The Benefits and Costs of Commodity Feeding

Michael F. Hutjens

Extension Dairy Specialist, University of Illinois, Urbana, 1207 West Gregory Drive, Urbana, IL 61801
Email: hutjensm@illinois.edu

Take Home Messages

- By-product feeds can provide nutritional and economic benefits for dairy managers.
- Pricing and positioning are key focus areas to consider.
- Several questions must be managed for on-farm success.
- Feed variation must be considered when building dairy rations using by-product feeds.

Introduction

By-product feeds (also referred to as co-product feeds) are produced during the production and manufacturing of human and industry products (such as sugar, ethanol, starch, or oil). These ruminant feeds can be more valuable than the original feed in some cases (such as corn distillers grain). This paper discusses positioning by-product feeds, calculating an economical value, strategies to use on dairy farms, and quality concerns.

Positioning By-Product Feeds

Positioning refers to determining how a by-product feed would be used in the dairy ration on each dairy farm situation. If the current ration does not need the nutrients in a by-product feed, it should not be considered. Categories are listed below with example by-product feeds that could fit in each group.

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- Protein source
  - Rumen degradable protein or RDP (corn gluten feed or raw soybeans)
  - Rumen undegradable protein or RUP (heat treated soybean meal, corn distillers grain, fish meal, or blood meal)
- Fiber source
  - Physical fiber (fuzzy cottonseed or straw)
  - Chemical fiber (soy hulls, beet pulp, or citrus pulp)
- Oil/fat source (corn distillers grain, pork meat and bone meal, or fuzzy cottonseed)
- Sugar source (citrus pulp, bakery waste, or molasses)
- Starch source (hominy, whey, or bakery waste)
- Phosphorous source (corn distillers solubles or pork meat and bone meal)

A by-product feed may fit in more than one position. Each dairy manager must determine if an opportunity exists. For example, a ration high in corn silage could benefit from by-product feeds that could provide functional fiber (depending on particle size of the corn silage), additional protein (both soluble protein and RUP high in lysine), rumen fermentable fiber (low in starch), and supplemental source of oil/fat (depending on production level of the herd). In the grass or small grain forage based ration, adding a RUP source, rumen fermentable carbohydrates, and fat/oil could be the optimal positioning of by-product feeds. An Illinois approach with higher levels of corn silage could include 2 to 2.5 kg of fuzzy cottonseed, 1 to 2 kg of soy hulls, and one kg heat-treated soy product. A computer rumen model program (such as the 2001 Dairy NRC model, AminoCow, or CPM model) can evaluate amino acid balance, dry matter intake, and energy discounts.

■ Pricing By-Product Feeds

Once the dairy manager has determined that an opportunity to use a by-product feed exists (positions properly), the next question is “is the feed favorably priced?” Software programs can answer this question by determining the value of nutrients in the by-product feed using reference feeds.

- “Feed Val” spreadsheets were developed by the University of Wisconsin to calculate a value of by-product feed nutrients using base feeds (Tables 1 and 2).
  - Feed Val 1 uses corn (energy) and soybean meal (protein) values.

- Feed Val 3 uses corn (energy), soybean meal (RUP source), tallow (oil or fat), dicalcium phosphate (phosphorous), and limestone (calcium).
- Feed Val 4 uses corn (energy), blood meal (RUP), urea (RDP), tallow (fat), dicalcium phosphate (phosphorous), and limestone (calcium).

- "Sesame" is a program developed by The Ohio State University that considers several reference feeds and calculates an economic value for the by-product feed.

Table 1. Break-even prices for energy feeds based on two shelled corn prices using Feed Val 3 (soybean meal 44% priced at $400US/ton).

Shelled corn price	**$3.50US/bu**	**$4.50US/bu**
	----------$US/ton----------	
Beet pulp	95	132
Corn gluten feed, dry	179	207
Hominy	139	171
Soy hulls	99	135
Wheat midds	139	166

Table 2. Break-even prices for protein feeds based on two soybean meal prices using Feed Val 3 (shelled corn price at $4.00US/bu).

Soybean meal (44%) price	$350	$450
	----------$US/ton----------	
Blood meal	1050	1464
Wet brewers (30% DM)	89	111
Dried brewers grain	292	368
Fuzzy cottonseed	288	326
Distillers grain, dry	335	413
Distillers grain, 35% DM	136	169
Distillers grain, 45% DM	174	217
Fish meal	927	1238
Pork meat and bone meal	879	1138
Soybeans, heated (45% RUP)	475	595
Soybeans, heated (55% RUP)	547	703
Soybeans, raw	267	313

When determining the value of a by-product feed, consider the following points to be sure the feed is a good value.

- Adjust the break even price of the by-product feed for storage and handling losses. Storage losses can be significant for wet by-product feeds (seepage of water and nutrients from the delivered feed, mold that must be discarded and dry matter losses due to fermentation). Shrink includes feed that is blown away, consumed by birds or rodents, contaminated by mud or manure, or spilled. Handling losses occur when the amount added is not accurately measured.
- Determine if the price is for semi-load quantities that must be paid for when the feed is delivered.
- Ask if the price is delivered to the farm or at the site of production (fob).

On-Farm Approaches

Herd size will have an impact on how an individual farm can use by-product feeds after determining it can be positioned and prices correctly. The minimum level of a feed or blend that can be successfully mixed in a TMR is 1 kg with 2 to 3 kg optimal. Two approaches are listed below.

- Buying semi-load quantities of individual by-product feeds can be feasible on larger dairy farms because it can be fed up in a timely period (less than 60 days). The following commodity feeds and storage needs can be considered.
  - Storage of processed hay
  - Storage of energy feed (hominy, corn, or barley)
  - Storage of an oil/fat (fuzzy cottonseed or roasted soybeans)
  - Storage of fibrous feed (soy hulls or citrus pulp)
  - Storage of micro-nutrient blend (mineral-vitamin-additive mixture)
  - Storage of a protein blend or feed

  Vertical storage bins with auger can improve mixing accuracy and minimize shrink losses. Inside storage also lowers shrink loss and comfort for the feeder. Outside flat storage protected from the weather and wind losses should be considered to minimize shrink.
- Buy a commercial blend of by-products along with mineral and vitamins and protein sources because semi-load quantities are difficult to store and payment is required when delivered. Larger herds also find this approach appealing IF the company or cooperative is willing to price the blended feed competitively. This approach can be a win-win situation for both businesses.
  - The supplier may strategically purchase by-product feeds as they can lock in large quantities when a by-product feed is at an optimal price (for example fuzzy cottonseed in October and November). Existing storage, mixing, labor, and transportation unit can be used effectively by the feed company or cooperative.
  - The dairy manager can have better control on mixing and feeding losses as only one blended feed is added to the TMR instead of 3 to 7 individual feeds.

By-Product Management

Cornell workers developed a list of questions that dairy managers should consider when deciding if using by-product feeds are “good” choices for their farms.

1. What guarantees of quality and composition will be provided for the feed from the supplier?
2. What range in nutrient value can be expected?
3. What additional supplements will be needed and how will smaller packages be handled and mixed in the TMR?
4. Is adequate storage available on the farm?
5. Will a continuous supply of this feed be available?
6. Can I contract or lock in a year long supply of the feed?
7. Does the farm have mixing, weighing, and handling equipment to accurately use this feed?
8. Who will formulate the ration?
9. How long can the feed be stored on the farm while maintaining quality?
10. Should vertical, horizontal, indoor, or outside storage be considered?
11. Will additional labor or management time by needed?
12. If a quality issue occurs, who do I talk to and how will it be addressed?
13. Who will be testing the feed for nutrient content?
14. Will someone inspect the feed before it arrives on the farm?
15. How much shrink can I expect and how much value should be discounted?

■ Feed Quality and Variation

Nutrient variation can occur with a by-product feed based on the level of nutrients in the base feed ingredient, processing plant, and processing method. Table 3 lists the nutrient composition of selected by-product feeds. An important question is how does the nutritionist build in and adjust for variation. One approach is to guard against a nutrient shortage that could reduce milk production (for example, using one standard deviation below the average protein content). A second consideration is to guard against a nutrient that could cause rumen health problems (for example, one standard deviation above the average oil content). Ohio State specialists suggest formulating for 1.5 standard deviations for the nutrient in ration formulation programs.

Table 3. Nutrient composition of by-product feeds (modified from St. Pierre, 2003).

By-product	NEl/kg	RDP	RUP	NDF	Eff. NDF	Level
		----------% total DM----------				(% ration)
Bakery waste	1.87	8.1	2.3	11.8	0	5
Beet pulp	1.30	2.1	5.4	27.1	13.4	10
Blood meal	2.09	19.4	53.1	0	0	1
Brewers grain	1.56	11.5	12.0	35.2	7.4	25
Cottonseed, fuzzy	1.73	16.3	3.9	20	45.3	10
Distillers grain, corn	1.78	13.2	10.9	33.6	1.4	10-20
Fishmeal	2.07	21.4	37.0	0	0	2
Hominy	1.68	7.25	2.96	17.0	1.7	20
Molasses, cane	1.30	3.53	0.78	0.3	0	10
Soy hulls	1.32	7.0	4.0	53.7	1.1	10
Wheat middlings	1.50	12.7	3.5	32.2	0.7	10

Feed quality reflects the wholesomeness of the feed which may change during storage. Bagging of wet brewers grain is recommended for herds that can not feed the quantity delivered in five to seven days during warm seasons. Covering with a tarp may protect the surface from rain and mold formation. Treating with a propionic acid blend can reduce mold formation.

Be aware of a by-product feed that appears too cheap. For example, fuzzy cottonseed is normally selling for $280 a ton, but an opportunity for $210 a ton is available. Should you buy it? What questions should you ask? Why is the feed discounted?

■ Corn Distillers Grain Update

Corn distillers grain will continue to be available and represent “good buys” for dairy managers and feed consultants. With continued effort to market

distillers grains, ethanol plant managers are refining their methods by extracting more starch for ethanol production. Another approach is to evaluate the corn by-products to determine if more value can be derived while providing feeds that can fit in modern dairy rations at higher levels. Table 4 lists several potential new products including corn germ, corn bran, modified corn gluten meal, and modified dried distillers grain (DDG) with "typical" DDG listed for comparison.

Table 4. Nutrient profile of corn grain by-products.

	Germ	Bran	Gluten meal	Modified DDG	"Typical" DDG
	----------% as fed basis----------				
Crude Protein	17	10	45	30	27
Fat	45	2	3	3	9 – 15
Fiber	6	17	4	8	8
Starch	8	6	2	4	Na
Ash	2	1	4	2.5	4.4

Corn germ could be a premium product that may be sold to corn oil processors. It contains a significant amount of phosphorous. Bio-diesel could be an alternative use for the corn oil.

Corn bran is a feed that ruminants could ferment and digest (similar to citrus or beet pulp). For dairy producers, this product could be used to replace lower quality forages, soy hulls, and/or dilute starch found in corn silage based dairy rations.

Modified corn gluten meal is more applicable as swine and poultry feed (source of pigmentation). The energy content is similar to high protein soybean meal, but does not contain higher fiber content that is important for swine and poultry rations.

Modified DDG would be similar to typical DDG, but it is lower in oil that can cause rumen fermentation challenges and lower milk fat test. For dairy managers, this product may allow for higher levels of inclusion of modified DDG compared to "typical" DDG.

As modified ethanol production plants come on-line, dairy and beef managers

will need to carefully consider which corn by-products are available, the break-even prices of each product, and strategy to balance rations with corn products used. New corn co-products will be a valuable tool for dairy nutritionists and managers for the following reasons: lower levels of oil will allow higher inclusion levels, less phosphorous may allow higher manure application rates and avoid high soil levels of phosphorous, and they can be a source of digestible fiber that is lower in protein compared to "typical" DDG.

Summary

Canadian applications may include more grass and small grain (barley) silages compared to Illinois corn silage based rations. When looking at pricing by-products, barley grain would be the energy base of choice and canola meal for the base protein source. Selecting by-products and levels will be different than the Illinois situations. By-products must be carefully considered when building rations in the future as a way to reduce feed costs and maintain rumen health and production. NDF sources from by-products can allow total ration NDF rations over 34 percent as these non-fiber NDF sources do not have the limitations of slower rates of passage and fill factors associated with forage NDF.

Selected References

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