

# Controlling Feed Costs Over the Long Haul

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After several years of relatively cheap grain prices, corn and soybean prices have increased significantly. The increase is primarily due to greater demand for corn and soybeans to produce ethanol and biodiesel. Most economists suggest that these higher prices will be with us for the foreseeable future. Since other feedstuffs are typically priced to reflect the corn and soybean market, the cost of almost all feed ingredients has increased.

Since feed is the largest single cost in producing milk, most producers review their feeding program to see if there are ways to reduce these costs. Any changes made to rations should only occur after a thorough review of the feeding program and must take into account the impact a change could have on other aspects of the overall operation. This paper will review factors that affect feed cost, methods for determining the value of byproduct feeds, review issues related to using byproduct feeds, and provide some suggestions for dealing with feed cost over the long haul.

## ***Factors that affect feed cost:***

Rations are formulated based on animal requirements and the quality of feeds available. In regards to animal requirements, higher producing cows have lower feed cost per cwt. This is because maintenance requirements, the amount of feed required to maintain basic body functions, are diluted by higher levels of milk production. Because of this, it is still more profitable to feed for high levels of milk production even when feed costs are high. The key is to use a realistic level of production for formulating rations.

Forage quality is one of the biggest factors affecting total feed cost. As forage quality increases, less concentrate is required to provide the additional nutrients needed to support maintenance, milk production, reproduction, and health. Considerable advances have been made by seed companies as they work to identify hybrids that not only yield well, but are more digestible so that the cow can obtain more metabolizable energy in support of milk production. We also have a better understanding of the importance of timely harvest and forage processing to get the most out of our forage. Research has also demonstrated the importance of managing the forage during storage and feed out to prevent secondary fermentation of silage or deterioration of hay once it has been baled.

The factor most of producers watch and talk about the most is the cost of supplements, especially corn as it and soybean meal are used to establish the price for most ingredients.

Fortunately there are a variety of feedstuffs available that can supply energy and protein in rations for dairy cows besides corn grain and soybean meal. The list of possibilities includes traditional grains and protein supplements as well as numerous byproducts from the production of food, fiber or fuel. There are also other unusual byproducts available in some areas that can be fed if the producer is set up to handle those ingredients. The initial attraction of byproduct feeds is their lower cost, but there are other factors to consider in addition to cost.

Most producers feed one or more additives which increases feed cost. Several additives have research data to validate their usefulness and document their potential to improve production or health. These additives when used according to directions provide a good return on investment and should be continued. However there are additives on the market that do not have unbiased information to support their potential usefulness. Often these products are included in the ration because they may help solve a problem. The use of these additives should be critically reviewed as to their need and usefulness as they add to the cost of production and may not provide any return. No product, with or without research documentation, should not be used as a band-aid for poor management. The same is true for certain ingredients as well. Remember:

- There are no magic bullets.
- If it sounds too good to be true, it probably is.
- No product can change the laws of science.

### ***Determining the cost of feed ingredients:***

There are several methods for comparing the prices of byproduct feeds. Many ration formulation programs calculate the value of each feed ingredient based on the nutrient requirements of the diet and the nutrients available from ingredients offered. This method provides specific information for that particular situation, but most producers do not have the software to perform these calculations.

More commonly, producers use programs specifically designed to compare the value of several feeds compared to a reference feed such as corn and soybean meal. One program that is commonly used is the FEEDVAL program available from the University of Wisconsin (<http://www.wisc.edu/dysci/uwex/nutritn/spreadsheets/FEEDVAL-Comparative.xls>). This program calculates the value (\$/ton) based on the dry matter (DM), crude protein (CP), total digestible nutrients (TDN), calcium (Ca), and phosphorus (P) contents of each feed compared with the test feeds (shelled corn, 48% CP soybean meal, limestone, and dicalcium phosphate). The nutrient composition of the feeds can be changed to match the products available in your area as well as the percentage feed loss. The values for forages are expressed on a dry matter basis whereas all other ingredient values are expressed on an as fed basis. A second version of this program (FEEDVAL4) is available that calculates the value of feeds based on undegradable

and degradable protein, TDN, fat, Ca, and P content using blood meal, urea, tallow, shelled corn, limestone, and dicalcium phosphate as reference feeds. Both programs allow the user to compare a wide variety of feedstuffs based on their primary nutrient content. The program can also be used to determine the feeding value of home-grown feedstuffs. There are other similar programs available as well as similar functions in many of the ration formulation programs available today.

As an example, market prices for select byproduct feeds obtained from dealers in the South Georgia market during late January were compared with the results from FEEDVAL using corn and soybean meal prices for the same market and time (Table 1). The calculated value of most feeds relative to corn and soybean meal were favorable except for cottonseed hulls and urea. Some of these byproducts offer greater saving potential (whole cottonseed and cottonseed meal) than others. The choice of which byproduct(s) you choose to examine in more detail depends on nutrients needed to compliment home-grown feeds.

**Table 1. Values (\$/ton) of select feed ingredients using FEEDVAL compared with current market prices<sup>1</sup>.**

Ingredient	Market price	Calculated value <sup>2</sup>	Difference, Calculated - market
Corn, high moisture ear	100 <sup>3</sup>	121	21
Corn gluten feed, dry	135	192	57
Cottonseed, whole	135	221	86
Cottonseed hulls	165	89	-76
Cottonseed meal	160	221	61
Distillers grains, dried	180	201	21
Hominy feed	155	171	16
Soy hulls	120	164	44
Wheat middlings	155	190	35
Urea	450	422	-28

<sup>1</sup>Reference feed cost used for this example were: \$4.65/bu for corn; \$240/ton for soybean meal, 48% CP; \$7.00/cwt for limestone; and \$27.00/cwt for dicalcium phosphate.

<sup>2</sup>The calculated price is based on the default nutrient content of the ingredients with 0% feed lost.

<sup>3</sup>Price estimated on input cost

These programs do not take into account the effect of nutrient balance in the final ration. Producers should compare similar types of ingredients when selecting those that they will

ultimately use. If you are not sure how a particular ingredient would fit into your ration, be sure and consult your nutritionist before you purchase any new ingredient. Most nutritionists keep up with ingredient cost and can provide a considerable amount of help when looking at any new ingredient.

There are several listing of ingredient prices that can be accessed by the internet including the University of Missouri site (<http://agebb.missouri.edu/dairy/byprod/>). These sites are good for information, but you will need to contact a broker to get a delivered price to your farm.

The true cost of a feed ingredient may be different from what we initially paid. Table 2 outlines some of the items that should be taken into account to determine the true cost of individual feeds. There are additional delivery costs for byproduct feeds that may not be included in the initial quote. If you must receive a semi-load of feed that will be fed over an extended time, you should include an interest cost on the money tied up in inventory. Shrinkage varies from 3 to 7% for dry ingredients to 15 to 35% for wet ingredients. Sometimes special storage or handling is required compared using a complete feed and these costs should be taken into account. The major cost in this analysis is typically shrinkage and delivery cost when the feed is used in a normal time frame.

### **Nutrient form and balance:**

Most feedstuffs provide a combination of nutrients but are classified according to the primary nutrient provided. In most situations it is desirable to include a mix of feedstuffs in the ration to help provide a more desirable balance of nutrients to optimize ruminal fermentation and health. For example, high-fiber energy supplements are useful for reducing the starch concentration of rations based on corn silage and supplemented ground corn. For diets containing high quality legume silage or high protein grass silage, protein supplements that contain rapidly degraded protein would not be desirable. However, there are other situations in which the use of urea or another source of degradable protein should be fed even though it may not be the least expensive protein source compared with soybean meal.

When byproducts are included in rations, we must be aware of the amount of phosphorus these ingredients add to the ration. With greater attention on nutrient runoff and its negative effect on the environment, we must consider the impact of overfeeding phosphorus and other nutrients on the long term aspects of whole farm nutrient balance. Several byproducts have relative high levels of phosphorus which is one of the primary concerns. If multiple feeds with higher than average concentrations of phosphorus are fed, the phosphorus content of the ration will be well above that NRC (2001) recommendations. The long term impact may be a limitation

**Table 2. Calculating the true cost of feed ingredients.**

Price delivered to the farm	_____ tons @ \$_____/ton	\$ _____
Interest	_____ % for _____ months	_____
Shrinkage and storage losses	_____ %	_____
Extra handling cost	_____ Hr @ \$_____/Hr	_____
Total cost		_____
Divide total cost by _____ tons		
Total cost per ton		\$ _____

Note: Shrinkage for dry ingredients varies from 3 to 5% whereas shrinkage for wet ingredients varies from 15 to 30%.

in the amount of manure that can be applied to your land which could reduce any future expansion plans with the purchase of additional land.

### ***Nutrient variation:***

When producers make the decision to use a byproduct, they also assume responsibility for quality control of that ingredient. Variation in the nutrient content of byproduct feeds occurs because of differences in the variety of grain used for processing, fertility of soil the crop was grown on, processing method used by the plant to extract the primary products, blending of multiple by-products together by the manufacturing plant, and storage conditions. The results of a study examining the variation in nutrient content of by-product feeds available to California dairy producers are summarized in Table 3 (DePeters et al., 2000). The variation in the nutrient concentration in a feed is reported as the coefficient of variation (CV) and is expressed as a percent. The lower the CV, the less variation there is for that nutrient. The amount of variation is normally higher for minerals than other nutrients. The expected variation for some byproducts is greater because of the different types of processing in the industry. For example greater variation is observed in fiber, and fat concentrations of hominy feed than any of the other ingredients listed reflecting the differences in processing methods used by processors in the industry.

The variation in nutrient content of a by-product is typically much higher for the industry compared with that from a single source. This is illustrated for wet brewers grains in Table 4. The data represent 192 samples of wet brewers grains from around the United States submitted to

a commercial laboratory and samples we collected during a research trial from one plant

**Table 3. Variation in the nutrient content of select by-product feeds.**

		CP <sup>1</sup>	UCP	ADF	NDF	EE	Ca	P	Mg	K
WBG <sup>2</sup>	Avg <sup>3</sup>	27.0	2.7	18.0	37.3	6.3	0.24	0.65	0.27	0.26
	Min	24.2	1.6	15.8	33.0	5.7	0.19	0.59	0.25	0.19
	Max	30.6	3.6	20.5	43.6	6.9	0.28	0.76	0.32	0.34
	CV	8.3	24.4	10.6	9.2	6.5	11.03	8.69	8.11	20.02
CGF	Avg	22.9	0.8	12.5	38.8	3.4	0.03	0.84	0.36	1.24
	Min	19.4	0.4	10.7	31.5	2.9	0.02	0.63	0.28	0.95
	Max	33.4	1.9	13.9	44.4	4.4	0.03	1.04	0.46	1.66
	CV	18.7	57.4	8.0	9.9	13.0	19.86	13.93	14.95	16.17
DDG	Avg	31.2	9.4	20.3	35.6	13.0	0.07	0.80	0.02	1.01
	Min	30.4	5.7	11.3	26.5	11.7	0.06	0.77	0.33	0.93
	Max	32.3	12.8	25.1	45.1	15.7	0.07	0.85	0.39	1.10
	CV	2.0	32.4	29.1	23.0	10.2	7.21	3.57	5.36	5.31
H	Avg	11.0	0.9	6.9	19.8	6.5	0.02	0.61	0.24	0.72
	Min	10.1	0.5	4.8	15.8	5.6	0.01	0.46	0.19	0.55
	Max	11.7	1.3	9.9	24.8	8.1	0.06	0.71	0.27	0.84
	CV	5.8	28.2	22.1	15.3	12.3	63.56	13.02	11.58	13.99
SH	Avg	11.8	1.3	46.6	64.4	2.5	0.60	0.13	0.25	1.32
	Min	10.8	1.0	40.4	57.3	1.2	0.18	0.04	0.07	0.35
	Max	14.2	1.6	49.9	71.6	3.7	0.73	0.19	0.29	1.60
	CV	9.8	12.7	6.2	5.9	35.7	25.60	29.99	26.06	26.62

<sup>1</sup>CP = crude protein; UCP = unavailable crude protein; ADF = acid detergent fiber; NDF = neutral detergent fiber; EE = ether extract; Ca = calcium; P = phosphorus; Mg = magnesium; and K = potassium.

<sup>2</sup>WBG = wet brewers grain; CGF = corn gluten feed; DDG = distillers dried grains; H = hominy; and SH = soybean hulls.

<sup>3</sup>Avg = average; Min = minimum; Max = maximum; and CV = coefficient of variation.

Source: DePeters et al. 2000. Prof. Anim Sci. 16:69-99.

analyzed by the same laboratory. Each brewery produces different types of beer which requires different ingredients to provide the unique properties for each beverage, resulting in high CV for all nutrients. In contrast, the variation in the nutrient content of wet brewers grain from a single brewery is typically much lower.

Processing methods used by manufacturers have changed greatly during the last decade. These changes allow the processor to more effectively remove the primary product (starch, oil, etc.) producing by-products that have a different nutrient profile than that listed in many references. For example, the processing methods used to produce ethanol have changed greatly which produce distillers' dried grains with solubles (DDGS) with a different nutrient content than previously available. The degree of change and the variation associated with DDGS is outlined in Table 5. The nutrient profile listed by the Distillers Grains Technology Council is similar to that published by NRC (1989) but differs from the information published by NRC (2001) in the latest edition. The University of Minnesota recently analyzed samples from 31 plants in the Mid-West (Anonymous, 2005). The results of this survey differ from the traditional book values reported by NRC (1989 and 2001) illustrating the variation in the nutrient content of DDGS that is present in the industry. Part of this variation is due to "new generation" plants that have come on line in the past few years that produce DDGS that are reported to have higher nutrient value than DDGS produced by older, more traditional ethanol plants.

Processing technology is constantly being refined to improve the extraction of primary ingredients. Researchers are also looking at ways to decrease the amount of nutrients such as phosphorus in by-products so that their use in animal feeds will improve whole farm nutrient balance and maintain water quality. Some processing technology being developed will allow the production of custom by-products for feeding in the near future which will be advantageous for dairy producers. For these reasons, producers should sample each feedstuffs on a regular schedule to keep track of the variation and any change in nutrient content that may impact the nutrient content of the diet.

### ***Quality Issues:***

Another aspect of quality control is safeguarding against potential contaminants in the byproduct feeds. Normally the raw materials used for manufacturing food are screened for mycotoxins and other potentially harmful contaminants before use and the byproducts are safe for animal consumption as long as they are handled properly after they leave the plant. There have been a limited number of cases in the past where byproducts from non-food industry sources were contaminated resulting in either the death of numerous animals or condemnation of the animals. Producers should ask about the quality control measures used by the manufacture to safeguard against contamination of the byproduct with mycotoxins or other harmful compounds.

**Table 4. Variation in the nutrient content of wet brewers grain (DM basis).**

Ingredient	DM <sup>1</sup> %	CP %	ADF %	NDF %	EE %	Ca %	P %	K %
Multiple sources, n = 192								
Avg <sup>2</sup>	25.45	32.38	23.27	46.25	9.17	0.32	0.60	0.14
Min	11.91	19.94	15.92	9.21	4.17	0.12	0.17	0.01
Max	44.87	44.87	33.63	60.34	11.43	0.79	0.81	0.41
CV	13.74	13.74	11.30	11.37	13.49	32.56	13.30	41.69
Single source, n = 6								
Avg	23.10	30.67	25.29	47.35		0.16	0.52	0.99
Min	22.10	29.90	24.67	43.34		0.15	0.47	0.94
Max	23.76	32.28	25.78	49.65		0.17	0.58	1.05
CV	2.66	2.89	1.47	4.72		8.18	4.21	5.22

<sup>1</sup>DM = dry matter; CP = crude protein; ADF = acid detergent fiber; NDF = neutral detergent fiber; EE = ether extract; Ca = calcium; P = phosphorus; and K = potassium.

<sup>2</sup>Avg = average; Min = minimum; Max = maximum; and CV = coefficient of variation.

As the production of biofuels increases, there may be situations where treated seed or fermentation products from other industries are used to make ethanol or biodiesel. The byproducts from these products could potentially be fatal to the animals consuming them.

Occasionally, there are “unusual” byproducts that may become available for use. Some examples include candy, cocoa byproduct, fruit pomace, fresh vegetables or fruits, vegetable residues or other products that are not typically fed. In some cases, there isn't any information available on the nutrient content of these feeds and the producer must run analysis before they can be included in a ration. Many of these products have handling issues (ex, individually wrapped pieces of candy) but other products may have some compounds, either natural or added during processing that would limit their use. In these cases, the producer should seek the assistance of a nutritionist with experience in this area.

### ***Energy supplements other than corn grain:***

Either you have already looked at replacing some or all of the corn in the diet or you will in the near future. Corn is fed primarily as a source of fermentable energy. The energy is primarily in the form of starch which is digested at varying rates depending on how finely it has been

**Table 5. Variation in the nutrient content of distillers grains with solubles (DM basis).**

Ingredient		DM <sup>1</sup>	CP	ADF	NDF	Fat	Ca	P	K
		%	%	%	%	%	%	%	%
NRC, 1989	Avg	92.0	25.0	18.0	44.0	10.3	0.15	0.71	0.44
NRC, 2001	Avg	90.2	29.7	19.7	38.8	10.0	0.22	0.83	1.10
Distillers Grains Technology Council									
	Avg	91.0	27.0	18.0	44.0	9.0	0.16	0.75	0.70
Midwest plants, n = 31									
	Avg <sup>2</sup>	89.22	30.90	13.81		10.72	0.07	0.76	1.00
	Min	86.22	28.33	8.03		3.52	0.02	0.42	0.45
	Max	92.40	33.74	20.95		12.83	0.51	0.99	1.33
	CV	1.69	4.67	23.08		16.38	116.54	18.16	21.55

<sup>1</sup>DM = dry matter; CP = crude protein; ADF = acid detergent fiber; NDF = neutral detergent fiber; EE = ether extract; Ca = calcium; P = phosphorus; and K = potassium.

<sup>2</sup>Avg = average; Min = minimum; Max = maximum; and CV = coefficient of variation.

Source Anonymous. 2005. <http://www.ddgs.umn.edu>.

ground or how it has been processed. There are several byproducts that can be used to partially replace corn grain in the diets. Some of the primary byproducts to consider include hominy feed, soybean hulls, bakery byproduct, citrus pulp, molasses, wheat middlings, brewers grain, corn gluten feed, or distillers grain. The energy in many of these byproducts is primarily in the form of digestible fiber, but some byproducts contain processed carbohydrates or sugar in the case of bakery byproduct and molasses which should be handled differently in the ration. Hominy can have more starch than most of the other products, but there is considerable variation among sources.

Another source of energy is to feed more fat from sources such as whole cottonseed, whole soybeans, tallow, animal-vegetable blends, or inert fat supplements. When multiple products that contain higher concentrations of fat are fed, the total amount of fat in the diet must be limited to avoid any negative effects on fiber digestion, animal health, and milk fat depression. Considerable research has been conducted on each of these and each has advantages and disadvantages. The amount of corn that can be replaced by one or more of these byproducts

depends on the quality and type of forage fed, production level, and feeding system constraints.

Distiller's grains have received a lot of press recently because this is the primary byproduct from the production of ethanol. As pointed out previously, there is a good deal of variation in the nutrient content of distiller's grains. Some plants have taken extra steps to produce a more consistent product and typically collect a premium for their distiller's grains. Research has demonstrated that distiller's grains can provide up to 40% of the total ration DM, but this is not practical for most dairies. Besides containing relatively high concentrations of fat, distiller's grains also contain high levels of phosphorus. Like other byproduct feeds that contain higher concentrations of phosphorus, high feed rates increase the amount of phosphorus in the manure which builds up in the soil. The long term implications include lower application rates of manure to land and limitations on herd expansion without purchasing additional land.

### ***Suggestions for dealing with higher feed cost:***

It is important to review all aspects of your feeding program from time to time, independent of feed prices. This review should address several questions including: what are the primary weaknesses of the current feeding program? Often the primary weakness is related to forage quality, feed bunk management, or some other aspect that is preventing your cows from being as productive as possible rather than the ration formulation. If cow comfort is not as good as it should be, the cows will not respond completely to any change in the feeding program. The same is true for all of the little things that should be done to make sure that each cow has feed when she is ready to eat, cows have plenty of bunk space, unrestricted access to water, waters are cleaned each week, and there is a good preventative health program in place.

The DM content of any wet feeds (silage or wet byproducts) should be measured routinely and rations adjusted as needed. This will reduce some of the variation in the nutrient content of the final ration and keep cows on a more consistent diet.

Sample forages and other home grown feed and have them analyzed. Use the analysis to fine tune your rations. Home-grown forages commonly have greater variation than purchased feeds, so it is very important to sample and analyze frequently. Fine tuning the ration can make a difference not only in milk production, but the amount of purchased feed needed and total feed cost.

Review mixing procedures and information used for mixing rations with the feeder to make sure that the rations mixed are the same as those formulated. A misplaced decimal or transposed number can be very costly in both feed cost and lost production. Too often the feeder doesn't understand (or forgets) the importance of adding the correct amount of each ingredient and the impact of a mistake on cow health and production or the bottom line.

Manage feed bunks to optimize intake. Old feed should be removed each day to prevent spoilage of new feed and encourage consumption. Feed should be pushed up several times a day

so cows have access at all times. Provide adequate bunk space for each cow. Normal recommendations are for a minimum of two linear ft. per cow and more for fresh cows. Adjust feeding amounts to minimize refusals. Normal recommendations are for 3 to 5% depending on how well you can time feed delivery. If feed refusals are primarily the fractions that are sorted out by the cow, the amount of feed offered probably should be increased and there are opportunities for improving feed mixing and processing.

Monitor dairy efficiency, the pounds of milk produced for each pound of DM consumed, is a good tool to help evaluate the effectiveness of a ration and economics. High producing cows should have a dairy efficiency greater than 1.6 whereas the majority of the herd should average 1.5. Dairy efficiency is lower for late lactation cows and during heat stress. Supplemental cooling should be optimized to maintain production and dairy efficiency.

Establishing production groups, when possible, allows different rations to be formulated according to need reducing total feed cost. It may be enlightening to determine the value of the milk produced by each cow, either current daily milk or lactation average, and compare that with the current feed cost to see which cows are profitable. The production data can be retrieved easily using PCDART and exported to a spreadsheet program.

### ***Summary***

As we look for ways of controlling feed cost in light of increasing corn and feed prices, it is important to remember the basics factors that contribute to total feed cost. A careful analysis of the total feeding program that includes forage quality, availability and cost of byproduct feeds, feeding management, and cow comfort should be conducted routinely to determine where cost can be trimmed and feed utilization can be improved. Given the current push for developing alternative fuels from corn and soybeans, producers must fine tune their feeding management to maintain profitability.

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