

By-products for Dairy Cattle

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Dairy producers often face limited supplies of forage and grain following a year when rainfall is extremely limited, as was the case in 2012, while in other years, they have faced flooding or fields simply too wet to harvest crops in a timely manner. Consequently, they often look for opportunities to utilize various by-products to stretch their available forage supplies or to substitute for corn or soybean meal. Although the list of various by-products that can be utilized in diets for dairy cattle is extensive, the list of those that are readily available in Iowa is more limited. Following is a brief description of these products with average nutrient composition values (NRC, 2001) listed in Table 1. Nutrient composition of by-products can vary so laboratory analysis is recommended. Nutrient values for more common feedstuffs are included for comparison purposes.

Beet pulp is high in pectin, which is fermented predominately to acetate and fits well in diets that are high in non-fiber carbohydrates (NFC). It can be fed wet or dry and is the residue remaining from the extraction of sugar from sugar beets.

Canola is primarily grown in Canada as it requires cooler temperatures than in many areas of the US. The seed is higher in oil (40% or more) than soybeans or cottonseed (both around 19-20%). The meal is the product remaining after the extraction of oil.

Corn distillers grains either with or without solubles are a co-product of ethanol production and are generally readily available in both wet and dry forms in Iowa. They are highly palatable and are a good source of protein and provide additional rumen undegradable protein than does soybean meal. Distillers grains can be derived from any cereal grain (barley, corn, rye, sorghum, and wheat) with the predominate grain listed as the first word in the name.

Corn gluten feed is a co-product available from processing plants that extract the starch, gluten and germ from shelled corn in a wet milling process to produce high fructose corn syrup or corn starch. It is available in both wet and dry forms, with the dry available as meal or pellets.

Cottonseed is readily available although there is no cotton grown in Iowa. Generally it is the intact seed with some lint attached and is sometimes referred to as "fuzzy cottonseed". It is an excellent source of crude protein, digestible fiber, and energy due to the oil in the seed. Whole cottonseed can be fed as a forage extender as the effective fiber content is similar to chopped silages. It can also be included in diets to lower the NFC content.

Hominy arises from the dry milling process to make corn meal or grits. It contains corn bran, germ, and some starch. It must contain at least 4% fat, and that along with its fiber and NFC content gives it a feeding value similar to ear corn. Since the fiber, starch, and fat content can vary widely, laboratory analyses is recommended.

Linseed meal, like soybean meal, is the product remaining after oil extraction, in this case from flax. It is very palatable and mildly laxative, with a higher fiber and lower energy content than soybean meal.

Malt sprouts generally come from barley, unless another cereal grain is specifically included in the name (such as rye malt sprouts or wheat malt sprouts). They are a spent product of the brewing industry and must contain at least 24% CP. They are an excellent protein supplement and are often used in diets high in NFC. Their feeding value as a forage extender is limited due to their small particle size reducing their effective fiber value.

Molasses can come from either sugar beets or sugar cane but cane molasses (sometimes referred to as blackstrap molasses) is most common in Iowa. It is available in both wet and dry forms and will increase palatability, decrease dustiness and provide an excellent source of sugar that can be quickly fermented in the rumen.

Soy hulls are left over after extracting the oil from soybeans and can be added back to the meal (resulting in 44% soybean meal) or marketed separately. They are high in chemical fiber, but not in effective fiber due to the small particle size. Much of the fiber is pectin, which is fermented in the rumen primarily to acetate rather than propionate. Thus, they have little risk of reducing milk fat tests, and do not promote acidosis.

Wheat bran is a coarse outer covering of wheat that is separated during the dry milling process. It is very palatable to dairy cattle, somewhat laxative and very bulky.

Wheat middlings or midds consist of fine particles or residue (fine particles of bran, shorts, germ, some flour) from dry milling of wheat. Their high RDP often limits the inclusion rate in diets for lactating dairy cows.

Whey is a by-product of cheese making and may be available in liquid, dried, or concentrated forms (whey permeate) with much of the whey proteins removed. Acid whey results from the manufacture of cottage cheese and can be fed as well. Lactose in whey is rapidly fermented in the rumen and can lead to situations similar to feedlot bloat.

Table 1. Nutrient composition and suggested feeding limits for various by-products commonly available in Iowa¹.

Feedstuff	DM %	CP %	RUP ² %	TDN %	NDF %	ADF %	NFC ³ %	Amount to feed ⁴
Beet pulp	88.3	10.0	76.3	69.1	45.8	45.8	41.3	8-12 lb.
Canola	90.3	37.8	35.7	69.9	29.8	20.5	25.9	6-8 lb.
Corn, grain ground	88.1	9.4	47.3	88.7	9.5	3.4	75.4	
Corn, ground ear	89.2	8.6	42.5	83.5	21.5	8.0	64.3	
Distillers dried grains	90.2	29.7	50.8	79.5	38.8	19.7	24.9	5-10 lb.
Corn gluten feed	89.4	23.8	30.0	74.1	35.5	12.1	34.0	10-15 lb.
Cottonseed w/lint	90.1	23.5	22.9	77.2	50.3	40.1	8.2	5-8 lb.
Hominy	88.5	11.9	31.2	83.1	21.1	6.2	61.6	10-16 lb.
Linseed meal	90.3	32.6	53.0	65.4	36.1	22.1	21.0	
Malt sprouts	90.5	20.1	27.4	66.4	47.0	21.8	26.9	5-9 lb.
Molasses, cane	74.3	5.8	18.1	81.0	0.4	0.2	80.3	1-3 lb.
Soybeans, raw	90.0	39.2	30.4	101.0	19.5	13.1	14.9	
Roasted	91.0	43.0	39.4	98.8	22.1	14.7	12.9	4-6 lb.
Hulls	90.9	13.9	44.6	67.3	60.3	44.6	21.8	8-12 lb.
Soybean meal, 44% solv	89.1	49.9	34.6	80.0	14.9	10.0	27.7	
48% solv.	89.5	53.8	42.6	81.4	9.8	6.2	29.6	
Expeller	89.6	46.3	69.0	88.5	21.7	10.4	28.0	
Tallow	99.8	.	.	147.4	.	.	.	
Vegetable oil	100.0	.	.	184.0	.	.	.	
Wheat bran	89.1	17.3	20.7	71.5	42.5	15.5	32.4	6-9 lb.
Middlings	89.5	18.5	23.7	73.3	36.7	12.1	38.1	8-12 lb.
Whey, wet	20.8	14.6	6.0	80.3	.	.	74.9	5-9 lb.

¹NRC (2001). Values expressed on DM basis

²Expressed as percentage of CP; assumed 50% forage diet and DMI=4% of body weight

³Adapted from Shaver (2008)

⁴Adapted from Howard et al. (1988), all values are lb. DM per cow per day