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G90-978 Byproduct Feedstuffs for Beef and Dairy Cattle

Don J. Kubik
University of Nebraska-Lincoln, atoyluv@yahoo.com

Rick Stock
University of Nebraska - Lincoln, rstock3@Unl.edu

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Byproduct Feedstuffs for Beef and Dairy Cattle

This NebGuide details the type of byproduct feedstuffs available for beef and dairy cattle, a description of their characteristics and discussion of their nutrient value.

Don Kubik, Extension Dairy Specialist
Rick Stock, Extension Feedlot Specialist

Byproduct feeds have become a stabilizing factor in the economic success of many beef and dairy operations. Byproduct feeds are the residue that remains after feeds have been processed. The processing of soybeans into soybean meal results in a large supply of soybean hulls. Processing corn into high fructose syrup provides corn gluten feed and corn bran. Converting corn starch into ethanol provides distillers grains. Hominy, a byproduct of processing corn starch for human consumption, is another byproduct feed.

The brewery industry provides wet and dry brewers grains, while the cotton and rice industries produce whole cottonseeds and rice bran. The wheat milling industry, located predominantly in western Missouri, Kansas and Nebraska, produces wheat midds, another good byproduct feed.

Soybean Hulls

During soybean processing, the whole soybean is rolled or flaked, which removes the soybean hull. An airstream separates the hulls from the seeds, and the seeds are extracted with hexane to remove oil, leaving high protein material (48 percent protein). The hulls are toasted and finely ground to increase their density for more economical transportation and to aid in blending to produce 44 percent soybean meal. The 44 percent soybean meal is most often used in dairy and beef diets while the 48 percent meal is used primarily in swine and poultry diets.

The soybean hull is high in fiber (73 percent) and low in protein (9.4 percent) (*Table I*). The protein is highly degradable, while the cell wall is low in lignin and highly digestible. Ground hulls are often sold as soy mill feed. This feed contains some meal so the protein content may equal 12 to 14 percent. Very fine meal in the mill feed is dusty. In at least one case, it appeared to produce a respiratory problem when fed to beef cows without pelleting or blending with molasses or a moist feed.

Soyhulls flow well and can be handled easily with augers and bins (*Table II*). Using soyhulls in energy-dense dairy diets, especially high starch diets, may improve animal performance because their buffering effect in the rumen can reduce acidosis. Recent Nebraska research suggests that when feeding high producing dairy cows, up to 50 percent of the corn portion of corn-alfalfa diets could be replaced with soyhulls without lowering the ration's energy value. The hulls minimized the depression in digestibility often observed with high starch diets.

The low density of hulls requires that more time be allowed for dairy cows to consume them in a parlor feeding system, if more than five to six pounds are fed per cow per day (*Table II*). By blending them into total mixed rations, cows can be fed up to eight to ten pounds a day.

With beef cattle, the best use of soyhulls is as a supplement to forage in growing rations. There were no significant differences in daily gain or feed efficiency when a forage ration consisting of equal proportions of corn stalklage, brome hay and corn cobs was supplemented with either 25 percent or 50 percent corn or soyhulls. Soyhulls tended to have higher feed conversions at the 50 percent level. These data suggest that soyhulls are an excellent energy supplement for wintering calves on hay. In many cases, the supplement is fed separately from hay. In winter and summer grazing situations, 3 pounds of soyhulls have provided similar or higher gains than corn. Overconsumption by calves would not be a concern with soyhull feeding, but it would be with grains.

Distillers Grains

Distillers grains are byproducts of when grains are fermented into alcohol. The spent grains are dried and sold as feed. Solubles left over from fermentation usually are added to the distillers grains (DDG) before drying, resulting in a product called distillers dried grains with solubles (DDGS), the most common commercial product. Distillers grains are identified by the type of grain from which they are made, i.e. corn distillers, milo distillers, or other grains (wheat or rye). Corn distillers grains have been more constant in quality and are most highly recommended for dairy cattle. Distillers grains contain 25 percent to 30 percent crude protein and 8 percent and 12 percent fat (*Table I*). Drying decreases protein degradabililty and increases bypass protein value. Bypass protein is the protein that escapes digestion in the rumen. This protein is subsequently digested in the intestinal tract. Protein degraded in the rumen has a similar value as urea. Soybean meal is only 25 percent to 30 percent bypassed whereas distillers grains is 50 percent to 60 percent bypassed. Solubles have no bypass value. Distillers grains are high in phosphorus and potassium and low in calcium. Some additional characteristics are low starch, highly digestible fiber and high fat, thus they are high in energy.

Even though the energy value of distillers grains is high, the economic value is at least twice as much when used as a protein source. This is because protein sources are more valuable than energy sources. When distillers grains are fed as an energy source, the grains are under utilized.

Distillers grains can be substituted for about half the concentrate or a maximum of 10 to 12 pounds per cow per day (*Table II*). Feeding distillers grains in a computer feeder or by top dressing are two good strategies. We have observed that substituting a significant proportion of distillers grains for corn often results in increased milk yield, reduced acidosis and improved rumination in high producing cows.

The best use of distillers grains with beef cattle is as a protein source for young, growing animals. Based on bypass values, an appropriate mixture of distillers grains and distillers dried grains with solubles and urea would be equal in feeding value to soybean meal. Usually either of the distillers grains mixtures cost less than soybean meal.

With feedlot cattle, the energy value of distillers grains or distillers dried grains with solubles is equal to or slightly superior to corn grain. Distillers grains contain highly digestible fiber. The protein is partially protected from ruminal breakdown. There is three times as much fat as in corn.

Corn Gluten Feed

Corn gluten feed (CGF) is a product of the corn wet milling industry, which produces high fructose corn syrup. Corn gluten feed is relatively high in protein (20-22 percent), moderately high in fiber (16-18 percent acid detergent fiber) and moderate in energy (net energy for lactation = .87 Mcal/lb). It is low in starch because most of the starch is converted enzymatically to syrup glucose, fructose and dextrose. The left-over product is a good substitute for high corn diets. Corn gluten feed can be obtained in meal form (dry or wet) or in pelleted form. The pelleted form (1/4" pellet) is best for handling and transporting and blends well into mixed diets. Corn gluten feed is high in phosphorus and low in potassium and calcium (*Table I*). Cattle may adapt slowly when first offered it, but will be up to full feed within two to three days.

Corn gluten feed is especially good blended into mixed diets for high producing dairy cows because the starch content of the total diet can be decreased. When substituted in significant quantities for corn, ruminal acidosis, off-feed and diarrhea decreased while rumination and milk yield increased in high-producing cows.

In cattle growth trials, corn gluten feed protein was more degradable (20 percent bypass) than soybean meal. Because less corn gluten feed protein escapes ruminal digestion, performance of growing calves may be reduced compared to calves fed soybean meal.

As an energy source in roughage rations, corn gluten feed provided similar gains and feed efficiencies as corn grain. In high-grain finishing diets, dry corn gluten feed reduced feed efficiency 5 percent to 15 percent. It should not be fed at levels exceeding 25 percent of diet dry matter unless its cost is very low compared to corn grain.

Corn Bran

Corn bran is the fibrous component of corn gluten feed. Sometimes the bran is not blended with steep liquor to make corn gluten feed and is sold separately. As mentioned above, the fiber is highly digestible. Corn bran is an excellent energy supplement to high roughage rations. Results with corn bran are similar to those with soyhulls.

Brewers Grains

Brewers grains (BG) are a byproduct of the beer malting industry. They are spent grains and usually are mostly barley, although there may be some corn and/or rice depending on the processor.

Brewers grains are high in protein (25 to 30 percent of dry matter) and fiber (*Table II*). When dried, the protein is slow to degrade, adding to its protein bypass value. Brewers grains are low in calcium and potassium and usually require supplementation. Storage life of wet brewers grains is 7 to 10 days in summer and possibly more than two weeks in winter. Wet brewers grains can be stored long-term in a bunker silo if covered and sealed adequately or they can be stored in a bag silage system. Wet brewers grains can be mixed with other feedstuffs to form a moist feed with similar handling characteristics as silages.

Brewers grains can be fed to cattle in either wet or dry form. In the wet form, two moisture levels are generally available--70 percent and 80 percent moisture. Transportation costs normally limit hauling wet brewers grain more than 150 miles. Wet brewers grains are very palatable. Moisture may reduce intake so feeding is limited to 30-50 pounds per cow per day.

Dried brewers grains are also available for use in cattle rations but are not as palatable as wet brewers grains. Dried brewers grains are very bulky and do not flow easily and thus must be handled mechanically (*Table I*). Brewers grains can be fed up to 15 pounds per day for lactating cows. Because dried brewers grains are bulky, dairy cows need more time to consume a ration containing them.

With growing calves, dried brewers grains have a greater protein value than wet brewers grains. As an energy source, brewers grains are 25 percent to 30 percent lower in energy than distillers grains because the fiber in barley is not as digestible as the fiber in corn.

Hominy

Hominy is a byproduct of the dry milling industry. Hominy feed contains corn bran, germ and some of the starchy portion of the kernel. Hominy results from producing the degermed corn meal used in food production. The energy value is at least equal to that of corn because of moderate fat content (at least 6 percent). Hominy tends to be very fine but is very palatable. In the laboratory, the rate of digestion of hominy feed is faster than with corn. This is probably due to the very fine particle size. Increased incidences of acidosis were found in the feedlot when hominy was fed, thus caution must be observed. Although hominy feed is a dry product, it will bridge-up when placed in overhead bins. It should be stored in covered sheds. Suggested levels are a maximum of 12 pounds per day for high milk producers. In high-grain feedlot diets, hominy should not exceed 20 percent of the diet dry matter.

Wheat Midds and Bran

Both midds and bran are byproducts of the wheat milling industry. Midds contains less fiber, but more starch and protein than bran and subsequently is 20 percent higher in energy. Whet fiber is not as digestible as corn fiber, but the extra amount of starch enhances its energy content. Because of its fine particle size and rapid rate of digestion, acidosis may occur. Most nutritionists limit midds to a maximum of 10 percent to 20 percent of the ration dry matter. Suggested feeding level for dairy cows is a maximum of eight pounds a day (*Table II*). Midds and bran can be bought in meal form and midds can be bought in a pelleted form. Pelleting midds reduces the loss of fines.

Rice Bran

Rice bran (RB) results from the physical abrasion and separation of the hull from rice grain. The rice grain is then used for human consumption. Rice bran is produced when hull and fragments of the hull are blended with some of the germ. Rice bran contains 10 percent to 12 percent fat, 12 percent fiber and 12 percent protein (*Table I*). The high fat content may make it more susceptible to rancidity during summer storage. Rice bran is finely ground and may not flow readily; it tends to stack vertically. Rice bran blends well with other feedstuffs for mechanical handling and fits well into blended rations. Feed four to eight pounds per cow per day (*Table II*) and 10 percent to 20 percent in feedlot diets.

Whole Cottonseed

Whole cottonseeds (WCS) have the unique distinction of being very palatable, high in NEL (1.03 Mcal/lb), fat (17 percent), protein (25 percent), and fiber (29 percent acid detergent fiber) (*Table II*). Seldom are all these nutritional characteristics found in one feed.

High fiber level is desirable in maintaining normal fat test in high producing dairy cows fed high grain diets. It seems some fat escapes ruminal digestion due to its encapsulation by the seed hull and coat. When the seed is digested in the intestine, some fat is directly incorporated into the milk fat and may change milk fat composition (more plant fatty acids). Another peculiarity is that feeding cottonseeds at more than 15 percent to 20 percent of the diet may increase milk fat percent and decrease milk protein percent. Excessive whole cottonseed will decrease fiber and energy digestibility. Excess oil in the rumen depresses microbial activity.

Quality of cottonseed varies. They should be lean, free of foreign debris and white to whitish-gray in color. Good quality whole cottonseed should rattle when shook. Storing cottonseed that is too wet at harvest may result in heating and/or molding, as evidenced in a dark or black seed. This may result in heat-damaged protein and may cause lipolysis (breakdown of fat into fatty acids), both of which may lower quality. Although there is potential for aflatoxin in moldy whole cottonseed, we have not detected it nor have we observed any animal symptoms to confirm its presence. Whole cottonseed is very palatable and can be fed in blended rations or manually. One disadvantage is physical form--they are very bulky and do not flow in mechanical systems. Whole cottonseed must be handled manually with a shovel, bucket or front-end loader.

Whole cottonseed should be fed at a maximum of six to eight pounds per cow per day (*Table II*). With growing and finishing cattle, whole cottonseeds should be fed at a level (about 10 percent) which meets the cattle's protein requirement. There is little advantage to feeding higher levels.

Beet Pulp

Beet pulp is a byproduct of the beet-sugar industry. Beet pulp may be fed wet (80 percent moisture), dried or combined with molasses and dried. These feeds are palatable, bulky and slightly laxative. The high moisture content of wet beet pulp may limit feed intake, so it should be fed with dry forage or grain. Beet pulp is high in fiber and calcium, but low in protein, fat and phosphorus. The fiber in beet pulp is highly digestible; thus, it is a viable option as an energy supplement to cows and growing calves. In high-grain diets, the energy content is too low to replace much of the grain; however, beet pulp can be used to supply the roughage portion in high-grain diets.

Cull Beans

Several types of beans are raised for human consumption. These include navy, lima, kidney, pinto and tepary beans. All of these have the same general composition. Cull beans sorted from high-quality beans

can be used in cattle operations. These beans include discolored, shrunken and broken beans and also may contain bean stems, small rocks and dirt. Unlike cottonseeds and soybeans, cull beans are low in fat and higher in fiber. Cull beans should be limited to 10 percent to 20 percent of the ration dry matter.

Grain Screenings

Grain screens are highly variable and may contain various proportions of small whole grain kernels, cracked grain, grain dust, forage residue, small rocks, dirt and metal. Particle size of the screened grain may be a problem and should be closely monitored. In many instances, the grain screenings are 95 percent grain and very economical. The smaller the particle size, the greater the risk of acidosis. Grain screens should be limited to a maximum of 50 percent in growing diets and 25 percent to 30 percent in finishing diets.

Using Byproduct Feedstuffs in Dairy Diets

We often recommend using byproduct feedstuffs in dairy diets to remedy certain nutritional problems. One problem is low forage quality. Low quality forages are high in fiber, which limits intake. If cows are fed grain twice a day in the parlor, grain intake is limited to 15-20 pounds a day. Milk production often stays at about 40-45 pounds a cow. In some cases, cows may be fed grain in the parlor or outside. Grain consumption may be high relative to forage (70 percent concentrate or more) causing cows to peak at low production levels and to not be persistent in yield. Sometimes dairymen will feed pelleted concentrates to increase grain intake, which usually aggravates the situation. Too much grain and/or pellets can depress milk fat percentages, because starch content is too high and acidosis occurs.

Another problem (almost the opposite of low forage quality) occurs when cows consume diets high in solubles and low in fiber, such as with corn silage or very high quality legume silages. Milk yield may be high but not quite where it should be. Cows may have diarrhea, off-feed and fluctuating milk yields. Acidosis is the major problem here and digestion is not as efficient as it could be.

Conclusion

There are no miracles or wonder feeds. One must consider basics--amount of feed, feed quality, genetic ability of the cow to eat and produce milk, management strategy and current feed prices. Byproduct feed can play a role in many diet formulations to provide supplemental nutrients (i.e., energy, protein, minerals, etc.). Chemical composition of many of these feeds may vary greatly, so testing is recommended.

Table I. Nutrient Composition of Byproduct Feedstuffs[1]

Feedstuff	CP[2]	Relative Bypass value[3]	NEM	NEG	NEL	TDN	NDF	ADF	Fat	Ca	P	K
	%		Mcal/cwt	Mcal/cwt	Mcal/cwt	%	%	%	%	%	%	%
Cull beans	23.0	1.0	93	64	84	83	60	40	1.2	.15	.57	1.27
Beet pulp	10.0	1.0	80	52	81	74	54	44	2.1	.69	.11	.20
Dry brewers grains	29.0	2.0	68	41	68	65	46	24	7.2	.29	.54	.10
Wet brewers												

grains	29.0	1.6	68	41	69	66	42	23	6.5	.29	.54	.10
Corn distillers grains	29.5	2.0	99	68	90	88	43	18	8.0	.10	.40	.18
Corn distillers grains plus solubles	29.5	1.5	102	70	93	90	43	18	8.4	.10	.71	.44
Milo distillers grains	33.2	1.5	92	62	86	83	43	18	9.5	.16	.76	.38
Milo distillers grains plus solubles	33.2	1.2	95	64	87	85	43	18	9.5	.16	.76	.38
Dry corn gluten feed	21.5	.8	94	60	87	77	42	10	2.4	.10	.83	1.50
Wet corn gluten feed	19.5	.8	96	67	97	85	38	14	2.4	.10	.83	1.50
Corn bran	10.0	1.0	93	64	85	83	69	30	2.0	.10	.3	.15
Hominy	11.5	1.0	107	75	97	94	55	13	7.7	.06	.58	.74
Cottonseed	24.9	1.0	109	77	104	96	39	29	23.1	.15	.73	1.2
Soybean meal	49.0	1.0	94	64	84	84	14	10	1.5	.33	.71	2.14
Soybean hulls	9.4	1.0	81	54	80	78	67	59	2.1	.45	.17	1.27
Soybean mill feed	12.0	1.0	82	55	81	79	63	47	2.7	.44	.20	1.33
Wheat bran	17.1	1.0	74	47	72	70	51	15	4.4	.12	1.32	1.39
Wheat middlings	18.7	1.0	90	61	84	85	37	11	4.9	.12	1.01	1.01
Wheat shorts	18.6	1.0	87	59	87	84	39	12	5.2	.10	.84	1.06
Rice bran	14.1	1.0	74	47	73	70	33	18	15.1	.08	1.70	1.92

[1]Dry matter basis.
[2]CP = crude protein; NEM = net energy for maintenance; NEG = net energy for gain; NEL = net energy for lactation; TDN = total digestible nutrients; NDF = neutral detergent fiber; ADF = acid detergent fiber; Ca = calcium; P = phosphorus; K = potassium.
[3]Bypass values are relative to soybean meal (30 percent bypass).

Table II. Handling, Storage and Physical Characteristics and Feeding Limits of Byproduct Feedstuffs to Dairy Cattle				
Feedstuff	**Physical Form**	**Storage**	**Handling**	**Maximum to Feed to Lactating Cow**
Soybean hulls	light and fine	storage bins, commod. shed	augers bulk loader	5-6 lb a day, fed alone 8-10 lb a day, fed in mixed ration
Dried distillers grains (DDG)	fine, granular	storage bins, commod. shed	augers bulk loader	8-12 lb a day
Corn gluten feed (CGF)	pelleted	storage bins, commod. shed	augers bulk loader	10-20 lb a day
Brewers grains (dry) (BG)	bulky light	storage bins, commod. shed	bulk loader	15 lb a day
Brewers grains (Wet)	silage-like	bulk, silo	bulk loader	30-40 lb a day
Hominy	fine dense	storage bins, commod. shed	bulk auger	10-15 lb a day
Wheat midds	bulky-meal, pelleted	commod. shed	bulk loader	6-10 lb a day
Rice bran (RB)	fine meal	commod. shed	bulk loader	4-10 lb a day
Whole cottonseed (WCS)	very bulky	commod. shed	bulk loader	5-8 lb a day

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