FATS AND PROTEINS RESEARCH FOUNDATION, INC.

Director's Digest

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PUT PROTEIN NEEDS OF COWS INTO PERSPECTIVE

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Dairymen have had a long-standing devotion to protein for their cows. They usually answer questions about the quality of their feeds by quoting the crude protein percentage of their hay, silage and grain rations. It is unusual to find a dairyman who also knows the ADF, NDF or net energy content of the same feeds. The emphasis on protein must be due to a failure on the part of those of us who are responsible for continuing education. We apparently have left the impression that, if protein is right, everything else will be right.

Despite this impression on the importance of protein, there is little agreement on the requirement for the nutrient. Since 1977, protein requirement systems have been published in six nations. To compare the systems, I have listed the protein requirements for a 1,300 pound cow giving 66 pounds of 4.0 percent milk. (See Table 1).

The system used in the United Kingdom allows the least; the U.S., the most. The difference is 30 percent for both pounds and percent protein.

The question is "why the differences?" Major problems are the feeds fed in calculating the requirements, the conditions under which they were determined and the fact that there are factors other than protein that determine the need.

A major hurdle is the complex of factors that determines both the amount and type needed. Here, I would like to try an approach that is new...at least to me.

Using the current NRC "Nutrient Requirements of Dairy Cattle", I programmed a ration for a 1,300 pound cow producing 93 pounds of milk with 3.5 percent fat and 3.25 percent milk protein. The ration includes a variety of feeds in order to illustrate a point. (See Table 2).

To explain the problems of protein programming, the chart above relates to the ration in Table 2 so we can follow the crude protein from the ration to milk production.

The top line is the total crude protein in the total ration. I have listed the various protein types in grams of protein since that is the method used in the NRC tables. The 3,954 grams of crude protein is 8.7 pounds. This is the crude protein requirement that varies so much between rationing programs. It is, in fact, only the total crude protein that must be fed to supply the types of protein needed in the ration. As we shall see, it varies with the feed used.

The first division of the protein requirements are in the second group...they are rumen degradable and undegradable crude protein. The two values are from NRC tables.

The ration described in Table 2 contains 2,481 grams of degradable and 1,473 grams of undegradable protein. These values have been determined through actdual research trials.

The degradable protein is broken down in the rumen to ammonia, amino acids and other simple compounds. The bacteria use these compounds for growth. In the process, they form "bacterial protein"...actually, just a mass of rumen bacteria and other organisms.

Since this is a growth process, maximum use of the protein will be achieved only if the protein supply is available as the bacteria need it. Thus, the rumen degradable protein is broken down into rapidly available protein (soluble) and slowly degradable protein which I have labeled "non"-soluble.

In the case of our ration in Table 2, the alfalfa silage supplies the most soluble protein, the wheat mids and soybean mill feed the next group and the corn and cottonseed the majority of the nonsoluble. By using a combination of feeds with known solubilities, you can provide a total degradable protein that is available over time.

The rumen undegradable crude protein includes two items that must be considered. Note that of the 1,473 grams of undegradable protein, 216 grams are bound protein. For all practical purposes, the bound protein is undigestible. Thus, without correcting for bound protein, you must take care not to include silages or hays that have reached high temperatures during storage or dried feeds such as distillers' grains that have been dried too fast at a very high temperature. It is important to keep in mind that bound protein escapes both the rumen and intestinal digestion.

The second point is that there is growing field experience to indicate that a variety of undegradable protein may be needed to provide the needed amino acids. Thus, in our ration we get undegradable protein from blood meal, cottonseed meal, the corn silage and corn grain and other feeds.

We now move down the chart to the fourth category of protein sources...the bacterial and escape proteins. The sum of the two multiplied by their percent digestibility is the amount of protein available at the point of absorption. The amount of escape protein is 1,257 grams. The amount of bacterial protein is the most variable of the values and is the primary reason for differences in protein requirements.

<u>Results Are Unpredictable</u>

Over an 18-month period, there were eight papers in the Journal of Dairy Science reporting on research to determine the need for undegradable protein for dairy cows. Half of the research indicated more milk from adding undegradable protein and half showed no benefits.

These differences highlight the fact that factors other than protein supply determine the amount of bacterial protein produced. Since this is a growth process, a major factor is energy supply. Just as you need a mixture of proteins to insure a supply of protein over the interval between feedings, so you need a variety of energy supplies to go with the protein.

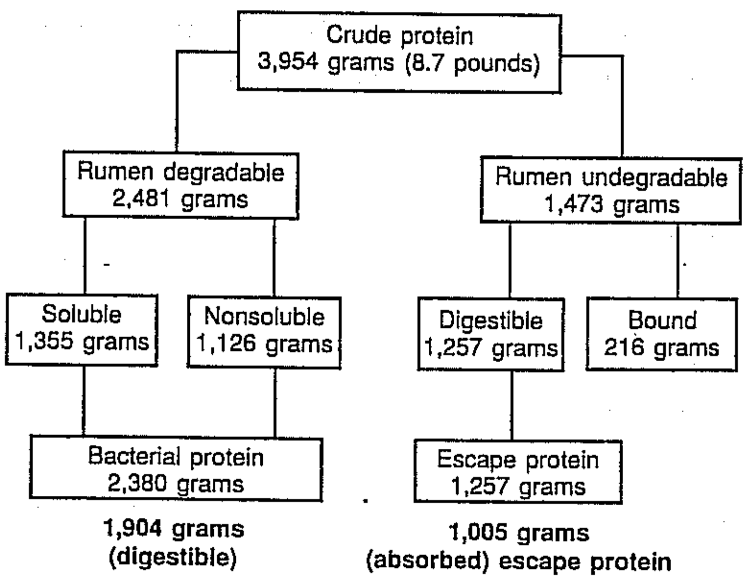
Recent Arizona research found that barley and cottonseed meal produced more milk than corn and cottonseed meal. The reason was the greater availability of the starch from barley in the rumen. We have been using a combination of barley and corn wherever possible for some years. We did so in this ration.

Of equal importance is the energy supplied by fiber. Around the world, dairymen like soybean mill feed because of its highly digestible fiber. The differences in energy supply and source has resulted in wide differences in the amount of bacterial protein provided by rations.

Finally, we come to the bottom line. We have produced 1,904 grams of digestible bacterial protein and 1,005 grams of escape protein for a total of 2,909 grams of intestinal protein. Our cows were calculated to need about 3,000 grams. Our ration may be just a little short.

However, what we are concerned with is how we got from the 8.7 pounds of crude protein fed to the 6.4 pounds of protein at the site of absorption. The system is complex, and we need only understand enough of it to make sure we program rations to give our cows the greatest opportunity to make efficient use of protein in their rations.

What happens to ration protein



Total digestible protein: 2,909 grams

Table 1. How protein requirements compare*

Country	Pounds of crude protein	Percent of dry matter
United Kingdom	4.96	12.9
France	6.23	16.2
Switzerland	6.38	16.6
West Germany	6.14	15.9
Scandinavian	6.05	15.7
United States	6.48	16.8

*Crude protein required by a 1,300-pound cow producing 66 pounds of 4 percent fat milk.

Table 2. Ration to meet protein needs*

Feed	As fed	Dry matter
	—lbs.—	
Corn silage	34.0	12.99
Alfalfa silage	30.0	10.50
Corn meal	6.7	5.90
Barley	6.0	5.28
Blood meal	1.0	0.92
Wheat mids	6.0	5.34
Cottonseed meal	4.5	4.05
Bypass fat	1.5	1.50
Soybean mill feed	5.0	4.55
Additives	1.0	1.00
Total	95.7	52.02

*Ration for cows weighing 1,300 pounds and producing 93 pounds of milk with 3.5 percent fat and 3.25 percent protein and having a body condition score of 2.
Total ration analysis: Dry matter, 54 percent; crude protein, 16.9 percent; ADF, 19.35 percent; NDF, 33.3 percent; nonfiber carbohydrate (NFC), 33.7 percent; NEL, 0.78 megacalories per pound.