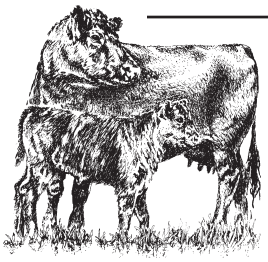

Western Beef Resource Committee

Cattle Producer's Library

Nutrition Section CL309

Pricing Protein and Energy Supplements Corrected for Moisture Content

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"You can't starve the profit out of a cow!" Many roughage feeds fall short of meeting the nutrient requirements of a mature cow or replacement heifer in their last trimester of pregnancy and 3 to 4 months postpartum. Protein and/or energy supplementation is essential during this period to help ensure conception of the cow or heifer while producing heavy calves at weaning. Comparing products on a cost per pound of nutrient basis can simplify choosing an economical protein or energy supplement.

Additionally, feeds frequently differ in water (moisture) content. Because moisture content directly affects nutrient concentration and dollar value per ton, a producer must correct for moisture in order to properly compare feeds when buying and selling. This fact sheet explains how to go "supplement shopping" with a least-cost ration formulation in mind.

Moisture and Dry Matter Content

"Percentage of moisture" is a term used to express the amount of water contained in feeds. Moisture content can be a large portion of the total weight of high moisture feeds, such as balage, haylage, and high moisture grains. High moisture balage containing 60 percent water is provided as an example (Fig. 1). If 1 ton (2,000 lb) of the balage is completely dried, only 800 pounds from the initial 2,000 pounds will remain. Therefore, the balage dry matter is 40 percent (800 ÷ 2,000 x 100) and the moisture is 60 percent. Either term can be used to describe the dry matter/water relationship. Conversion between the two terms is as follows:

% dry matter = 100 - % moisture = 100 - 60 = 40

% moisture = 100 - % dry matter = 100 - 40 = 60

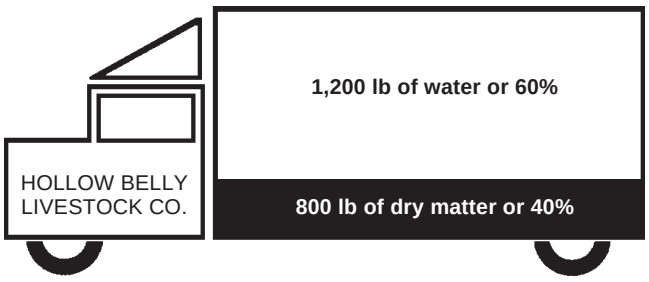

Fig. 1. High moisture balage containing 60 percent water.

In laboratory reports, nutrient composition of feeds is recorded with and without correction for moisture content. As-fed composition is used to describe feeds without correction for moisture and relates to the composition of the feed at time of feeding and (or) in storage.

Some feed testing laboratories use the term "as-received" in place of "as-fed" when reporting nutrient composition of a feed. As-received and as-fed analysis will be equivalent if moisture is not lost between time of sampling, analysis, and feeding. "Dry matter basis" is a term that is used to express the nutrient content of a feed without the moisture included. Therefore, the proportion of each nutrient will be greater on a dry matter basis compared to the as-fed value.

In some situations, only one form of nutrient composition is available: either the as-fed values or values on a dry matter basis. It is important to fully understand the difference because as-fed composition and dry matter composition are different. The magnitude of the difference will depend on the moisture content.

To compare the amount of protein in two feeds with differing amounts of moisture, the percent protein must

be expressed on a dry matter basis. For example, on an as-fed basis Alfalfa Hay A is 87 percent dry matter and 17 percent crude protein and Alfalfa Hay B is 92 percent dry matter and 17 percent crude protein. The equations on the next page are used to convert protein on an as-fed basis to a dry matter basis so the two hays can be compared directly.

Hay A: $\frac{17 \times 100}{87}$ = 19.54% protein on a DM basis

Hay B: $\frac{17 \times 100}{92}$ = 18.48% protein on a DM basis

Pricing Method

Supplements should not be compared by cost per ton of the total feed, as this can be misleading. Rather, supplements should be compared on cost per pound of actual nutrients needed. When nutrient shopping, you are normally interested in protein and/or energy. Mineral requirements can be met with less expense using a free choice salt/mineral program and water requirements can be met cheapest by a visit to the water trough. Also, producers may be paying high prices for ingredients used as fillers. When comparing supplements for specific nutrients, the following guidelines assist in determining the best buy:

Step 1. Determine the total pounds of dry mater of the feeds to be compared. Do this by multiplying 2,000 pounds by the percentage of dry mater contained in the feed as determined by laboratory analysis. As an example let's use Alfalfa A in the earlier example. The hay is 87 percent dry matter. Multiply 2,000 pounds of as-fed hay by 87 percent (0.87) dry mater content, which results in 1,740 pounds of actual dry matter (Fig. 2).

Step 2. Determine the total pounds of a nutrient in those 1,740 pounds of dry matter. Do this by multiplying 1,740 pounds by the percent of the nutrient (on a DM basis) contained in that feed. For this example, Alfalfa A is 19.55 percent crude protein on a dry matter basis. Multiply 1,740 pounds of dry matter x .1955 (19.55% crude protein) = 340 pounds of crude protein. This leaves 1,660 pounds of water, other nutrients, and filler contained in 1 one ton of as-fed feed (2,000 pounds - 340 pounds of crude protein = 1,660 pounds) (Fig. 3).

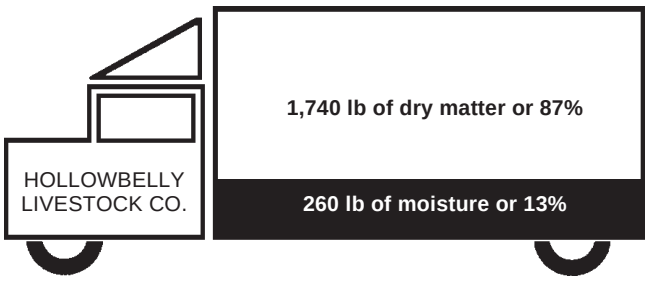

Fig. 2. Low moisture balage containing 13 percent water.

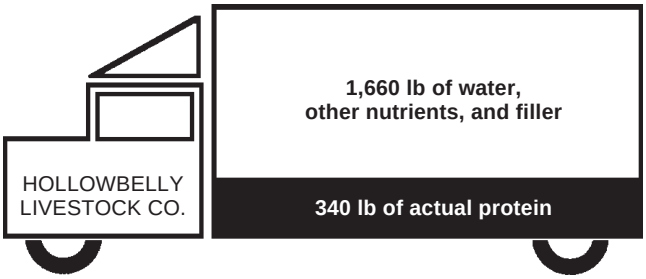

Fig. 3. Balage containing 340 pounds of actual protein.

Fig. 4. Balage containing 340 pounds of protein.

Step 3. Determine cost per pound of actual nutrient. Do this by dividing the ton price of as-fed feed (most feeds are priced as-fed and by the ton) by the pounds of actual nutrient contained in that ton of as-fed feed ($100/ton ÷ 340 pounds of crude protein/ton = 29.4¢/lb). In this example, $100/ton as-fed alfalfa hay with a protein content of 19.54 percent (on DM basis) has a price comparison shopping value of 29.4 cents per pound of crude protein (Fig. 4).

Cost of Protein

Protein supplements are probably the most difficult supplements to evaluate because they can differ in the amount of utilizable protein. Producers must distinguish between natural protein and nonprotein nitrogen (NPN), bypass protein and ruminal degradable protein, and dry vs. liquid. Urea, biuret, and other forms of NPN do not equal natural protein. The extent to which NPN is utilized is dependent on several factors, including the energy content (especially starches from cereal grains) of the diet and the quality of the available forage. Also, an understood concept is that NPN should not exceed one-third the total protein provided to the animal. Refer to CL 322, Ureau in Range Cattle Supplements, for more information on feeding NPN to ruminants.

Table 1 shows price comparisons for some supplements commonly available to livestock producers. Alfalfa hay at a cost of $100/ton is the most economical protein supplement. Its cost is 29 cents per pound of crude protein, which is 5 cents cheaper than its closest

Table 1. Comparison of some potential crude protein supplements based on cost per pound of crude protein.

Supplement	$/ton	CP (%)	CP (lb/ton)	Price of CP (¢/lb)
Alfalfa hay	100	17	340	29.4
Alfalfa hay	116	17	340	34.1
20% range cube	138	20	400	34.5
20% range block	155	20	400	38.8
25% molasses mix	378	25	500	75.6
Wheat-midd pellet	168	16	320	52.5

competitor. Given the costs of crude protein supplements in Table 1, a producer should be able to pay up to $116/ton for alfalfa hay before the other feeds become price competitive per pound of crude protein.

Table 2 is a quick reference that can be used to compare protein supplements based on price quotes and crude protein content. Also, it is a good idea to add transportation costs into the price per ton before selecting a protein supplement.

Table 2. Cost per pound of crude protein for supplements ranging from 15% to 35% crude protein.

Supplement cost ($/ton)	Supplement crude protein 15%	20%	25%	30%	35%
	Cost per lb crude protein (¢)				
80	26.7	20.0	16.0	13.3	11.4
85	28.3	21.3	17.0	14.2	12.2
90	30.0	22.5	18.0	15.0	12.9
95	31.7	23.8	19.0	15.8	13.6
100	33.3	25.0	20.0	16.7	14.3
105	35.0	26.3	21.0	17.5	15.0
110	36.7	27.5	22.0	18.3	15.7
115	38.4	28.7	23.0	19.2	16.5
120	40.0	30.0	24.0	20.0	17.2
125	41.7	31.3	25.0	20.8	17.9
130	43.3	32.5	26.0	21.7	18.6
135	45.0	33.8	27.0	22.5	19.3
140	46.7	35.0	28.0	23.3	20.0
145	48.3	36.3	29.0	24.2	20.7
150	50.0	37.5	30.0	25.0	21.4
155	51.7	38.8	31.0	25.8	22.1
160	53.3	40.0	32.0	26.7	22.9
165	55.0	41.3	33.0	27.5	23.6
170	56.7	42.5	34.0	28.3	24.3
175	58.3	43.8	35.0	29.2	25.0
180	60.0	45.0	36.0	30.0	25.7
185	61.7	46.3	37.0	30.8	26.4
190	63.3	47.5	38.0	31.7	27.1
195	65.0	48.8	39.0	32.5	27.9
200	66.7	50.0	40.0	33.3	28.6
300	$1.00	75.0	60.0	50.0	42.9
400	$1.33	$1.00	80.0	66.7	57.1

Table 3. Comparison of some potential crude protein supplements based on cost per pound of total digestible nutrients (TDN).

Supplement	$/ton	TDN (%)	TDN (lb/ton)	Price of TDN (¢/lb)
Alfalfa hay	100	58	1,160	8.6
Alfalfa hay	116	58	1,160	10.0
20% range cube	138	80	1,600	8.6
20% range block	155	72	1,440	10.8
25% molasses mix	378	80	1,600	23.6
Wheat-midd pellet	168	79	1,580	10.6

Cost of Energy (TDN)

Table 3 shows cost comparisons for energy (total digestible nutrients or TDN) using the same feeds shown in Table 1. Alfalfa loses some of its competitive edge when energy is the nutrient of choice. The range cube priced at $138/ton, or 8.6¢/lb of TDN, is equal in value to alfalfa at $100/ton if only energy were considered. The alfalfa at $100/ton should remain the feed of choice if energy AND protein are required.

How Much Protein and Energy Do I Need?

Contained within CL300, Nutrient Requirements of Beef Cattle, are the NRC nutrient requirements for all classes of cattle at various stages of production. Tables are also available listing the approximate nutritive content of various supplemental feeds in CL301, Composition of Common Beef Cattle Feeds.

Producers should perform forage testing on homegrown feeds to remove the guesswork on forage quality and minimize supplemental feed costs (see CL305, Common Sense Feed Analysis and Intrepreting Forage Analysis). The cost of forage testing is minimal compared to the cost of most protein and/or energy supplements.

A producer can determine the supplemental needs to balance a ration through a mathematical process of matching a cow's nutritional needs to the nutrition content of feeds. Several computer programs are available that balance rations on a least-cost basis. Ask the Extension educator in your county for assistance.

More to Consider Than Price Alone

Factors other than price must be considered when supplement shopping.

- Convenience/feedability—feeding every 3 or 4 days vs. every day

- Transportation cost of getting feed to the ranch
- Storage facilities at the ranch
- Cost of feeding the product
- Availability of the product
- Consumption amount required to balance the ration
- Other nutrients required to balance the ration
- Waste
- Salt and mineral content
- Competition when fed (bunk space)
- Opportunity to medicate feed
- Worn and broken teeth on blocks

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