



# Goat Nutrition - Protein

by Dr. Rick Machen  
Associate Professor & Extension Livestock Specialist  
Texas Agricultural Extension Service, Uvalde

Question: What is protein?

The five major categories of nutrients are:

- water
- protein
- energy
- vitamins
- minerals.

Protein consists of the elements carbon, hydrogen, oxygen, nitrogen and sulfur. These elements are assembled into links called amino acids. Amino acids are then hooked together, like links in a chain, to form proteins.

The most common and economical sources of protein for goats in the Southern US are the oilseed meals: cottonseed, soybean, peanut and sunflower. The cereal grains and forages also contain protein (Table 1).

When feed, forage or hay is analyzed for protein content, the chemist is actually measuring the amount of nitrogen (N) in a sample. Proteins, on average, contain 16% nitrogen. The ratio of N content to the entire sample is

$$100\% \div 16\% = 6.25.$$

The 6.25 is a conversion factor: crude protein content of a sample is determined by multiplying the N content by 6.25. For example, if a feed sample had 2.56% N, its crude protein content would be

$$2.56 \times 6.25 = 16\%.$$

Protein is associated with the contents or inside of a plant cell. The protein content of old, dry, weathered grass is low because the plant cells have ruptured or dried out. Therefore, the cell contents have been lost or are a small portion of the total weight of the dormant plant. The fiber (relatively less digestible) to cell content ratio is very high. In contrast, young, green, growing plants are made up of active, growing cells that contain proteins and other nutrients. The fiber to cell content ration is now very low.

## How are proteins digested?

When feed is ingested by a goat, salivary enzymes initiate the digestion process immediately. Upon arrival in the rumen (the largest of the four stomachs), the feed is greeted by literally millions of microscopic bacteria. **These bacteria are the key to the nutritional well-being of a ruminant.** In fact, it is these cellulose-digesting bacteria that enable a goat to digest leaves from woody plants, forbs (weeds) and grass.

Table 1.	
Feedstuff	% Crude Protein
Cottonseed meal	41
Soybean meal	44
Peanut meal	52
Corn	10
Oats	10
Grain sorghum	10
Wheat	14
Alfalfa hay	17
Prairie hay	5

Bacteria in the rumen break down dietary proteins into individual amino acids. These amino acids are then used by the bacteria to construct bacterial protein and make more bacteria.

Bacteria are continuously being flushed out of the rumen, through the reticulum, to the omasum (where moisture is removed from the digesta) and finally to the abomasum or fourth stomach .

The abomasum is similar to a monogastric (meaning one stomach; human, pig, chimp, etc.) stomach. It is a very acidic environment. In the abomasum, the bacterial proteins are broken down into amino acids, which pass through the small intestine and in to the bloodstream.

## What is by-pass protein?

By-pass protein, more appropriately known as escape protein, is that portion of the dietary protein that escapes degradation in the rumen and arrives in the abomasum in its intact, dietary form. Obviously, there is some efficiency to be gained by avoiding the bacterial breakdown and reconstruction previously mentioned.

Feedstuffs differ in their escape protein values: protein from plant sources (soybean meal, cottonseed meal, wheat midds, etc.) generally has a lower escape value than that of animal origin (feather meal, blood meal, fish meal, etc.).

Caution: The bacteria in the rumen have a well defined nitrogen requirement. If *too much* of the

dietary protein escapes degradation in the rumen, the available N in the rumen will be deficient and the bacterial population will suffer.

The minimum crude protein content of a goat's diet is thought to be 7-8%. Below that, rumen bacteria suffer and so does performance of the goat.

Most commercially prepared goat feeds contain 12-17% crude protein - enough to support those itty, bitty, all-important bacteria and the productivity of their hosts, your goats.

Bottom line: Most goat owners need not concern themselves with the escape protein content of their precious darling's diet.