amino acids or bacterial protein.

**Cheapest way to go**

"Rumen bugs are the cheapest feed in the world," says Brian Perkins, dairy nutritionist at New Haven, Vt., who helps producers like Eric Clifford get maximum production by concentrating on the rumen bugs. Yet, it's one thing to say that bugs are the cheapest feed source: it's another to calculate the cost in dollars and cents. University of Minnesota's Marshall Stern compared the cost of various bypass protein sources per kilogram of intestinally-absorbable dietary protein (IADP). Among his results:

| | Cost ($/ton) | IADP ($/kg) |
|---|---|---|
| Brewers grains, dried | 94 | .87 |
| Corn gluten meal | 239 | .54 |
| Distillers grain, dried | 117 | 1.01 |
| Blood meal, batch-dried | 400 | 1.01 |
| Blood meal, ring dried | 400 | .81 |
| Feather meal, hydrolyzed | 163 | .43 |
| Fish meal, menhaden | 396 | 1.63 |
| Meat and bone meal | 183 | 1.19 |

Source: 1996 Maryland Nutrition Conference for Feed Manufacturers, proceedings.

For batch-dried blood meal, Stern calculated the cost per kilogram of IADP as follows:

2,000 lbs/ton x 0.4535 kg/lb=907 kg as fed x 92 percent dry matter in blood meal. 834.1 kg of dry matter x 87.2 percent crude protein on a dry-matter basis = 727.6 kg of protein.

Then, he figured that the protein in blood meal is about 55 percent IADP. So 727.6 kg x .55 = 400.2 kg of IADP.

Since blood meal cost $400/ton when he first did his calculations, the cost per kilogram of IDP derived from that ton would be approximately $1.

Blood meal currently runs around $530 per ton, which would drive up the cost to $1.32 per kilogram, or 60 cents per pound.

How does that compare to a protein source, such as soybean meal, that is degraded mainly into microbial protein?

The calculation for soybean meal would be as follows:

2,000 lbs/ton x 0.4535 kg/lb = 907 kg x 91 percent dry matter in soybean meal = 825 kg x 54 percent crude protein on a dry matter basis = 445.5 kg of protein.

Soybean meal is about 70 percent degradable in the rumen, so 445.5 X .70 = 312 kg, assuming all of it is converted to microbial protein. About 80 percent of microbial protein is true protein, and since it is about 85 percent digestible in the small intestine, 312 kg x .80 x .85 = 212 kg of IADP.

Current cost of soybean meal is $270 per ton. The cost of IADP, therefore, would be $1.27 per kilogram, or 58 cents per pound.

Yet a simple cost comparison does not take into account the quality of the microbial protein. As we pointed out earlier, you can't beat it.

**Don't overlook it**

Perkins realizes how easy it is to overlook these fundamental principles. For instance, producers who feed by-products often fall into the trap of formulating a ration that appears to meet the cow's energy requirements, but is actually deficient in starch and sugar. Many by-product feeds are low in starch and high in oil and fat, so the cows get their energy from oil and fat rather than starch. Consequently, the rumen bugs are deprived of starch, and they don't grow to their maximum potential.

"It's easy to think that you're feeding a cow, but in reality you're not," Perkins says. "You're feeding rumen bugs."

**Microbial protein synthesis**