Getting the most feed nutrient for the dollar

Glenn Shewmaker, John Hall, and Sarah Baker

Feed is expensive, but you may be surprised by which feeds provide the best value for a given nutrient. Livestock producers should always put the pencil to a ration, especially in times when feed prices are high and feed supply is short. This publication describes a process to determine the value of a feed when you particularly need energy or protein to balance a forage-based ration.

8-step process

1. Take an inventory of your feed on hand.
2. Plan rations for each class of animal for each month and determine the amount of each feed you need for the period.
3. Allocate your feed on hand to the appropriate class of livestock. Plan to use the best forage resources for the highest need such as young and high-producing animals.
4. Determine which supplemental nutrient(s) you will need to economically balance the ration, for example, total digestible nutrients or crude protein. Test your forages for actual nutrient content to get a better handle on what's needed.
5. Determine the best value for a given nutrient on a dry matter basis at current prices.
6. Consider transportation costs, the risk of feed-induced animal disorders, and ease and practicality of providing the feed. The more water in the feed and the less nutrient dense it is, the higher the cost per nutrient in the actual delivered cost.
7. Consider feed palatability and wastage. For example, barley straw or grass seed straw may be an economical source of fiber and energy, but dry matter intake will likely be limited and wastage could be much higher than buying a good grade of hay. When all things are considered, there is no such thing as "cheap feed."
8. Secure the feed sources and store them in a manner that minimizes the risk of loss or spoilage.

Comparing nutrient sources

Feeds can't be compared fairly on price per ton alone. The lowest-price feed may not be the most economical feed. Protein and energy are the primary nutrients needed to balance a forage-based ration. Most proteins from natural sources are equally usable by cows, thus price per pound of protein is a good method to determine the best buy. However, when nonprotein nitrogen is the majority of the crude protein for a product, it is necessary to have a readily fermentable energy source to enable the rumen microbes to take advantage of the nonprotein nitrogen.

If the ration needs energy, calculate and compare the costs per unit of total digestible nutrients (TDN) for available feeds at current prices. Then consider the value of other nutrients the feed contains.

Comparing the price per pound of nutrient between products requires three numbers—the nutrient concentration of the product, its dry matter (DM) concentration, and the price per ton. Compare all nutrients on a dry matter basis to determine the lowest cost per nutrient.

We recommend using a decision aid developed at the University of Georgia. The UGA Feed Cost Analyzer is a spreadsheet-based decision aid to compare potential feedstuffs on the basis of price per pound of crude protein (CP) and energy (total digestible nutrients [TDN]). This program consists of a feed library prepopulated with some common feedstuffs, a least cost feedstuff analyzer, and a feedstuffs replacement calculator. Each page contains step-by-step directions.

Table 1. Costs per unit of dry matter (DM), crude protein (CP), and total digestible nutrients (TDN) given costs per ton of feed, dry matter (DM) concentration, CP concentration, and TDN concentration. Wholesale prices in dollars per short ton, bulk, FOB Portland and selected markets as of August 21, 2013.

Ingredient	$/ton	% DM	% CP	% TDN	$/CWT DM	$/lb CP	$/lb TDN
Cottonseed meal	342	90	41	78	19.00	0.46	0.24
Corn gluten	236	90	25	83	13.11	0.52	0.16
Soybean meal	490	90	49	84	27.22	0.56	0.32
Whole cottonseed	490	90	25	95	27.22	1.09	0.29
Canola meal	333	92	36	69	18.10	0.50	0.26
Molasses block	650	76	30	80	42.76	1.43	0.53
Liquid feed	350	67	45	80	26.12	0.58	0.33
Alfalfa hay, 1st bloom	185	90	16	52	10.28	0.64	0.20
Orchardgrass hay, good	180	88	10	58	10.23	1.02	0.18
Distiller's corn, wet	96	36	29	98	13.33	0.46	0.14
Distiller's grains	298	90	28	95	16.56	0.59	0.17
Oat hay	160	88	10	54	9.09	0.91	0.17
Corn	260	90	8	90	14.44	1.81	0.16
Barley	244	90	13	84	13.56	1.03	0.16
Barley straw	80	90	4	43	4.44	1.11	0.10
Barley hay	120	90	9	57	6.67	0.74	0.12
Corn stover, stalks	32	80	5	54	2.00	0.40	0.04

Source for feedstuff prices: USDA Agricultural Marketing Service. Pacific Northwest Feedstuffs.

Example 1: Alfalfa hay at first bloom

Alfalfa hay at first bloom is available for $185 per ton. The concentration (percentage) of dry matter is 90%, crude protein (CP) is 16%, and total digestible nutrients (TDN) is 52%.

First, calculate the value of the feed on a dry matter basis. The cost per ton of feed is divided by 20 to convert the units to hundredweight (cwt or 100 lb), then divided by the DM concentration to express the cost per cwt of DM:

$$\text{Cost per cwt DM} = \frac{\$185}{\text{ton feed}} \times \left(\frac{1\text{ ton}}{20\text{ cwt}}\right) \times \left(\frac{100\text{ lb feed}}{90\text{ lb DM}}\right) = \frac{\$10.28}{\text{cwt DM}}.$$

Then calculate the cost per unit of CP on a dry matter basis by dividing the cost per cwt of DM by the crude protein concentration:

$$\text{Cost per lb CP} = \frac{\$10.28}{\text{cwt DM}} \times \left(\frac{\text{cwt DM}}{16\text{ lb CP}}\right) = \frac{\$0.64}{\text{lb CP}}.$$

Calculate the cost per unit of TDN on a dry matter basis:

$$\text{Cost per lb TDN} = \frac{\$10.28}{\text{cwt DM}} \times \left(\frac{\text{cwt DM}}{52\text{ lb TDN}}\right) = \frac{\$0.20}{\text{lb TDN}}.$$

The UGA spreadsheet easily calculates these values based on the values entered into the feed library tab. Book values are entered into the feed library for convenience, but you should enter actual feed test values and current prices into the feed library for the most accurate analysis. Table 1 contains some feeds that are available in the West that can be entered into the feed library's blank lines.

The analyzer tab allows you to compare the costs per pound for the nutrient of interest on a dry-matter basis. Different ingredients can be selected and compared on this sheet with a pull-down menu that uses data from the feed library.

For example, if alfalfa hay is priced at $185 per ton at first bloom stage, the cost per pound of protein would be 64 cents (example 1). If 41 percent cottonseed meal was priced at $342 per ton, then which is most economical? The protein in cottonseed meal would cost 46 cents per pound making it the best buy.

However, the cottonseed meal price is freight-on-board (FOB) at the shipping point and may need to be delivered from Portland, California, or Texas, so be sure to consider transportation costs. Assuming it would cost $90 per ton freight for a semi-load, the feed cost as delivered is $342 + $90 = $432. This increases the cost to 59 cents per pound of CP delivered. Each producer will need to research these numbers for the products that are available to them, and consider the value of other constituents such as TDN.

Example 2: Wet distiller's corn

Wet distiller's corn is available from a local ethanol plant. Assuming the cost is $96/ton delivered in a 50-mile radius and the product is 36% DM and 29% CP, the cost is 46 cents per pound of CP. However, this is a high-moisture feed that is expensive and difficult to transport and feed. Shelf life is only about 1 week, depending on temperature, and it is difficult to feed without blending it into a ration with a vertical mixer.

Example 3: Molasses blocks

Molasses blocks provide protein for $1.43 per pound of CP, which is more than twice the cost of alfalfa hay at 64 cents per pound of CP. How much is the convenience worth for putting out molasses blocks once a week versus alfalfa hay every other day?

Focusing on the entire diet

The process described in this publication is simple to do, but requires common sense and thinking about the entire diet while finding the lowest cost nutrient. For example, corn stover (stalk) grazing or feeding barley straw can provide the cheapest source of energy for nonlactating cows up to a point. However, dry matter intake is restricted because it takes a long time for the fiber to be digested and make room for more intake. Generally, corn stover, barley straw, and grass seed straw are useable up to about half of a dry cow's ration, then more nutrient-dense feed is needed to balance the protein and energy. Equally important is the fact that these feeds provide only about half of the protein required for a nonlactating mature beef cow.

Furthermore, grass seed straw should only be purchased from endophyte-free tall fescue and perennial ryegrass fields. Avoid turf-type grass straws as they may contain high levels of endophyte toxins, which severely impair cattle performance and reproduction.

Thus, it is important to use common sense and a ration-balancing program as the next step in formulating a good low-cost ration. Examples of good ration-balancing programs include the OSU Cow-Culator from Oklahoma State University, which is designed for beef cows, and, for dairy cows, FeedVal from University of Wisconsin and SESAME from Ohio State University.

Feed sampling

We highly recommend sampling the feed and getting a feed nutrition test, especially with forages. The nutritional value of forages varies greatly with plant maturity and harvest management. Forages that have heat damage need a test for acid detergent insoluble CP (ADICP) in addition to CP and TDN because much of the CP in heat-damaged forage is tied up with carbohydrates and not very digestible. A test for ADICP which shows greater than 1.5% can indicate heat damage, and the CP level should be discounted. We recommend using a NFTA certified forage testing laboratory and TDN determined from the summative equation, not calculated from acid detergent fiber (ADF).

Resources and further readings

Calculators and ration-balancing programs

UGA Feed Cost Analyzer —
http://www.caes.uga.edu/Publications/pubDetail.cfm?pk_id=7906

OSU Cow-Culator —
http://beefextension.com/new%20site%202/cccalc.html

FeedVal — http://www.uwex.edu/ces/dairynutrition/

SESAME — http://www.sesamesoft.com

Sampling forages

National Forage Testing Association —
http://www.foragetesting.org

Proper Sampling (Coring) of Hay Bales and Stacks (CIS 1178) — http://cals.uidaho.edu/edcomm/pdf/CIS/CIS1178.pdf

Idaho Forage Handbook, 3d edition (BUL 547) —
http://cals.uidaho.edu/edcomm/pdf/BUL/BUL0547.pdf

Forage quality

National Forage Testing Association —
http://www.foragetesting.org

Idaho Forage Webpage, University of Idaho Extension —
http://www.extension.uidaho.edu/forage/

If you want more assistance with comparing feeds on a nutrient value basis, contact your local Extension educator or consulting nutritionist.

About the Authors:

Glenn E. Shewmaker, Extension Forage Specialist, Kimberly Research and Extension Center, University of Idaho; **John B. Hall,** Extension Beef Specialist and Superintendent of the Nancy M. Cummings Research, Extension, and Education Center, University of Idaho; and **Sarah D. Baker**, Extension Educator, Beef and Range Management, University of Idaho Extenion, Custer County

Published October 2013