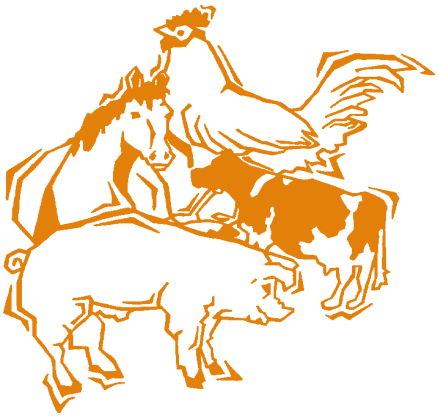

MANAGEMENT

Bypass Protein for Cattle no. 1.609

by T.L. Stanton [1]

Quick Facts...

Bypass protein is protein that escapes digestion in the rumen of cattle.

Bypass protein has potential economic advantages when included in beef cattle diets.

Lightweight and stressed cattle have the greatest ability to use bypass protein.

It is doubtful that bypass proteins will prove to be beneficial for finishing cattle that weigh more than 800 pounds with normal intake.

Bypass protein supplements should be evaluated in a cost-per-unit-of-protein basis.

Protein is expensive. What happens to this nutrient inside cattle is somewhat of a mystery. Studies within the last decade have greatly increased the knowledge concerning protein nutrition in growing-finishing cattle.

Exploring the Rumen

Figure 1 represents a schematic summary of protein use by cattle and may explain where bypass proteins have potential in beef cattle diets. The true or natural protein contained in grains, soybean meal, cottonseed meal and forages is shown with dots. This protein may escape bacterial breakdown in the rumen and go to the intestine as shown by path 1. This often is called “bypass” protein.

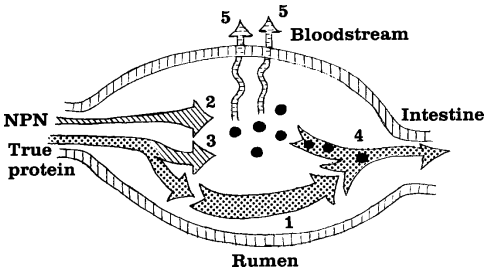

Figure 1: Protein utlization by cattle.

Protein sources vary greatly in the extent to which they are broken down in the rumen. Such factors as solubility, heat treatment and particle size change exposure of protein to bacteria and alter bypass. Furthermore, the time protein spends in the rumen can alter degradation. For example, soybean meal and alfalfa protein continue being degraded after eight to 12 hours of ruminal exposure. In contrast, meat meal and corn gluten meal degradation slows after this time. The faster the protein flows out of the rumen, the greater the bypass. High feed intakes usually increase ruminal outflow rate.

Feedstuffs contain some naturally occurring nonprotein nitrogen (NPN). If some urea or corn silage treated with ammonia is fed, more NPN is present in the rumen. The feed indicated by diagonal lines in Figure 1 represents NPN sources used. Note such protein is completely converted to ammonia and path 3 adjoins path 2 in the drawing.

The ammonia going into the rumen by path 2 or 3 is now used by the bacteria to make bacterial protein, but converting ammonia to protein requires energy. In other words, cattle that consume a high-grain diet can support more bacteria to use ammonia than cattle that graze native pasture.

Eventually, the resultant bacteria (shaded circles) are flushed out of the rumen and follow path 4. Path 4 also is coded by dots because, when the bacteria move into the intestine, they are digested, as is the natural protein in path 1.

The supply of ammonia in the rumen balances the bacterial appetite for ammonia when the total ration is about 12.5 percent crude protein for finishing cattle that weigh more than 750 pounds. But if too much protein is fed, ammonia production from the broken-down protein exceeds the appetite that rumen bacteria have for ammonia. This results in ammonia overflow, which is absorbed

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by the rumen wall that exits by path 5 (broken lines) and consequently is lost via the bloodstream, liver, kidneys and urine. On the other hand, if rations with too little protein are fed, the bacteria will be partially starved for ammonia and their ability to digest feed is reduced.

During certain stages of production, ruminants need more protein than what is furnished by microbial protein synthesis and the normal escape of dietary proteins from the rumen. The value of this protein is primarily dependent on amino acid composition. Poor quality protein feeds are improved by rumen microbes, and good quality protein feeds are reduced in quality.

Table 1: Bypass classes of protein.

	% bypass
Very low bypass:	0-20
Urea	
Casein	
Low bypass:	20-40
Soybean meal	
Peanut meal	
Medium bypass:	40-60
Cottonseed meal	
Dehydrated alfalfa	
Linseed meal	
Corn grain	
Brewers dried grains	
High bypass:	60+
Meat meal	
Corn gluten meal	
Blood meal	
Feather meal	
Distillers dried grains	

Bypass Values

How much protein normally is bypassed? Values for bypass typically are listed as the percentage of fed protein that passes out of the rumen undegraded. Proteins have been categorized into four broad bypass classes (Table 1).

More precise bypass values may be cited from specific experiments; however, feed processing conditions and animal and microbial variability make estimates less than accurate.

Desirability of Bypass Protein

Increasing the amount of protein that escapes degradation in the rumen may not bring improved cattle performance. This protein must be digested in the small intestine. Such natural proteins as feather meal escape the rumen but are poorly digested in the small intestine. Any process that reduces ruminal breakdown of a protein must not prevent subsequent intestinal digestion of the bypass protein. The bypass protein must provide amino acids that the animal needs for growth.

Is bypass protein desirable? Production responses from formulating with high bypass proteins in growing-finishing diets can be expected only when the animal's requirement for protein (amino acids) is not being met.

Research suggests that at least two situations exist where bypass proteins would have some use in the feedlot. One situation involves young, lightweight feeder calves during the initial phase of the feeding period. With rapid growth, young steers may deposit up to 200 grams of protein per day, though averaged over the finishing period, protein accretion (deposition) is usually in the 100- to 120-gram range. Deposition rate markedly declines as cattle fatten and reach higher quality grades.

Ohio State University workers reported a 15 percent increase in average daily gains for 415-pound calves receiving corn gluten meal versus soybean meal supplemented in corn silage diets. This increase in gain plus a 17 percent improvement in feed conversion were reported for the first 46 days of the trial.

It is doubtful that bypass proteins will prove to be beneficial for finishing cattle that weigh more than 800 pounds provided dry matter intake is normal and the diet contains 50 percent or more grain. In general, these diets have shown no improvement when supplemented with natural protein versus non-protein nitrogen.

The second situation where bypass proteins may have some use is when they are fed to stressed cattle (cattle shipped long distances). Although research is lacking in this area, such rations should supply increased percentages of energy, minerals and vitamins, as well as protein, in view of the reduced intakes normally observed in stressed animals. To benefit from bypass protein, improvements must be observed in animal health, performance or cost of gain.

Rate and efficiency of gain with feedlot rations that contain protein levels recommended by the National Research Council generally have not been improved with bypass protein. Isolated studies have shown that heavyweight

cattle fed high grain diets respond to bypass proteins or natural protein supplements fed at higher than recommended levels.

Feeding Bypass Protein

To realize a cost-of-gain advantage, protein levels must be reduced or urea substituted for some of the protein when bypass protein is fed. When protein levels are reduced, care must be exercised to ensure that enough NPN and available minerals are provided. Substituting a smaller amount of high bypass protein for other protein supplements may result in some saving and thus justify the risk with carefully balanced feedlot rations for younger, rapidly growing cattle. However, the total economics need to be considered, not just the relative cost of the protein supplement.

How much of a premium should one pay for bypass protein? The real goal of the bypass protein concept is to balance energy and ammonia so neither is wasted, and to balance ration protein to the growth stage of the animal. Several systems that account for bypass protein have been proposed. A comprehensive system eventually will be developed that will more accurately allow formulation and evaluations of rations.

Accurate bypass values for feedstuffs are being developed to match animal requirements. The bypass protein concept is being used with some success to market commercial protein supplements. Evaluate these supplements on a cost-per-unit-of-protein basis, remembering that bypass protein has the most potential with lightweight and stressed cattle. Although research has not clearly demonstrated how much of a premium should be given for bypass protein on a cost-per-unit-of-protein, a small one might be considered under the correct feeding situation.

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