

Alternative Protein Sources for Cattle

Jeff Lehmkuhler, Katie VanValin, Kevin Laurent, Darrh Bullock, and Les Anderson, Animal and Food Sciences; and Darrell Johnson, Regulatory Services



Corn gluten and soybean hull mixture commonly offered to beef cattle as a supplement.

Kentucky has several bourbon distilleries and one fuel ethanol plant. The spent grains from the production of ethanol are utilized as a protein source in livestock feed. Most distilleries and fuel ethanol plants will have a scheduled maintenance shutdown each year. Shutdowns for fuel ethanol plants may also occur as a result of unfavorable profit margins when crude oil prices are low. During a shutdown, availability of distillers grains and other coproducts from these plants may be limited or unavailable. So the question is: What else can I feed in place of distillers grains?

Fortunately, several alternative protein options are available. However, for this discussion, only dry protein sources will be considered. The first alternative choices would be other plant-derived protein sources. The most common in Kentucky are either soybean meal or corn gluten feed. Cottonseed meal from the cotton growing areas south and west of the Commonwealth can also be an option.

Dietary protein sources include true protein and non-protein nitrogen (NPN) forms. True protein refers to peptides and amino acids. Zein, for instance, is a

true protein found in corn. Non-protein nitrogen refers to nitrogen sources within a feed that are not incorporated into an amino acid and may include nitrate, nitrite, diammonium phosphate, urea, and biuret as examples. Feedstuffs will often contain a combination of both true and NPN forms. Alfalfa silage, for example, may contain 40 to 60 percent of the nitrogen content as NPN and the remainder as true protein.

Many producers have developed the habit of buying unblended feedstuffs, such as dried distiller's grains with solubles (DDGS), and they often forget about protein supplements available from feed companies. Feed companies market a "natural" protein supplement. Natural refers to not having an NPN source. These natural protein products often range between 24 to 38 percent crude protein.

Protein levels for a variety of feedstuffs are shown in Table 1. Protein guarantees on a feedtag will be lower than reported in the table, as most protein products from a feed company will include minerals, eliminating the need for additional mineral supplementation. Inclusion of mineral dilutes the protein content. Natural protein products will be slightly more expensive on the basis of price per pound of crude protein.

Most feed companies also sell a higher crude protein line that includes a blend of plant-derived protein and NPN sources. Urea is the common NPN source utilized in dry feeds, but biuret, a slower rumen degrading form of NPN, may also be utilized. On a price per pound of crude protein basis, urea is the cheapest source of protein (see Table 2). Feeding NPN as a protein source is best when feeding diets

Table 1. Average crude protein content of various feedstuffs commonly offered to beef cattle.

| Feedstuff | Crude protein (%)* |
|--------------------------------------|--------------------|
| Alfalfa meal | 16 |
| Brewers grains, dried | 22 |
| Corn gluten feed, dried | 21 |
| Corn gluten meal, dried | 57 |
| Cottonseed meal, solvent extracted | 42 |
| Dried distiller's grains w/ solubles | 28 |
| Flaxseed/Linseed meal | 20 |
| Soybean meal | 46 |
| Soybeans, whole, raw | 38 |
| Urea | 287 |

Source: <https://animalnutrition.org/feed-composition-database> accessed 3/20/20, excluding urea.

*Values are expressed on a 90 percent dry matter basis.

Table 2. Price per pound of crude protein from various feedstuffs.

| Feedstuff | DM (%) | CP (% DM) | Cost (\$/unit) | Unit (lb) | Cost/lb CP (\$) |
|-------------------|--------|-----------|----------------|-----------|-----------------|
| Alfalfa hay | 86 | 20.0 | 10 | 60 | 0.97 |
| 34% pellet | 90 | 37.8 | 17 | 50 | 1.00 |
| Corn gluten feed | 90 | 21.1 | 180 | 2000 | 0.47 |
| Soybean meal | 90 | 50 | 13.50 | 50 | 0.60 |
| Distillers grains | 90 | 27.8 | 225 | 2000 | 0.45 |
| Urea | 90 | 287.8 | 15 | 50 | 0.12 |

Note: Price will vary based on actual costs for feedstuffs.

containing rapidly fermenting carbohydrates such as starch.

Feedlot diets containing mostly corn and/or other cereal grains are ideal for urea. Urea should be avoided when feeding feedstuffs high in NPN. Excessive ammonia production in the rumen can lead to disorders and potentially death. If water sources are known to contain elevated NPN sources, urea should not be offered. Alfalfa haylage, drought-stressed corn, or sorghum silages that have accumulated nitrates are example feedstuffs in which urea should be avoided. In addition, urea should not be fed in combination with raw soybeans due to the urease activity of soybeans and risk of ammonia toxicity.

When reading feedtags that contain NPN sources, tags will include the amount of NPN protein in the feed. The statement often reads: "This includes not more than XX.X% equivalent crude protein from non-protein nitrogen." For example, a protein supplement may list a guaranteed minimum crude protein level of 44 percent. The feedtag states that the product contains not more than 18 percent equivalent NPN protein. The product would have approximately 40 percent of the protein from NPN sources (18% NPN equivalent CP/ 44% CP).

General rules of thumb exist when using NPN or urea in high-grain diets. These guidelines should be followed, as urea can be toxic to cattle. One rule of thumb is that NPN sources should not provide more than one third of the total crude protein in the diet. For example, if a diet contained 13 percent crude protein, urea should not provide more than 4.3 crude protein units ($13\% \times 0.33$). Another feeding guideline is that the diet should contain no more than 1.5 percent of urea on a dry matter basis. This is simplified by recommending no more than one fourth to one third of a pound of urea be fed daily to a finishing animal. Generally, urea is avoided in light-weight calves and diets comprised of low-quality forages. In larger feedyards, urea is often delivered mixed into liquid molasses. Having the urea mixed into liquid supplements improves mixing and reduces the risk of sorting. When adding urea sources to diets, ensure it is evenly mixed with the other feedstuffs.

The cost of the protein source needs to be considered as well. A commercial feed that includes the minerals would eliminate the need to provide additional mineral supplement, providing a savings of \$0.10 per day at current prices. The min-

eral provided in the supplement would be a value of \$120 per ton, assuming a bag of the protein supplement provided 30 head feeding days (ex. 50 lb bag/1.67 lb fed per day). In many instances, one may purchase alternative protein supplements in bags instead of bulk. Bagged feed prices will be higher, and discounts are offered for bulk orders.

In Table 2, several feeds are shown, with prices, to determine the price per pound of crude protein. Determining the price per unit of protein is one approach at determining which protein source may be economically better. Price alone is not the only decision driver. Handling, mixing, sorting, risk of feeding disorders, and other factors should be considered.

In summary, when a protein source becomes limited in availability, seek alternatives. Do your homework to learn how much protein, energy, and other nutrient levels make up the feedstuffs that are available. Consider the price on a nutrient basis as shown above. Work with your nutritionist to develop a new feed ration that will meet the nutrient needs of the animals and avoid feeding disorders. For more information, contact your county Extension office and visit with your nutritionist.

Photo: Jeff Lehmkuhler